A contingency study of costing system design in Saudi Arabia

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Abstract

A proper understanding of the impacts on optimal costing system design (CSD), with respect to the assignment of indirect costs to products, that balances the costs of measurements and errors is necessary to maintain optimal performance. Nevertheless, contingency theory research on optimal CSD has failed to provide such an understanding. This might have been caused by using the selection form of fit and moderation sub-form of fit rather than the more realistic and appropriate matching sub-form of fit and system form of fit of contingency theory. A further related issue is that, although the contingency theory literature has promoted the joint use of polynomial regression analysis (PRA) and response surface methodology (RSM) rather than the problematic difference-score models to test for the matching sub-form of fit, it has failed to describe thoroughly the combined use of these techniques. Thus, this research aims to contribute to the extant literature by investigating the influence of different contingency factors on optimal CSD, where: (1) the matching sub-form of fit and system form of fit are applied; and (2) a procedure involving the recommended joint usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. Data were collected from Saudi manufacturing business-units via a survey strategy that involved an exploratory qualitative stage with eight business-units, and a model-testing quantitative stage with 204 business-units. The results of testing both the matching sub-form of fit and system form of fit showed predominantly unpredicted findings, of which the negative matching impact of production complexity on optimal CSD is the most prominent. Although the tentative results of this research are insufficient to question the existence of a joint effect of contingency factors on optimal CSD, they cast some doubt on the validity of prior contingency research findings, and suggest ways to capture the optimality of CSD. Hence, further research on this area, considering the theoretical and methodological contributions, limitations and implications of this research, is required to validate the findings of this research and also those of prior research that produced mostly contradictory findings regarding the influences on optimal CSD.

Dedication

To my parents for their prayers and support;

To my wife Norah for her prayers, love, patience, encouragement and belief;

To my son Ali for being with us;

To my brothers and sisters for their prayers and motivation;

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Praise be to Allah, the lord of the worlds. And the blessings and the peace be upon the last messenger of Allah, Mohammed (peace be upon him).

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List of abbreviations

The list of abbreviations is divided into: (1) the list of general abbreviations for the various terms that are used throughout this thesis; and (2) the list of specific abbreviations for the constructs included in the research model. Some of the abbreviations are repeated in both lists. For example, PC is included in the list of general abbreviations to stand for the production complexity contingency factor, and in the list of specific abbreviations to stand for the production complexity construct.

List of general abbreviations

ABC	Activity-based costing
AMT	Advanced manufacturing technologies
ANOVA	Analysis of variance
AVE	Average variance extracted
CB-SEM	Covariance-based structural equation modeling
CFA	Confirmatory factor analysis
CSC	Costing system complexity
CSD	Costing system design
CS-Soph	Costing System Sophistication
EFA	Exploratory factor analysis
ERP	Enterprise resource planning
GCC	Gulf Cooperation Council
HTMT	Heterotrait-Monotrait ratio of the correlations
IMA	Institute of Management Accountants
ISIC	International Standard Industrial Classification
JIT	Just-in-Time
Matching-Fit-Line	Fit line according to the matching sub-form of fit

MCAR	Missing completely at random
MCI	Ministry of Commerce and Investment
MCS	Management control systems
MODON	Saudi Industrial Property Authority
MRA	Moderated regression analysis
NIS	National industrial strategy
OS	Organisational structure
PC	Production complexity
PLS-SEM	Partial least squares structural equation modeling
PRA	Polynomial regression analysis
RCJY	Royal Commission for Jubail and Yanbu
RSM	Response surface methodology
SD	Standard deviation
SEM	Structural equation modeling
SIDF	Saudi Industrial Development Fund
SPSS	Statistical Package for the Social Sciences
SR	Saudi riyal
TCS	Traditional costing systems
TMKA	Top management knowledge and awareness of the importance of cost information in decision-making
TMS	Top management support
TQM	Total quality management
UK	United Kingdom
USA	United States of America
USAGE	The extent of cost information usage in decision-making
USEFULNESS	Respondents' perception of the usefulness and accuracy of cost information

VIF	Variance inflation factor
WTO	World Trading Organization

List of specific abbreviations

COMP	Competition
CostStructure-COMBINED	The percentage of the sum of indirect manufacturing costs and non-manufacturing costs to total costs
CostStructure-MANUFACTURING	The percentage of indirect manufacturing costs to total manufacturing costs
CSC-COMPOSITE	The composite costing system complexity measure of the number of cost pools and cost drivers.
CSC-CostDrivers	The number of cost drivers
CSC-CostPools	The number of cost pools
CSC-DEVELOPED	The developed measure for costing system complexity
CultureControl	The cultural dimension of tight versus loose control
CultureDetail	The cultural dimension of attention to detail
CultureOutcome	The cultural dimension of outcome orientation
PC	Production complexity
SizeEmployees	The number of employees
SizeRevenue	The amount of sales revenue
TMKA	Top management knowledge and awareness of the importance of cost information in decision-making
TMS	Top management support
USAGE	The extent of cost information usage in decision-making
USEFULNESS	Respondents’ perception of the usefulness and accuracy of cost information

List of conference papers

Aljabr, A. A., Brierley, J. A. & Lee, B. (2015). An exploratory study of costing system design in Saudi Arabia. Paper presented at the *British Accounting and Finance Association Annual Conference of the Northern Area Group.* Hull, United Kingdom, 03-04 September.

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Chapter one: Introduction

1.1 Introduction

An appropriate understanding of the influences on optimal costing system design (CSD) is critical, given that the lack of such raises several problems (Cooper and Kaplan, 1991; Kaplan and Cooper, 1998; Stuart, 2013; Drury, 2015) that might, in the end, negatively impact companies' overall performance (Ittner, Lanen and Larcker, 2002; Pizzini, 2006; Stuart, 2013). Nevertheless, contingency research on optimal CSD has hitherto failed to furnish a proper understanding of the influences on optimal CSD. This is, possibly, due to the main limitation of this strand of research concerning the lack of an appropriate application of contingency theory in relation to the adopted forms of fit. This research attempts to contribute towards providing a proper understanding of the influences on optimal CSD by overcoming the main limitation of the contingency research related to this area. The objective of this chapter is to introduce this thesis, and it is organised as follows. Section 1.2 provides the background information about this research. Section 1.3 explains the research issue, while Section 1.4 discusses the significance of the research issue. Section 1.5 states and details the research aim and contributions, while Section 1.6 provides information about and justifies the selection of the research context, site and unit of analysis. Section 1.7 concludes this chapter and outlines the structure of the thesis.

1.2 Research background

Since the 1990s, a considerable amount of research on CSD with respect to the assignment of overhead/indirect costs to products has been conducted in different countries for many reasons (Drury and Tayles, 1994; Brierley, Cowton and Drury, 2001).[1] One of these reasons is to verify the applicability of the criticisms raised by many researchers regarding the irrelevance of the traditional costing systems (TCS) used by companies to the new

[1] The terms "overhead costs" and "indirect costs" are employed interchangeably in this thesis.

manufacturing and business environments (e.g., Kaplan, 1983; 1984a; 1986a; 1988; Johnson and Kaplan, 1987; Cooper, 1987a; 1988a; 1988b; 1989a; 1989b; 1989c; Cooper and Kaplan, 1988a; 1988b; Shank and Govindarajan, 1988; Swenson, 1995; Kaplan and Cooper, 1998). These criticisms started in the United States of America (USA) during the 1980s and were based on a small number of companies and informal communications between academics and practitioners (Anthony, 1989; Holzer and Norreklit, 1991; Drury and Tayles, 1994; 2000; Brierley et al., 2001). Principally, these criticisms pointed out the deficiency of TCS with regard to assigning overhead costs to products in an accurate manner. Among the specific criticisms of TCS were the usage of department-based cost centres/cost pools, the utilisation of volume-based second-stage allocation bases/cost drivers - i.e., second-stage allocation bases/cost drivers, such as labour hours, machine hours and number of units produced that change with the level of production volume - to allocate overhead costs between products and the exclusion of non-manufacturing costs from product costs (Cooper, 1987a; Cooper and Kaplan, 1991; Kaplan and Cooper, 1998).

What prompted these criticisms were the changes that had occurred within the US manufacturing and business environments, which included an increased level of overhead costs as a result of the transformation from a labour intensive-based manufacturing environment to an automated one where advanced technologies are used (Kaplan, 1984a; Johnson and Kaplan, 1987; Cooper and Kaplan, 1988a; 1988b; Cooper, 1988b; Kaplan and Cooper, 1998), an increased level of production complexity caused by producing more diverse and customised products to satisfy customers' demands to compete more effectively and efficiently (Kaplan, 1984a; 1984b; 1986a; Cooper and Kaplan, 1991; Kaplan and Cooper, 1998), an increased level of competition due to deregulation, the entrance of foreign competitors and the establishment of focused companies (Kaplan, 1984a; Johnson and Kaplan, 1987; Cooper, 1988b; Kaplan and Cooper, 1998) and a decline in the advanced information systems' costs owing to the huge improvements in computing capacity (Johnson and Kaplan, 1987; Cooper, 1988b; Cooper and Kaplan, 1988b; Kaplan and Cooper, 1998).

In the late 1980s, activity-based costing (ABC) was proposed to solve the shortcomings of TCS regarding the inaccurate assignment of overhead costs to products (e.g., Cooper and Kaplan, 1988a; Cooper, 1988a; 1988b; 1989a; 1989b). Concurrently, the idea of optimal CSD is affected by different factors was emphasised by Cooper (1988b). Optimal CSD is a CSD that minimises the sum of the costs associated with the measurements required by the costing system - i.e., costs of measurements - as well as those incurred as a result of inferior decisions being made based on distorted product costs, i.e., costs of errors. The reason for Cooper's (1988b) emphasis was to point out that designing the costing system to be an ABC system, which tends to be a more complex costing system than TCS, is only justified when ABC, based on various factors such as the level of competition, the proportion of indirect costs and the level of production complexity, is most likely to be the optimal CSD.

In a wider context that covers not only ABC but also TCS, the idea that optimal CSD is influenced by different factors was also emphasised. Particularly, it was stressed in the context of costing system complexity (CSC) or costing system sophistication (CS-Soph) with respect to the assignment of indirect costs to products (Cooper and Kaplan, 1991; Drury, 2015). CSC or CS-Soph, in relation to the assignment of indirect costs, incorporates many dimensions, such as the number of cost centres/cost pools and the number of second-stage allocation bases/cost drivers (Abernethy, Lillis, Brownell and Carter, 2001; Drury and Tayles, 2005). The idea that optimal CSD is impacted by different factors in the context of CSC or CS-Soph, similar to Cooper's (1988b) emphasis in the context of ABC, indicates that designing a more complex/sophisticated costing system is only justified in cases where, based on various factors such as the level of competition, the proportion of indirect costs and the level of production complexity, this is most likely to be the optimal CSD.

The idea that optimal CSD is affected by different factors indicates that the optimality of a CSD does not depend on the CSD being ABC versus TCS or more complex/sophisticated versus less complex/sophisticated, but on the extent to which the CSD is appropriate to the internal and external circumstances, i.e., contingency factors, facing an organisation (Kaplan and Cooper, 1998; Cagwin and Bouwman, 2002; Ittner et al., 2002; Pizzini, 2006; Maiga, Nilsson and Jacobs, 2014; Drury, 2015). This suggests that the idea that optimal CSD is influenced by various factors is aligned with contingency theory (e.g., Drazin and Van de Ven, 1985; Donaldson, 2001). Contingency theory argues that there is no universal optimal organisational structure (OS) or system, e.g., management control system (MCS), that is equally adequate for all organisations, but that optimal OS or system is impacted by different contingency factors, such as the organisation's technology, environment and size (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert, Davila, Mehta and Oyon, 2014).[2]

Since the introduction of the idea that optimal CSD is affected by different factors, an extensive amount of contingency research on optimal CSD has been conducted to investigate, explicitly or implicitly, the influence of a wide range of contingency factors on this phenomenon (e.g., Gosselin, 1997; Krumwiede, 1998a; Malmi, 1999; Abernethy et al., 2001; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013; Schoute, 2009). This strand of research has operationalised CSD in terms of two different perspectives; namely, ABC adoption and the level of CSC/CS-Soph. Most contingency studies on optimal CSD have operationalised CSD with respect to ABC adoption (e.g., Gosselin, 1997; Krumwiede, 1998a; Malmi, 1999; Hoque, 2000; Al-Mulhem, 2002; Cagwin and Bouwman, 2002; Ittner et al., 2002; Baird, Harrison and Reeve, 2004; Cohen, Venieris and Kaimenaki, 2005; Schoute,

[2] According to Chenhall (2003; 2007), management accounting is the collection of practices, such as budgeting and product costing; the management accounting system is the systematic use of management accounting to accomplish goals; and MCS is a broad term that includes the management accounting system and other controls, such as personal or clan controls.

2011; Jusoh and Miryazdi, 2016), and this can be attributed to the high profile that ABC has enjoyed since the 1980s as a solution to the disadvantages of TCS concerning the inaccurate assignment of overhead costs to products. Due to issues associated with operationalising CSD in terms of ABC adoption that may have caused invalid and, subsequently, inconsistent findings and so, ultimately, hindered the development of a proper understanding of the influences on optimal CSD, other contingency studies on this area have operationalised CSD in relation to the level of CSC/CS-Soph (e.g., Abernethy et al., 2001; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013; Brierley, 2007; Schoute, 2009). These issues include a failure to acknowledge the fact that both TCS and ABC can vary in their level of complexity/sophistication and/or the difficulty of precisely distinguishing ABC users from non-users when employing the data collection method that is most widely-utilised by contingency studies on ABC adoption; namely, the questionnaire. Although contingency studies on CSC/CS-Soph have attempted to utilise variables that better reflect CSD, i.e., the level of CSC/CS-Soph, they share, together with contingency studies on ABC adoption, a major limitation in the form of a lack of an appropriate application of contingency theory in relation to the adopted forms of fit.[3] Having provided the background information about this research, the next section will illustrate the research issue.

1.3 Research issue

The issue regarding the contingency research strand on optimal CSD, including contingency research on both ABC adoption and CSC, is that it has, so far, failed to furnish an appropriate understanding of the factors that influence optimal CSD. This may be due to the main limitation associated with this research strand, which is, as mentioned in Section 1.2, the lack of an appropriate application of contingency theory in relation to the adopted forms of fit. The core of contingency theory is the concept of fit, and it is crucial to understand the

[3] The term "CSC" will be used hereafter to refer to both CSC and CS-Soph.

differences between the various forms of fit in order to apply those that best reflect the reality and the hypothesised relationships between the independent variables - i.e., contingency factors - and the dependent variable - e.g., optimal OS or MCS - and avoid any misguided interpretations of the prior research's findings (e.g., Drazin and Van de Ven, 1985; Venkatraman, 1989; Hartmann and Moers, 1999; Donaldson, 2001; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Meilich, 2006; Klaas and Donaldson, 2009; Burkert et al., 2014). Contingency theory has three forms of fit; namely, the selection, interaction and system forms of fit (e.g., Drazin and Van de Ven, 1985; Selto, Renner and Young, 1995; Chenhall and Chapman, 2006; Sousa and Voss, 2008; Burkert et al., 2014). Most contingency studies on optimal CSD have used the selection form of fit (e.g., Krumwiede, 1998a; Clarke, Hill and Stevens, 1999; Drury and Tayles, 2005; Ismail and Mahmoud, 2012), which makes the equilibrium assumption, meaning that all surviving companies are assumed to have optimal OS or MCS, in this research, CSD (Chenhall and Chapman, 2006; Meilich, 2006; Burkert et al., 2014). Because of the equilibrium assumption, the selection form of fit uses the unrealistic outcome measure of company survival rather than real outcome measures, e.g., financial or operational performance, to account for OS or MCS optimality (Chenhall, 2003; Meilich, 2006; Sousa and Voss, 2008). However, researchers have suggested that differences may exist between the optimality of OS or MCS, in this research, CSD, due to variations in the selection fit (Donaldson, 2001; 2006; Ittner and Larcker, 2001; Luft and Shields, 2003; Hartmann, 2005; Meilich, 2006; Burkert et al., 2014). The empirical evidence supports this assertion, as differences in the optimality of MCS, including CSD, between the surviving companies have been found (e.g., Frey and Gordon, 1999; Abernethy et al., 2001; Cagwin and Bouwman, 2002; Ittner et al., 2002; King, Clarkson and Wallace, 2010; Chen and Jermias, 2014; Krumwiede and Charles, 2014; Maiga et al., 2014).

Other contingency studies on optimal CSD have avoided the unrealistic selection form of fit, preferring to use the interaction form of fit instead (e.g., Frey and Gordon, 1999; Abernethy et al., 2001; Cagwin and Bouwman, 2002; Ittner et al., 2002; Banker, Bardhan and Chen, 2008). The interaction form of fit does not make the equilibrium assumption and, thus, anticipates that the optimality of the OS or MCS, in this research, CSD, of the surviving companies varies (Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Burkert et al., 2014). Hence, it accounts for the optimality of OS or MCS, in this research, CSD, by using real outcome measures rather than the unrealistic outcome measure of company survival (Drazin and Van de Ven, 1985; Gerdin and Greve, 2004; Sousa and Voss, 2008; Burkert et al., 2014). The interaction form of fit includes the matching, moderation and mediation sub-forms of fit (Gerdin and Greve, 2004; 2008; Chenhall and Chapman, 2006; Meilich, 2006; Burkert et al., 2014), the first two of which are considered part of contingency theory and have been used by interaction studies on optimal CSD. The matching sub-form of fit assumes that the relationship between OS or MCS and the outcome is curvilinear that is shifted by the contingency factor, meaning that, for each level of the contingency factor, there is only one level of OS or MCS that produces the highest level of outcome, i.e., the optimal level of OS or MCS (Schoonhoven, 1981; Donaldson, 2001; Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014).[4] In contrast, the moderation sub-form of fit assumes that the relationship between OS or MCS and the outcome is linear that differs at different levels of the contingency factor, meaning that the contingency factor impacts on the strength and/or form, i.e., sign, of the linear relationship between OS or MCS and the outcome (Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014).[5]

[4] Donaldson (2001) named the matching sub-form of fit "congruence fit".
[5] Some researchers used the term "multiplicative" (e.g., Chenhall and Chapman, 2006; Gerdin and Greve, 2008) or "interaction" (Meilich, 2006) rather than "moderation".

Most interaction studies have used the moderation sub-form of fit (e.g., Frey and Gordon, 1999; Cagwin and Bouwman, 2002; Banker et al., 2008; Maiga et al., 2014) rather than the matching one (Abernethy et al., 2001; Ittner et al., 2002), despite the fact that both contingency theory (e.g., Donaldson, 2001; 2006; Chenhall and Chapman, 2006; Meilich, 2006) and the CSD literature (e.g., Cooper, 1988b; Cooper and Kaplan, 1991; Innes and Mitchell, 1998; Pizzini, 2006; Drury, 2015) support the latter over the former. For contingency theory, the curvilinear relationship between OS or MCS - in this research, CSD - and the outcome postulated by the matching sub-form of fit is considered more rational and, therefore, realistic and appropriate than the linear one assumed by the moderation sub-form of fit. For the CSD literature, the relationships between the contingency factors and optimal CSD are deemed to be in accordance with the matching sub-form of fit. Only Abernethy et al. (2001) and Ittner et al. (2002) used the matching sub-form of fit, but both of these studies suffered from several limitations, such as examining the impact of a limited number of contingency factors on optimal CSD. A problem, nonetheless, exists that, although contingency theory researchers have recommended the joint adoption of two statistical analysis techniques, namely, polynomial regression analysis (PRA) and response surface methodology (RSM), to test for the matching sub-form of fit (Donaldson, 2006; Burkert et al., 2014), they have not described the combined use of PRA and RSM in detail.

To the author's knowledge, the third form of fit, the system form of fit, has not been utilised by any contingency study on optimal CSD. Like the interaction form of fit, the system form of fit does not assume that all surviving companies have optimal OS or MCS, in this research, CSD (Drazin and Van de Ven, 1985; Chenhall, 2003; 2007). Accordingly, it accounts for the optimality of OS or MCS, in this research, CSD, by utilising real outcome measures rather than the unrealistic outcome measure of company survival (ibid). Furthermore, the system form of fit agrees with the matching sub-form of fit in presuming that a curvilinear relationship exists between OS or MCS and the outcome that is shifted by the contingency factor. However, the unique feature of the system form of fit is that it accounts for the combined influence of all contingency factors on this curvilinear relationship rather than the individual impact of each contingency factor, as occurs under the matching sub-form of fit. This suggests that the system form of fit deals with the joint effect of all contingency factors on optimal OS or MCS, whereas the matching sub-form of fit is concerned with the individual influence of each contingency factor on optimal OS or MCS (Chenhall and Chapman, 2006; Meilich, 2006; Burkert et al., 2014), indicating the increased thoroughness of the former compared to the latter.[6] Having demonstrated the research issue, the next section will discuss its significance.

1.4 Significance of the research issue

It is crucial to have an appropriate understanding of the effects on optimal CSD that, as described in Section 1.2, minimises the sum of the costs associated with the measurements required by the costing system - i.e., the costs of measurements - as well as the costs incurred as a result of making inferior decisions based on distorted product costs, i.e., the costs of errors (Cooper, 1990a; Kaplan and Cooper, 1998; Stuart, 2013; Drury, 2015). This is because a lack of CSD optimality is associated with problems (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015), which may eventually detrimentally affect companies' overall performance (Ittner et al., 2002; Pizzini, 2006; Stuart, 2013). Specifically, less complex than required costing systems, while being less costly in terms of measurement, they produce distorted product costs that can lead to inferior product-related decisions being made, i.e., more costly regarding errors, whereas more complex than required costing systems, while providing more accurate product costs that can assist in making

[6] Like the matching sub-form of fit, the selection form of fit and moderation sub-form of fit are concerned with the effect of each contingency factor, independent from the effects of other contingency factors, on optimal CSD. Further details about the various forms and sub-forms of fit are provided in Section 3.3.

informed product-related decisions, i.e., less costly with respect to errors, they are more costly in terms of measurement (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015).[7] Having explained the research issue in Section 1.3 and discussed its significance in this section, the next section will state and detail the research aim and contributions.

1.5 Research aim and contributions

Given: (1) the main limitation of contingency research on optimal CSD related to the lack of an appropriate application of contingency theory with respect to the adopted forms of fit, which may have caused the issue of this strand of research (see Section 1.3); and (2) the significance of the research issue (see Section 1.4), this research seeks to overcome this important limitation and, thus, contribute towards providing a proper understanding of the influences on optimal CSD, i.e., to contribute towards solving the research issue. More specifically, the aim of this research is to investigate the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. To achieve this aim, this research develops, based on contingency theory, the CSD literature and the findings of an exploratory investigation carried out at the beginning of the empirical work of this research, and empirically tests a research model that represents a set of hypotheses related to the impact of different contingency factors on optimal CSD. The research model considers

[7] In the thesis, the accuracy of product costs refers to the accurate measurement of the indirect costs consumed by individual products for decision-making purposes. Drury and Tayles (2000) explained how the accuracy of product costs is influenced by the purpose for which the cost information is required. They pointed out that high levels of accuracy in individual product costs are needed for decision-making purposes to determine profitable and unprofitable products. However, they noted that accurate individual product costs are not required for financial reporting purposes where the concern is to allocate the total costs incurred during a period between the inventory and the cost of goods sold.

the main limitation of contingency research on optimal CSD by: (1) applying the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory; and (2) developing and employing a procedure encompassing the recommended joint usage of PRA and RSM to test for the matching sub-form of fit.

From the aim of this research, which reflects its consideration of the main limitation of contingency research on optimal CSD, three main research contributions emerge. The first is the application of the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory when examining the effect of the contingency factors on optimal CSD. The second is the development and employment of a procedure involving the recommended combined usage of PRA and RSM to test for the influence of the contingency factors on optimal CSD from the perspective of the matching sub-form of fit. The third is the results of testing the hypotheses pertaining to the impact of the contingency factors on optimal CSD from the viewpoints of the matching sub-form of fit and the system form of fit. The third main contribution is the outcome of the first and/or second main contributions.

To address the main limitation of contingency research on optimal CSD successfully and, hence, accomplish the research aim, this research and, therefore, the research model account for a further four minor limitations of contingency research on optimal CSD. This is because the four minor limitations are related to the two components investigated in this research; namely, the contingency factors and optimal CSD.

The first minor limitation is exclusive to contingency studies that operationalised CSD with regard to ABC adoption (e.g., Gosselin, 1997; Nguyen and Brooks, 1997; Hoque, 2000; Chen, Firth and Park, 2001; Cagwin and Bouwman, 2002; Ittner et al., 2002; Khalid, 2005;

Krumwiede and Charles, 2014), and is related to the adopted perspective of operationalising CSD, i.e., ABC adoption. Operationalising CSD in terms of ABC adoption is problematic and less appropriate for two reasons. First, it fails to acknowledge the fact that both ABC and TCS can vary in their level of complexity and, accordingly, does not capture the differences in CSD that exist in practice (Drury and Tayles, 2000; 2005), posing a threat to the validity of the findings. Second, it disregards the fact that practitioners hold different views and opinions regarding the meaning of ABC and the consequent difficulty associated with correctly differentiating between ABC adopters and non-adopters when using the data collection method that is most widely-used in contingency studies on ABC adoption; namely, the questionnaire (e.g., Malmi, 1996; Dugdale and Jones, 1997; Drury and Tayles, 2005). This negligence, in turn, can result in erroneously identifying ABC adopters as non-adopters, and vice versa (e.g., Malmi, 1996; Dugdale and Jones, 1997), which, eventually, can lead to invalid findings.

The second and third minor limitations are exclusive to contingency studies that operationalised CSD with respect to the level of CSC (e.g., Abernethy et al., 2001; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013; Schoute, 2009). The second minor limitation is a failure to examine the influence of organisational factors related to the organisation's management and employees on optimal CSD. This is an important omission, given that prior research has asserted the significant role of different organisational factors relating to the organisation's management and employees, such as top management support, in facilitating the adoption and success of innovative management accounting techniques, including ABC, a complex costing system (e.g., Shields and Young, 1989; Innes and Mitchell, 1990a; Argyris and Kaplan, 1994; Shields, 1995; Krumwiede, 1998b; Baird et al., 2004). The third minor limitation is the lack of usage of a comprehensive multi-dimensional CSC measure that captures all of the CSC dimensions identified in the literature, such as the number of cost centres/cost pools[8] and the number of second-stage allocation bases/cost drivers (e.g., Cooper and Kaplan, 1991; Innes and Mitchell, 1998; Drury and Tayles, 2000; 2005; Abernethy et al., 2001; Schoute, 2009).[9] Exploiting a comprehensive multi-dimensional CSC measure is vital, given that the probability of revealing the true influence of the various contingency factors on the optimal CSC level is more likely to be higher when CSC is measured using a comprehensive multi-dimensional measure compared to when single-dimensional or incomprehensive multi-dimensional measures are employed for this purpose.

The fourth minor limitation pertains to both sub-strands of contingency research on optimal CSD; namely, that on ABC adoption and that on CSC. This limitation is the failure to use a sufficiently comprehensive multi-dimensional production complexity measure that covers multiple dimensions of production complexity dimensions discussed in the literature, such as product complexity (e.g., Banker, Datar, Kekre and Mukhopadhyay, 1990; Foster and Gupta, 1990; Swenson, 1998), product diversity (e.g., Hayes and Clark, 1985; Cooper, 1988a; 1988b; Estrin, Kantor and Albers, 1994; Drury and Tayles, 2005), product customisation (e.g., Kaplan, 1984a; 1984b; Cooper and Kaplan, 1991; Kaplan and Cooper, 1998; Drury and Tayles, 2005; Brierley, 2011) and the frequency of introducing new products (Cooper, 1988b; Nguyen and Brooks, 1997; Ittner et al., 2002). This is surprising, given that the prior literature has intensively emphasised and empirically examined the critical role of production complexity in altering optimal CSD (e.g., Kaplan, 1983; 1984a; 1984b; 1986a; Johnson and Kaplan, 1987; Cooper, 1988a; 1988b; Cooper and Kaplan, 1991; Jones, 1991; Estrin et al., 1994; Malmi, 1999; Schoute, 2011; Al-Omiri and Drury, 2013). Utilising a sufficiently comprehensive multi-dimensional production complexity measure is important because

[8] The term "cost centres" is equivalent to "cost pools", with the former being used with TCS and the latter being used with ABC. Given this, this thesis, hereafter, will use only the term "cost pools" for ease of presentation.
[9] The term "second-stage allocation bases" is equivalent to "cost drivers", with the former being used with TCS and the latter being used with ABC. Given this, this thesis, hereafter, will use only the term "cost drivers" for ease of presentation.

single-dimensional or incomprehensive multi-dimensional production complexity measures may prove less effective than a sufficiently comprehensive multi-dimensional production complexity measure for uncovering the true effect of production complexity on optimal CSD.

In this research, the four minor limitations discussed above are accounted for by: (1) operationalising CSD in terms of the level of CSC and, thus, optimal CSD is reflected in the optimal level of CSC; (2) examining the influence of organisational factors relating to the organisation's management and employees, such as top management support, on the optimal level of CSC; (3) developing and confirming a comprehensive multi-dimensional CSC measure that captures all of the CSC dimensions identified in the literature and using this together with other CSC measures employed by the prior literature to measure CSC; and (4) developing a sufficiently comprehensive multi-dimensional production complexity measure that covers the most indicative dimensions of the production complexity dimensions discussed in the literature and using this measure to measure production complexity.

The ways in which the four minor limitations of contingency research on optimal CSD are accounted for bring about four minor research contributions. First, the addition to the few contingency studies that operationalised CSD from the perspective of the level of CSC. Second, the examination of the influence of organisational factors relating to the organisation's management and employees on the optimal level of CSC. Third, the development and confirmation of a comprehensive multi-dimensional CSC measure that captures all CSC dimensions identified in the literature and the usage of this measure, along with other CSC measures, to measure CSC. Fourth, the development and utilisation of a sufficiently comprehensive multi-dimensional production complexity measure that encompasses the most indicative dimensions of the production complexity dimensions discussed in the literature. Having stated and detailed the research aim and contributions, the next section will provide information about and justify the selection of the research context, industry and unit of analysis.

1.6 Research context, site and unit of analysis

1.6.1 Research context

The chosen context for this research is Saudi Arabia, which was deemed suitable for two reasons. The first reason is the expected consequences of the huge and rapid changes that Saudi Arabia has witnessed across its manufacturing and business environments (Ministry of Commerce and Investment (MCI), 2013; Saudi Industrial Development Fund (SIDF), 2017). Regarding its manufacturing environment, Saudi Arabia adopted the national industrial strategy (NIS) in 2009 (MCI, 2009; SIDF, 2009; Burton, 2016). The aim of the NIS is to achieve balanced and stable growth of the national economy by decreasing the country's heavy dependence on oil and natural gas revenues that are subject to global fluctuations, and also by diversifying its economy (SIDF, 2009; Burton, 2016). To this end, the NIS has sought to develop the country's manufacturing industry, excluding the oil and natural gas production and extraction sector, through, among other things, developing the production technologies used and increasing the diversification of the products produced in order, eventually, to increase the manufacturing industry's contribution to the country's gross domestic production from around 11% to 20% by 2020 (SIDF, 2009; Industrial Clusters, 2017). This change is anticipated to increase the level of production complexity in some Saudi manufacturing companies. With respect to the business environment, Saudi Arabia joined the World Trading Organization (WTO) in 2005 (WTO, 2017), which will probably facilitate the entrance of foreign investors and products to the Saudi market and, ultimately, increase the level of competition faced by some Saudi manufacturing companies.

In conjunction, the changes that have occurred within the Saudi manufacturing and business environments are expected to produce certain outcomes, which are, respectively, increasing levels of production complexity of and levels of competition faced by some Saudi manufacturing companies. These expected outcomes will probably result in variations in optimal CSD. Hence, they make the country an attractive context for investigating the impact of production complexity and competition on optimal CSD. Production complexity and competition have been identified as two of the most crucial contingency factors that influence optimal CSD (e.g., Cooper, 1988b; Bjørnenak, 1997; Al-Omiri and Drury, 2007; Drury, 2015). In addition, the variations in optimal CSD that are predicted to result from the increasing levels of production complexity and competition make it possible to explore the effects of other contingency factors on optimal CSD in Saudi Arabia.

The second reason that justifies the selection of Saudi Arabia as the current research context relates to the growing interest in conducting accounting research in developing countries (Alawattage, Hopper and Wickramasinghe, 2007; Hopper, Tsamenyi, Uddin and Wickramasinghe, 2009; Albu and Albu, 2012), of which Saudi Arabia is a representative. The rising interest in and, therefore, importance of conducing accounting research in developing countries may be attributed to the increasing economic interconnectedness because of globalisation, requiring countries to learn from the experiences and practices of each other. In addition, and in the context of management and cost accounting, the escalating interest in and, accordingly, importance of conducting accounting research in developing countries might be ascribed to its perceived role in improving the management and cost accounting practices and systems applied in these countries and also enhancing the knowledge about the extent to which the management and cost accounting practices and systems introduced and utilised in developed countries are applicable in their developing counterparts (van Triest and Elshahat, 2007). The current research on optimal CSD in Saudi Arabia is limited, making the country a relatively unexplored research context compared to developed countries. To the author's knowledge, only four contingency studies on optimal

CSD have been carried out in Saudi Arabia (Al-Mulhem, 2002; Khalid, 2005; Al-Omiri, 2012; Al-Omiri and Drury, 2013), but they all suffered due to the main limitation and other minor limitations identified in Sections 1.3 and 1.5, respectively. Consequently, this is an appropriate time to conduct further research on Saudi Arabia.

1.6.2 Research site

The selected site for this research is all sectors of manufacturing industry apart from the oil and natural gas production and extraction sector. This research did not include both manufacturing and non-manufacturing industries due to the vast differences existing between the two regarding, for example, company structure, the nature of the activities undertaken and outputs provided by companies and cost structure of companies, which might have threatened the validity of the results (Nassar, Morris, Thomas and Sangster, 2009; Zhang, Hoque and Isa, 2015). This research was confined to the manufacturing industry alone for four reasons. First, this industry can be considered the most important segment of any country's economy, as the standard of living is strongly associated with the country's capability to manufacture products (Dhavale, 1989). Second, the manufacturing industry is less heterogeneous than the non-manufacturing industry (Clarke et al., 1999; Nassar et al., 2009; Al-Sayed and Dugdale, 2016). Although the former includes different sectors that produce a wide range of distinct products, the manufacturing processes across all sectors include one or more stage/s and are supported by support functions or departments. However, the non-manufacturing industry comprises different sectors, such as healthcare, banking, insurance and education, which provide distinct services that share little, if any, characteristics in common. The greater amount of heterogeneity between the various sectors of the non-manufacturing industry compared to the manufacturing one might have reduced the validity of the results.

Third, the main factors influencing optimal CSD are less obvious in the manufacturing industry compared to the non-manufacturing one. In the latter, the cost structure includes no direct materials and little or no direct labour costs and so, accordingly, consists mainly of indirect costs. Given this, it can be argued that cost structure is the main contingency factor that causes most non-manufacturing companies to find that their optimal CSD is one with higher levels of CSC (Kaplan and Cooper, 1998; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013; Nassar et al., 2009; Drury, 2015). Fourth, there is a great need to focus on and contribute to the Saudi manufacturing industry by furnishing an appropriate understanding of the influences on optimal CSD, which should be sought by Saudi manufacturing companies to avoid the problems associated with less optimal CSDs (see Section 1.4). This is because Saudi Arabia has devoted significant development efforts to its manufacturing industry, as reflected by the adoption of the NIS. Providing a proper understanding of the influences on optimal CSD within the Saudi manufacturing industry is likely to promote the development of this economical segment and, subsequently, achieve the aim of the NIS. Lastly, this research excluded the oil and natural gas production and extraction sector, as this lies outside the focus of the NIS.

1.6.3 Research unit of analysis

The chosen unit of analysis for this research is the business-unit rather than the company for three reasons. First, CSD and the characteristics of the contingency factors - e.g., production complexity and competition - might differ between the business-units of companies, especially, large ones that have multiple divisions and plants, each of which is considered a separate business-unit (Frey and Gordon, 1999; Abernethy et al., 2001; Cagwin and Bouwman, 2002; Baird et al., 2004; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Schoute, 2009; Al-Sayed and Dugdale, 2016). This, in turn, increases the difficulty for respondents to answer questions at the company level and, therefore, makes the company an inappropriate unit of analysis. Second, prior contingency research showed that decisions relating to optimal CSD are likely to be made at the business-unit level rather than the company level (e.g., Gosselin, 1997; Booth and Giacobbe, 1998; Krumwiede, 1998a; Brown, Booth and Giacobbe, 2004; Al-Omiri and Drury, 2007; Al-Sayed and Dugdale, 2016). Third, utilising the business-unit rather than the company as the unit of analysis allows comparability with the majority of contingency studies on optimal CSD that have used the business-unit as the unit of analysis (e.g., Krumwiede, 1998a; Abernethy et al., 2001; Cagwin and Bouwman, 2002; Ittner et al., 2002; Baird et al., 2004; 2007; Brown et al., 2004; Drury and Tayles, 2005; Brierley, 2007; 2011; Al-Omiri and Drury, 2007; 2013).

1.7 Conclusion and outline of the thesis structure

The objective of this chapter was to introduce this thesis, which seeks to promote our understanding of the influences on optimal CSD by taking into account the main limitation of contingency research on this area. It furnished the background information about this research and demonstrated the research issue and discussed its significance. In addition, this chapter stated and detailed the research aim and contributions. Furthermore, it provided information about and justified the selection of the research context, site and unit of analysis.

The remainder of this thesis is organised as follows. Chapters two, three and four are the literature review chapters. Chapter two is concerned with ABC and CSC, which contingency research on optimal CSD has relied upon to operationalise CSD. Chapter three sheds light on different aspects of the theory selected to increase our understanding of the influences on optimal CSD; namely, contingency theory. Chapter four reviews contingency studies on optimal CSD, including those on ABC adoption and CSC. It also discusses, together with their importance, the main and minor limitations of contingency research on optimal CSD and points out how this research attempts to overcome them. Chapter five demonstrates the research model for optimal CSD tested in this research, which accounts for the main and four minor limitations of contingency research on optimal CSD. Chapter six explains the research methodology and methods adopted to conduct this research.

Chapter seven provides the results of the preliminary analysis that was performed prior to conducting the main data analysis. The preliminary analysis included three aspects; namely, data examination and preparation, an assessment of the quality of the latent, i.e., unobservable, constructs, including reflective and formative constructs, and descriptive analysis. Chapter eight: (1) develops and employs a procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit; and (2) provides the results of testing the hypotheses related to the influence of the contingency factors on optimal CSD from the viewpoint of the matching sub-form of fit. Chapter nine provides the results of testing the hypothesis concerning the influence of the contingency factors on optimal CSD from the perspective of the system form of fit. Chapter ten discusses the results of testing the matching sub-form of fit and system form of fit's hypotheses. Chapter eleven concludes this thesis.

Chapter two: Literature review 1: Activity-based costing (ABC) and costing system complexity (CSC)

2.1 Introduction

This chapter aims to discuss ABC and CSC, which contingency research on optimal CSD has depended on to operationalise CSD. Thus, this chapter provides critical information about one of the two components investigated in this research; namely, optimal CSD. Hence, it assists in realising the third main contribution of this research related to the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5). This chapter, therefore, contributes towards achieving the research aim of investigating the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. Additionally, this chapter assists in realising the first and third minor contributions of this research concerning, respectively, the operationalisation of CSD and the measurement of CSC (see Section 1.5). Accordingly, it contributes to successfully considering the main limitation of contingency research on optimal CSD and, thus, accomplishing the research aim (see Section 1.5).

This chapter is organised as follows. Section 2.2 briefly illustrates the various types of costing system, then, this chapter focuses down on two types, namely, TCS and ABC, that assign, in addition to direct costs, indirect costs to products. More specifically, Section 2.3 introduces ABC, which was developed to solve the deficiencies of TCS, and compares TCS with ABC with respect to the assignment of indirect costs to products. Section 2.4 reviews the development and explains the meaning of CSC. Section 2.5 concludes this chapter.

2.2 Types of costing system

Different types of costing system exist that differ in terms of the calculation of product costs. More specifically, these costing systems vary regarding the type of costs included in product costs - direct versus indirect - and the level of complexity associated with the assignment of overhead costs to products (Drury, 2015). According to Drury (2015), there are three types of costing system; namely, direct costing, TCS and ABC. Given the fact that direct costing only assigns direct costs to products, Drury (2015) criticised direct costing for its inability to measure and assign indirect costs to products, arguing that the use of this system can only be justified where the proportion of indirect costs is insignificant. Otherwise, the omission of indirect costs will result in distorted product costs. The complete failure to include any indirect costs in direct costing renders the system unsuitable for external reporting and being considered the least complex costing system (Drury and Tayles, 2000; Al-Omiri and Drury, 2007).

In contrast to direct costing, TCS and ABC assign both direct and indirect costs to products (Drury, 2015). Therefore, both TCS and ABC are considered absorption costing systems (Drury and Tayles, 2000; Drury, 2015), which is the type of costing system required for external reporting by the majority of countries (Kaplan, 1988; Drury and Tayles, 2000; Kaplan and Cooper, 1998; Garrison, Noreen and Brewer, 2010). In relation to the level of complexity, both TCS and ABC can vary from simple to complex depending on many dimensions, as will be discussed in Section 2.4 (Drury and Tayles, 2000; 2005). However, ABC is generally considered to be more complex than TCS (Cooper, 1988b; 1989b; 1990a; Cooper and Kaplan, 1988b; Innes and Mitchell, 1990b). Having briefly described the various types of costing system and identified that both TCS and ABC assign both direct and indirect costs to products, the next section will introduce ABC, which was developed to overcome the shortcomings of TCS, and compare TCS with ABC in relation to the assignment of indirect costs to products.

2.3 Activity-based costing (ABC) and a comparison between traditional costing systems (TCS) and ABC

As explained in Section 1.2, TCS have been criticised, mainly, for their inability to assign indirect costs to products in an accurate manner (e.g., Kaplan, 1983; 1984a; 1986a; 1988; Johnson and Kaplan, 1987; Cooper, 1987a; 1988a; 1988b; 1989a; 1989b; Cooper and Kaplan, 1988a; 1988b; Shank and Govindarajan, 1988; Swenson, 1995; Kaplan and Cooper, 1998), and so ABC was proposed in the late 1980s as a solution to the drawbacks of TCS (e.g., Cooper and Kaplan, 1988a; Cooper, 1988a; 1988b; 1989a; 1989b). ABC was designed not to "trigger automatic decisions" but to provide more accurate information about the company's activities and product costs to guide management to focus on the products and processes that have the highest impact on increasing profitability and help managers to make better strategic and operational decisions (Cooper and Kaplan, 1988b, p. 103). Cooper and Kaplan (1988b) outlined the logic behind ABC. They noted that all of the company's functions perform activities that aim to support the production and delivery of products to customers. Thus, Cooper and Kaplan (1988b) emphasised the importance of considering the costs of all of the company's functions - e.g., marketing, financial and general administration - as product costs. In addition, they stated the significance of including costs that do not vary in the short-term with the volume of outputs, but do vary in the long-term with the complexity of products, e.g., costs that change in the long-term according to changes in the design, mix and range of the company's products. Furthermore, Cooper and Kaplan (1988b) explained that the usage of volume-based cost drivers is inappropriate for assigning non-volume related overhead costs, e.g., factory support costs. Moreover, they pointed out that certain costs, e.g., costs related to unutilised capacity, should not be included as product costs, as this might lead to the making of erroneous decisions.

With respect to the differences between TCS and ABC regarding the assignment of indirect costs to products, the main difference is related to the usage of the two-stage overhead assignment procedure (Innes and Mitchell, 1998; Kaplan and Cooper, 1998; Garrison et al., 2010; Drury, 2015).[10] Both TCS and ABC use this procedure, albeit in different ways (Cooper, 1987b; 1987c; 1988c; Cooper and Kaplan, 1991; Kaplan and Cooper, 1998; Drury, 2015). TCS, in the first stage, assign all of the overhead costs to multiple department-based cost pools, i.e., production and support. Then, most of the TCS used in practice reassign the costs of the support cost pools to the production cost pools. The first stage is conducted using first-stage allocation bases/resource drivers.[11] In the second stage, most of the TCS used in practice allocate the costs accumulated in the production cost pools between products using cost drivers that change with the level of production volume, e.g., labour hours, machine hours and number of units produced. However, it should be noted that some of the TCS used in practice, in the first stage, do not reassign the costs of support cost pools to production cost pools, and, in the second stage, they allocate the costs accumulated in the support cost pools between products using appropriate cost drivers that are most likely to be non-volume-based (Drury and Tayles, 1994; Lamminmaki and Drury, 2001).[12]

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[10] Besides the usage of the two-stage overhead assignment procedure, there are two additional differences between TCS and ABC concerning the assignment of direct and indirect non-manufacturing costs and part of the indirect manufacturing costs. For further details about the differences between TCS and ABC, see Cooper and Kaplan (1991), Innes and Mitchell (1990b; 1998), Kaplan and Cooper (1998), Drury and Tayles (2000), Garrison et al. (2010) and Drury (2015).

[11] The term "first-stage allocation bases" is equivalent to "resource drivers", with the former being used with TCS and the latter being used with ABC. Given this, this thesis, hereafter, will use only the term "resource drivers" for ease of presentation.

[12] The illustration of the usage of the two-stage overhead assignment procedure by TCS assumes that multiple cost pools and one or multiple cost drivers are used. However, TCS can use only one cost pool and one cost driver, i.e., a plant-wide overhead rate. In this case, TCS assign all overhead costs to a single cost pool and, then, allocate the costs accumulated in this cost pool to products using a volume-based cost driver.

Compared to TCS, ABC, in the first stage, assigns overhead costs to a greater number of activity-based cost pools - e.g., setting-up machines and moving materials - using resource drivers. In addition, there is no reassignment of the costs of the support cost pools to the production cost pools as occurs with most of the TCS used in practice. In the second stage, ABC allocates the indirect costs accumulated in the production and support cost pools between products using a greater number of different types of volume- and non-volume-based cost drivers. The ability of ABC to use a greater number of both volume- and non-volume-based cost drivers is attributed to the system's ability to classify costs in a detailed manner. In particular, ABC classifies costs, based on four levels of activity, into unit, batch, product and facility-level costs (Cooper, 1990a). Unit-level costs are driven by the number of units produced or the production volume, e.g., direct material and labour costs; batch-level costs are driven by the number of batches regardless of the number of units produced in each batch, e.g., set-up costs; product-level costs are related to the product lines regardless of the number of units or batches produced in each product line, e.g., product design and license costs; and, lastly, facility-level costs are related to the whole manufacturing facility, regardless of the number of units and batches and the product mix produced there, e.g., factory building insurance and taxes costs.

The preceding discussion suggests that three main differences exist between TCS and ABC in relation to the usage of the two-stage overhead assignment procedure (Drury, 2015). First, by using a greater number of activity- rather than department-based cost pools, ABC assigns, more accurately, the cost of resources to the final products (Drury and Tayles, 2000). This is because, within each cost pool, the degree of homogeneity of the processes/activities that consume the resources is likely to be higher when the number of cost pools is higher, and further enhanced when the cost pools are activity- rather than department-based, allowing the cost system to measure the amount of process/activity resources' consumption by products accurately (Drury and Tayles, 2000; 2005; Al-Omiri and Drury, 2007). Second, by avoiding reassigning the costs of support cost pools to production cost pools, as occurs with most of the TCS used in practice, ABC accurately assigns these costs to products using cause-and-effect cost drivers (Drury, 2015). Notwithstanding the fact that, as mentioned earlier in this section, some of the TCS used in practice do not reassign the costs of support cost pools to production cost pools, these TCS employ a smaller number of cost pools that are department-based. Third, by using a greater number of a wider variety of cost drivers - i.e., volume- and non-volume-based - to allocate the costs accumulated in both the production and support cost pools between products, ABC measures, more accurately, the resources consumed by each product (Drury and Tayles, 2000). This is because utilising a greater number of cost drivers and using both volume- and non-volume-based cost drivers rather than the former alone make it possible to employ cause-and-effect cost drivers (Kaplan and Cooper, 1998; Drury and Tayles, 2005; Al-Omiri and Drury, 2007). Although some TCS use non-volume-based cost drivers to allocate the costs of support cost pools between products, these TCS exploit a smaller number of cost drivers, utilise only volume-based cost drivers to allocate the costs accumulated in the production cost pools between products and, as mentioned earlier, use fewer cost pools that are department-based. Having introduced ABC and compared TCS with ABC in relation to the assignment of indirect costs to products, the next section will review the development and explain the meaning of CSC.

2.4 Costing system complexity (CSC)[13]

Although studies on CSC first appeared in the 2000s (e.g., Drury and Tayles, 2000; Abernethy et al., 2001), the term “CSC” has been in use since the introduction of ABC in the 1980s given the fact that ABC has been considered a more complex costing system than TCS

[13] Given that the focus of this thesis is on CSD with respect to the assignment of indirect costs to products, the material of this section is related to the type of CSC concerning the assignment of indirect costs to products and not the other types of CSC identified by Brierley (2008a).

(Cooper, 1988b; 1989b; 1990a; Cooper and Kaplan, 1988b; Innes and Mitchell, 1990b). Early ABC studies used the term "CSC" to refer to the CSC concerning the assignment of indirect costs. For example, Cooper (1988b) used CSC when introducing the idea that optimal CSD is influenced by different factors. Cooper (1988b) pointed out that increasing CSC reduces the costs of errors, i.e., the costs incurred as a result of making poor decisions based on distorted product costs, but at the expense of increasing the costs of measurements, i.e., costs associated with the measurements required by the costing system. In a different context, Cooper (1989b) used CSC to report on the causes of the differences in the design complexity of ABC systems applied by different companies. Cooper (1989b) determined the design complexity of ABC by the number of cost pools as well as the number and type of cost drivers, and found that product diversity and the number of objectives of the costing system have a positive influence on the design complexity of ABC.

As indicated in Section 1.2, most contingency studies on optimal CSD have operationalised CSD with respect to ABC adoption due to the high publicity given to ABC (e.g., Gosselin, 1997; Krumwiede, 1998a; Malmi, 1999; Hoque, 2000; Al-Mulhem, 2002; Cagwin and Bouwman, 2002; Ittner et al., 2002; Baird et al., 2004; Cohen et al., 2005; Schoute, 2011; Jusoh and Miryazdi, 2016). Moreover, because of issues associated with such an operationalisation, e.g., omitting the fact that both TCS and ABC can vary in their level of complexity, it was mentioned in Section 1.2 that other contingency studies on optimal CSD have operationalised CSD in relation to the level of CSC (e.g., Abernethy et al., 2001; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013; Brierley, 2007; Schoute, 2009; Ismail and Mahmoud, 2012). Contingency studies on CSC have identified six CSC dimensions and, by using different combinations of these dimensions, developed different CSC measures.[14] All six of the CSC dimensions identified are related to the two-stage overhead assignment

[14] Further details about the CSC measures used by contingency studies on CSC are provided in Sections 4.3 and 4.4.3.2.2.

procedure and are assumed to improve the accuracy of this procedure (see Section 2.3). The six identified CSC dimensions increase CSC because they, simply, require additional measurements (Cooper and Kaplan, 1991). The following paragraphs discuss these six dimensions and their influence on accuracy and CSC.

The first dimension is the number of cost pools (Drury and Tayles, 2000; Abernethy et al., 2001). As mentioned in Section 2.3, increasing the number of cost pools increases the accuracy by reducing the heterogeneity of the processes/activities within each cost pool (Cooper and Kaplan, 1991; Innes and Mitchell, 1998; Drury and Tayles, 2000). If the products produced by a company require different proportions of processes/activities that consume the resources, a costing system with a higher number of cost pools will accurately measure the amount of process/activity resources' consumption by products (Drury and Tayles, 2000; 2005; Al-Omiri and Drury, 2007). In addition, increasing the number of cost pools increases CSC because it requires additional measurements for each additional cost pool (Cooper and Kaplan, 1991).

The second dimension is the number of cost drivers (Drury and Tayles, 2000; Al-Omiri and Drury, 2007). Increasing the number of cost drivers increases the accuracy because, as noted in Section 2.3, it allows the use of cause-and-effect cost drivers that assist in determining, more accurately, the resources consumed by products (Drury and Tayles, 2005; Al-Omiri and Drury, 2007). Further, it increases CSC because it necessitates collecting more information for each additional cost driver.

The third CSC dimension is the nature of cost pools (Abernethy et al., 2001; Drury and Tayles, 2005; Schoute, 2009). As mentioned in Section 2.3, it is argued that the accuracy increases when using activity-based cost pools, as in ABC, compared to department-based cost pools, as in TCS. Innes and Mitchell (1998) pointed out the considerable difficulty in achieving a high degree of homogeneity when the cost pools are at the department-level, which negatively affects the accuracy of the product costs, as the cost driver used for a department-based cost pool has a cause-and-effect relationship with only a small proportion of the department's costs. Using activity- rather than department-based cost pools increases CSC because it makes it necessary to establish additional cost pool/s for each activity and, subsequently, conduct more measurements for each additional cost pool.

The fourth CSC dimension is related to the nature of cost drivers (Drury and Tayles, 2000; Al-Omiri and Drury, 2007). According to Kaplan and Cooper (1998), cost drivers can be divided into transaction, duration and intensity drivers. Transaction drivers are based on the number of times the activities are performed, and are considered the least accurate because they assume that products consume exactly the same amount of resources each time an activity is performed. The second type, duration drivers, are based on the amount of time needed to perform the activity and, therefore, are deemed more accurate compared to transaction drivers. Lastly, intensity drivers are considered the most accurate, given that they directly charge for the resources used each time an activity is performed. In terms of complexity, transaction drivers are the least complex because they only require the number of times an activity is performed to be counted. Duration drivers are more complex than transaction drivers because they require the amount of time spent performing each activity to be measured. Intensity drivers are the most complex because they require the resources consumed each time an activity is performed to be determined.

The fifth CSC dimension is the type of cost drivers (Drury and Tayles, 2000; Abernethy et al., 2001; Schoute, 2009), which can be volume- or non-volume-based (Cooper, 1990a). The former are associated with unit-level activities, whereas the latter are related to batch- and product-level activities. Using a combination of both types of cost drivers enhances the accuracy because it enables the company to match the level of activities with suitable cost drivers that can reflect the nature of the activities' costs, i.e., using cause-and-effect cost drivers (see Section 2.3) (Kaplan and Cooper, 1998; Drury and Tayles, 2005; Al-Omiri and Drury, 2007). Costing systems that use a combination of both types of cost drivers are considered more complex compared to those that use only volume-based cost drives (Schoute, 2009), due to the need to collect additional information for each type of cost drivers.

The sixth dimension is related to the way in which overhead costs are assigned to the cost pools in the first stage of the two-stage overhead assignment procedure (Drury and Tayles, 2005; Al-Omiri and Drury, 2007). In the first stage, overhead costs can be assigned using a direct, a cause-and-effect or an arbitrary assignment using resource drivers. Compared to arbitrary assignment, direct or cause-and-effect assignments are likely to be more accurate because they ensure that the costs of resources assigned to the cost pools represent the real consumption of these resources by the activities performed within each cost pool (Cooper and Kaplan, 1991). In addition, using direct or cause-and-effect assignments increases CSC because they require more resource drivers to be found in order to measure, more accurately, the consumption of each resource by each cost pool (ibid).

Researchers have utilised different CSC dimensions to develop various CSC measures for CSC. However, it should be noted that some of the identified dimensions have not been used by prior CSC studies, possibly due to the difficulty associated with collecting reliable information about the unutilised CSC dimensions in questionnaire studies (Drury and Tayles, 2005; Al-Omiri and Drury, 2007). The most widely-utilised dimension is the number of cost pools, which is employed by seven contingency studies on CSC (Abernethy et al., 2001; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013; Brierley, 2007; Schoute, 2009; Ismail and Mahmoud, 2012). The second most widely-utilised dimension is the number of cost drivers, which is employed by six contingency studies on CSC (Drury and Tayles, 2005;

Al-Omiri and Drury, 2007; 2013; Brierley, 2007; Schoute, 2009; Ismail and Mahmoud, 2012). The third most widely-utilised dimensions are the nature of cost pools – i.e., activity- versus department-based - and the type of cost drivers, i.e., volume- versus non-volume-based, which are employed by two contingency studies on CSC (Abernethy et al., 2001; Schoute, 2009). Two dimensions have not been used by contingency studies on CSC. The first dimension is the nature of cost drivers - i.e., transaction, duration or intensity drivers - and the second concerns the approach used to assign overhead costs to the cost pools in the first stage of the two-stage overhead assignment procedure, i.e., direct, cause-and-effect or arbitrary assignment.

2.5 Conclusion

This chapter aimed to discuss ABC and CSC that contingency research on optimal CSD has hinged on to operationalise CSD. Therefore, this chapter furnished essential details about one of the two components investigated in this research; namely, optimal CSD. Accordingly, it contributed to realising the third main contribution of this research and, thus, attaining the research aim (see Section 1.5). In addition, this chapter contributed to realising the first and third minor contributions of this research (see Section 1.5). Hence, it assisted in successfully addressing the main limitation of contingency research on optimal CSD and, therefore, acquiring the research aim (see Section 1.5).

This chapter briefly explained the different types of costing system, and, then, it focused on TCS and ABC that assign, besides direct costs, indirect costs to products. It introduced ABC, which was developed to overcome the problems of TCS, and compared TCS with ABC in relation to the assignment of indirect costs to products. Moreover, this chapter reviewed the development and explained the meaning of CSC. Having discussed ABC and CSC that contingency research on optimal CSD has relied upon to operationalise CSD, the next chapter will review the theory selected to assist in furnishing a proper understanding of the influences on optimal CSD; namely, contingency theory. The review of contingency theory precedes the review of contingency studies on optimal CSD because these studies will be partially reviewed from the perspective of contingency theory.

Chapter three: Literature review 2: Contingency theory

3.1 Introduction

This chapter seeks to illustrate contingency theory chosen by this research to contribute towards providing an appropriate understanding of the influences on optimal CSD. Hence, this chapter assists in realising the first and second main contributions of this research relating to, respectively, the application of contingency theory with respect to the adopted forms of fit and the statistical analysis techniques exploited to test for the matching sub-form of fit (see Section 1.5). It, therefore, contributes towards accomplishing the research aim of investigating the influence of different contingency factors on optimal CSD where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit.

This chapter furnishes information on different aspects of contingency theory, and is organised as follows. Section 3.2 provides a background of the theory and a description to the theory's main concepts. Section 3.3 demonstrates the most crucial element of the theory, the forms of fit. Section 3.4 identifies the main criticisms raised against contingency research on optimal MCS in relation to the application of the theory and discusses how this research attempts to overcome these criticisms. Section 3.5 justifies the adoption of contingency theory in this research and Section 3.6 concludes this chapter.

3.2 Contingency theory: background and main concepts

Contingency theory is an important and major theoretical lens through which organisations can be viewed (Donaldson, 1995; 2001; 2006). According to Otley (1980), contingency theory was developed in the organisational theory literature during the early to mid-1960's to study the influence of different contingency factors on optimal OS (e.g., Burns and Stalker, 1961; Chandler, 1962; Woodward, 1965), but was not referred to in the accounting literature until the mid-1970’s (e.g., Burns and Waterhouse, 1975; Gordon and Miller, 1976). The necessity for resolving conflicting findings and the availability of a ready-made theory have led to the popularity of contingency theory in the accounting literature (Otley, 1980). Despite the intense usage of contingency theory to study OS, the theory has been employed to study many different organisational characteristics, such as MCS, operations management, human resource management, leadership, strategic management and strategic decision-making processes (Donaldson, 2001; Chenhall, 2003; 2007; Sousa and Voss, 2008; Boyd, Haynes, Hitt, Bergh and Ketchen, 2012).[15] Contingency theory views the organisation as an open system with no universal optimal CSD that is equally suitable for all organisations; instead, optimal CSD is influenced by different contingency factors, such as an organisation’s technology, environment and size (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014). The assumption underlying contingency theory in the management accounting field is that any aspect of MCS, including the costing system, is adopted and used to assist managers to achieve the organisational goals, and that the most appropriate, i.e., optimal, design will be affected by the context (Haldma and Lääts, 2002; Chenhall, 2003).

Contingency theory was developed as a response to two approaches. The first is the universalistic approach, e.g., classical management organisational theory, which argues that there is one optimal CSD that can be applied and used in all companies and settings,

[15] In this thesis, the description of contingency theory is drawn from various literature that discussed this theory in different contexts from our current one, i.e., CSD. Examples of these contexts include OS (e.g., Drazin and Van de Ven, 1985; Donaldson, 1995; 2001; 2006; Meilich, 2006), MCS (e.g., Fisher, 1995; 1998; Chenhall, 2003; 2007; Burkert et al., 2014; Otley, 2016), management accounting systems (e.g., Otley, 1980; Gerdin and Greve, 2004; 2008; Hartmann, 2005) and operations management (Sousa and Voss, 2008). Hereafter, acknowledging that other literature was not concerned with CSD, the term “CSD” will be mainly used when drawing from other literature to explain contingency theory because CSD is the focus of this research. However, the terms “OS” and “MCS” will be utilised when required.

regardless of the surrounding circumstances (Otley, 1980; 2016; Fisher, 1995; 1998; Hartmann and Moers, 1999; Donaldson, 2001). The second approach is the situation-specific approach, which asserts that every company has unique contingency factors that influence its optimal CSD, and, thus, generalisations about optimal CSD cannot be made (Fisher, 1995; 1998). According to Fisher (1995; 1998), contingency theory is located between the two extremes, i.e., approaches. It contradicts the universalistic approach's idea by arguing that there is no universal optimal CSD for all companies, but that it differs for different companies based on the contingency factors (Otley, 2016; Fisher, 1995). Yet, contingency theory disagrees with the situation-specific approach's idea, as it attempts to identify only "the key contingencies from which prescriptions to suit different sets of circumstances could be developed" (Otley, 2016, p, 46) rather than unique contingencies for each company (Fisher, 1998). In other words, contingency theory differs from the situation-specific approach in that, for the former, the number of contingency factors affecting optimal CSD is limited to the key ones, whereas, for the later, this number is unlimited (Fisher, 1995).

According to Donaldson (2001), much of the contingency theory research has focused on OS, and this research stream is known as structural contingency theory. The structural contingency frameworks developed within organisational theory have contributed towards identifying contingency factors (Chenhall, 2003). Subsequently, researchers have used these contingency factors to investigate their impact on the optimality of the design of different aspects of MCS, including the costing system (Chenhall, 2003; Chenhall and Chapman, 2006). Contingency researchers have used different classifications for the contingency factors (e.g., Fisher, 1995; Merchant, 1998; Chenhall, 2003). For example, Chenhall (2003) classifies contingency factors into the external environment (e.g., Khandwalla, 1972; Gordon and Narayanan, 1984; Chenhall and Morris, 1986), technology (e.g., Merchant, 1984; Dunk, 1992; Abdel-Kader and Luther, 2008), structure (e.g., Chenhall and Morris, 1986; Abdel-

Kader and Luther, 2008), size (e.g., Merchant, 1981; 1984; Abdel-Kader and Luther, 2008), strategy (e.g., Simons, 1987; Chenhall and Morris, 1995) and culture (e.g., O'Connor, 1995; Brewer, 1998; Morakul and Wu, 2001).

Contingency theory includes three vital elements that collectively represent its core paradigm (Donaldson, 2001). First, there is an association between the contingency factor and CSD. Second, the contingency factor determines CSD in that a change in the contingency factor leads to a change in the CSD. Third, for each level of the contingency factor, there is a fit level of CSD that results in higher outcomes, whereas a misfit causes lower ones. According to Donaldson (2001), the third element, i.e., the fit-outcome relationship, lies at the heart of contingency theory, providing the theoretical explanation of the first two elements. The three elements of contingency theory mean that the contingency factors influence optimal CSD, at which higher outcomes are obtained, and that deviations from optimal CSD cause lower outcomes (Otley, 1980; 2016; Fisher, 1995; 1998; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014).

Contingency theory has been widely used in the MCS literature (Fisher, 1998; Chenhall, 2003; 2007; Chenhall and Chapman, 2006), including CSD (e.g., Krumwiede, 1998a; Drury and Tayles, 2005), for various reasons, such as to investigate and provide explanations regarding different aspects of the MCS used in practice (Otley, 1980; 2016; Chenhall, 2003; Gerdin and Greve, 2004) and to determine how MCS should be designed and implemented in a way that best suits the context (Hartmann, 2005; Chenhall and Chapman, 2006). Having provided a background of the theory and described the theory's main concepts, the next section will explain the most critical element of the theory; namely, the forms of fit.

3.3 Forms of fit

The concept of fit lies at the core of contingency theory, and it is important to understand the differences between the different forms of fit in order to employ those that better represent the reality and the hypothesised relationships between the independent variables - i.e., the contingency factors - and the dependent variable - e.g., optimal CSD - and prevent any erroneous interpretations of the findings of prior research (Drazin and Van de Ven, 1985; Venkatraman, 1989; Donaldson, 2001; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Meilich, 2006; Klaas and Donaldson, 2009; Burkert et al., 2014). Each form of fit postulates a specific form of relationship between the three components making up the relationship between the contingency factors and optimal CSD, namely, the contingency factors, CSD and the outcomes reflecting the optimality of CSD, has a distinct theoretical meaning and is associated with an appropriate statistical analysis technique (Venkatraman, 1989; Hartmann and Moers, 1999; Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014). In relation to this, Schoonhoven (1981, p. 352) commented:

> *The mathematical function used to express an interaction is not a trivial operation decision. It is one that should be grounded in theory, since its form makes assumptions with clear theoretical implications. If this function is reduced to a relatively thoughtless operationalization, then the theory tested may have different properties from the one asserted.*

Contingency theory researchers have used different terminology and classifications to explain the various forms of fit (e.g., Drazin and Van de Ven, 1985; Venkatraman, 1989; Donaldson, 2001; Gerdin and Greve, 2004; 2008; Chenhall and Chapman, 2006). In this regard, Chenhall and Chapman (2006) pointed out that these variations represent a challenge to researchers in understanding the meaning of fit and its related theoretical and methodological implications. Following the early classification of the forms of fit proposed by Drazin and

Van de Ven (1985), the discussion will include three forms of fit; namely, the selection, interaction and system forms of fit.

3.3.1 The selection form of fit

The selection form of fit, as is the case for all other forms of fit of contingency theory, assumes that optimal CSD is influenced by the contingency factors (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014). However, in contrast to all other forms of fit, the selection form of fit holds the view that companies operate in situations of equilibrium, meaning that all surviving companies have aligned their CSD with the requirements of their context, i.e., have optimal CSD (Chenhall and Chapman, 2006; Meilich, 2006; Burkert et al., 2014). For this reason, the selection form of fit does not use real outcome measures, e.g., financial or operational performance, but instead utilises the unrealistic outcome measure of company survival to express the optimality of CSD (Drazin and Van de Ven, 1985; Chenhall, 2003; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Meilich, 2006; Sousa and Voss, 2008).[16]

The selection form of fit is considered a bivariate model, meaning that it focuses on the unique and identifiable impacts of the contingency factors on optimal CSD (Meilich, 2006). Thus, it deals with the effect of each contingency factor, independent from the effects of other contingency factors, on optimal CSD. Given the equilibrium assumption held by the selection form of fit, determining the influence of each contingency factor on optimal CSD from the perspective of the selection form of fit involves simply testing the impact of the contingency factor on CSD without linking the latter with an outcome expressing its optimality (Gerdin and Greve, 2004; Hartmann, 2005; Burkert et al., 2014). A significant impact of the contingency factor on CSD indicates that the former affects optimal CSD from

[16] Gerdin and Greve (2004) named the selection form of fit “congruence fit”.

the viewpoint of the selection form of fit. It also represents the fit relationship between the contingency factor and CSD, and that any misfit is assumed to cause companies to disappear. If the significant impact of the contingency factor on CSD agrees with the expectations, e.g., positive, the hypothesised effect of the contingency factor on optimal CSD is supported. Other findings, however, indicate that the influence of the contingency factor on optimal CSD from the standpoint of the selection form of fit either is not supported or does not agree with the hypothesised one. Correlation, regression and one-way analysis of variance (ANOVA) are common statistical analysis techniques used to test for the selection form of fit (Meilich, 2006; Chenhall, 2007).

3.3.2 The interaction form of fit

The interaction form of fit, in accordance with all other forms of fit of contingency theory, assumes that optimal CSD is influenced by the contingency factors (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014). Nonetheless, in contrast to the selection form of fit, the interaction form of fit presumes that attaining equilibrium takes time, and that companies are in a dis-equilibrium position because not all companies have adapted their CSD to suit the requirements of their context even though all companies are expected to be moving towards this (Chenhall and Chapman, 2006; Burkert et al., 2014). Therefore, variations in the optimality of CSD between the surviving companies are expected (Gerdin and Greve, 2004). Because of the doubt over the equilibrium assumption, the interaction form of fit uses real outcome measures rather than the unrealistic outcome measure of company survival to represent the optimality of CSD (Drazin and Van de Ven, 1985; Gerdin and Greve, 2004; Sousa and Voss, 2008; Burkert et al., 2014).

Like the selection form of fit, the interaction form of fit is considered a bivariate model (Meilich, 2006) and, hence, deals with the impact of each contingency factor, independent from the impacts of other contingency factors, on optimal CSD. Researchers have divided the interaction form of fit into several sub-forms, including the matching (Section 3.3.2.1), moderation (Section 3.3.2.2) and mediation (Section 3.3.2.3) sub-forms of fit (Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2004; 2008; Burkert et al., 2014). All three sub-forms of fit aim to examine the independent effect of each contingency factor on optimal CSD. However, they differ regarding: (1) the specific form of relationship between the three components of the relationship between the contingency factors and optimal CSD, which are the contingency factors, CSD and the outcomes reflecting the optimality of CSD; (2) the theoretical meaning; and (3) the utilised statistical analysis technique.

3.3.2.1 The matching sub-form of fit

Under the matching sub-form of fit, the relationship between CSD and the outcome is curvilinear that is affected by the contingency factor, which means that, for each level of the contingency factor, there is only one level of CSD that generates the highest level of outcome, i.e., the optimal level of CSD (Schoonhoven, 1981; Donaldson, 2001; Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014).[17] If the levels of the contingency factor and CSD match, then a fit is achieved and the outcome is maximised (Klaas and Donaldson, 2009; Burkert et al., 2014). Any mismatch, due to either an over-fit, i.e., a higher level of CSD compared to the level required by the contingency factor, or under-fit, i.e., a lower level of CSD compared to the level required by the contingency factor, decreases the outcome (Chenhall and Chapman, 2006; Klaas and Donaldson, 2009; Burkert et al., 2014). A fit line can be visualised by joining the matching/fit points between the various levels of the contingency factor and CSD (Chenhall and Chapman, 2006; Klaas and Donaldson, 2009).

[17] As mentioned in Section 1.3, Donaldson (2001) named the matching sub-form of fit “congruence fit”.

Given the above, identifying the influence of each contingency factor on optimal CSD from the perspective of the matching sub-form of fit involves determining the direction of the association between the contingency factor and optimal CSD - i.e., positive or negative - and the magnitude and sign of the impact of the misfit, including both over- and under-fit, between the contingency factor and optimal CSD on the outcome. A conformable direction of the association between the contingency factor and optimal CSD to the expectations - e.g., positive - and a significant effect of the misfit between the two on the outcome that agrees with the anticipations, e.g., negative, provide support for the hypothesised influence of the contingency factor on optimal CSD from the viewpoint of the matching sub-form of fit. Other findings, however, indicate that the impact of the contingency factor on optimal CSD from the standpoint of the matching sub-form of fit either is not supported or does not agree with the hypothesised one.

The classical matching sub-form of fit assumes that: (1) the outcome is at the same level along the fit line, regardless of whether the matching is between low levels of the contingency factor and CSD or between high levels of both, i.e., iso-outcome; and (2) both over- and under-fit have similar, i.e., equal, negative effects on the outcome (Donaldson, 2001; 2006; Burkert et al., 2014). Nevertheless, there are two extensions to the classical matching sub-form of fit. The first extension includes a matching sub-form of fit with the outcome being, along the fit line, higher when the matching is between higher levels of the contingency factor and CSD compared to lower levels, i.e., hetero-outcome (Donaldson, 2001; 2006).[18] The second extension encompasses a matching sub-form of fit with under-fit

[18] For further details about the first extension to the matching sub-form of fit, see Donaldson (2001, pp. 263-268 and pp. 280-281).

having a more detrimental influence on the outcome compared to over-fit (Klaas and Donaldson, 2009).[19]

The matching sub-form of fit has not been widely adopted in the contingency-optimal management and contingency-optimal MCS literature (Chenhall and Chapman, 2006; Chenhall, 2007; Burkert et al., 2014), including the contingency-optimal CSD literature (for exceptions, see Abernethy et al., 2001; Ittner et al., 2002). Difference-score models - e.g., algebraic, absolute, squared, empirical-Euclidian distance and residual analysis - and PRA along with RSM are the statistical analysis techniques that can be used to test for the matching sub-form of fit (Chenhall and Chapman, 2006; Donaldson, 2006; Meilich, 2006; Burkert et al., 2014).

3.3.2.2 The moderation sub-form of fit

The moderation sub-form of fit differs from the matching one in that the former assumes that the relationship between CSD and the outcome is linear that varies at different levels of the contingency factor, meaning that the contingency factor influences the strength and/or form, i.e., sign, of the linear relationship between CSD and the outcome (Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014).[20] However, both the moderation and matching sub-forms of fit agree with the general idea that the contingency factor impacts the relationship between CSD and the outcome (Venkatraman, 1989; Gerdin and Greve, 2004; 2008; Burkert et al., 2014).

Given the above, identifying the effect of each contingency factor on optimal CSD from the perspective of the moderation sub-form of fit involves testing the influence of the contingency factor on the linear relationship between CSD and the outcome. If the

[19] For further details about the second extension to the matching sub-form of fit, see Klaas and Donaldson (2009).

[20] As mentioned in Section 1.3, some researchers used the term “multiplicative” (e.g., Chenhall and Chapman, 2006; Gerdin and Greve, 2008) or “interaction” (Meilich, 2006) rather than “moderation”.

contingency factor impacts on this linear relationship in the way that agrees with expectations, the hypothesised effect of the contingency factor on optimal CSD from the viewpoint of the moderation sub-form of fit is supported. Other findings, nonetheless, indicate that the influence of the contingency factor on optimal CSD from the standpoint of the moderation sub-form of fit either is not supported or does not agree with the hypothesised one.

There are two different types of the moderation sub-form of fit; namely, monotonic and non-monotonic (Schoonhoven, 1981; Hartmann and Moers, 1999; Chenhall and Chapman, 2006; Burkert et al., 2014). The monotonic type assumes that, at all levels of the contingency factor, the relationship between CSD and the outcome is either positive or negative. In contrast, the non-monotonic type presumes that, at some levels of the contingency factor, the relationship between CSD and the outcome is positive, whereas, at other levels of the contingency factor, the relationship between the two is negative.

The moderation sub-form of fit can be used for two different objectives; namely, examining the strength or the form, i.e., sign, of the relationship between CSD and the outcome (Venkatraman, 1989; Hartmann and Moers, 1999; Gerdin and Greve, 2004; Chenhall and Chapman, 2006). While examining the strength involves testing the differences in the strength of the relationship between CSD and the outcome at different levels of the contingency factor, examining the form is concerned with whether the slope of the relationship between CSD and the outcome differs at different levels of the contingency factor. The moderation sub-form of fit has been widely adopted in the contingency-optimal management and contingency-optimal MCS literature (Chenhall and Chapman, 2006; Burkert et al., 2014), including the contingency-optimal CSD literature (e.g., Cagwin and Bouwman, 2002; Schoute, 2009). Moderated regression analysis (MRA) and sub-group regression analysis are common statistical analysis techniques used to test for the moderation sub-form of fit (Hartmann and Moers, 1999; Chenhall and Chapman, 2006; Burkert et al., 2014).

3.3.2.3 The mediation sub-form of fit

The mediation sub-form of fit examines how the contingency factor influences the outcome through a mediator variable represented by CSD (Venkatraman, 1989; Gerdin and Greve, 2004; Burkert et al., 2014). Thus, identifying the impact of each contingency factor on optimal CSD from the perspective of the mediation sub-form of fit involves testing the indirect effect of the contingency factor on the outcome through CSD. A significant indirect effect that is in accordance with expectations provides support to the hypothesised effect of the contingency factor on optimal CSD from the viewpoint of the mediation sub-form of fit. Other findings, however, convey that the influence of the contingency factor on optimal CSD from the standpoint of the mediation sub-form of fit either is not supported or does not agree with the hypothesised one.

The mediation sub-form of fit was proposed by Gerdin and Greve (2004) as an alternative to the moderation one. They drew on Shields and Shields (1998) to argue that the moderation sub-form of fit is invalid when a significant relationship exists between the contingency factor – i.e., moderator - and either CSD or the outcome, because this violates the assumption of the moderation sub-form of fit that the moderator should not have a significant relationship with either the independent, i.e., CSD, or the dependent, i.e., the outcome, variables. However, the moderator can be related to both the independent variable - i.e., CSD - and the dependent one, i.e., the outcome (Sharma, Durand and Gur-Arie, 1981; Burkert et al., 2014). Therefore, Gerdin and Greve's (2004) argument is not totally supported. Many researchers have argued that the mediation sub-form of fit should not be considered part of contingency theory because of its failure to capture the states of misfit between the contingency factors and optimal CSD and, then, test their impact on the outcome, its assumption that the relationship between CSD and the outcome is linear that is not affected by the contingency factor and its assumption that some states of fit, e.g., low levels of both the contingency factor and CSD, result in lower outcome levels (Gerdin, 2005a; 2005b; Hartmann, 2005; Chenhall, 2007; Burkert et al., 2014). Structural equation modeling (SEM) and simple path models are common statistical analysis techniques used to test for the mediation sub-form of fit (Chenhall, 2007; Burkert et al., 2014).

3.3.3 The system form of fit

The system form of fit, in agreement with all forms of fit of contingency theory, assumes that optimal CSD is influenced by the contingency factors (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014). Like the interaction form of fit, the system form of fit presumes that companies are in a dis-equilibrium position, which means that differences in the optimality of CSD between the surviving companies are anticipated. Given this, the system form of fit utilises real outcome measures rather than the unrealistic outcome measure of company survival to account for the optimality of CSD (Drazin and Van de Ven, 1985; Chenhall, 2003; 2007). In contrast to the selection and interaction forms of fit, the system form of fit is not considered a bivariate model (Meilich, 2006). To illustrate this, the system form of fit examines how different combinations of multiple contingency factors and multiple factors representing many aspects of OS or MCS, simultaneously, impact the outcome (Drazin and Van de Ven, 1985; Chenhall, 2003; Chenhall and Chapman, 2006; Burkert et al., 2014). The plurality of factors can be restricted to: (1) multiple contingency factors with one factor that represents one aspect of OS or MCS, e.g., CSD; (2) a single contingency factor with multiple factors that represent many aspects of OS or MCS, e.g., CSD and budgeting-style; or (3) multiple contingency factors with multiple factors that represent many aspects of OS or MCS

(Donaldson, 2001).[21] This suggests that the system form of fit is concerned with the joint effect of all contingency factors rather than the individual influence of each contingency factor on optimal CSD, as is the case under the selection and interaction forms of fit (Chenhall and Chapman, 2006; Burkert et al., 2014).

Determining the joint effect involves testing the magnitude and sign of the impact of the misfit, including both over- and under-fit, between all contingency factors, taken together, and optimal CSD on the outcome. Therefore, the system form of fit is similar to the matching sub-form of fit regarding the testing for the effect of the misfit on the outcome (Drazin and Van de Ven, 1985; Chenhall and Chapman, 2006) and, accordingly, presuming that the relationship between CSD and the outcome is curvilinear that is shifted by the contingency factor. However, the former involves conducting this test once incorporating all contingency factors, whereas the latter is a bivariate model and, thus, involves performing this test separately for each contingency factor. A significant influence of the misfit between all contingency factors, taken together, and optimal CSD on the outcome that conforms to expectations, e.g., negative, provides support for the hypothesised impact of the contingency factors on optimal CSD from the perspective of the system form of fit, i.e., joint impact. Other findings, nevertheless, mean that the effect of the contingency factors on optimal CSD from the viewpoint of the system form of fit, i.e., joint effect, either is not supported or does not correspond to the hypothesised one.

When testing the magnitude and sign of the impact of the misfit between all contingency factors, taken together, and optimal CSD on the outcome to determine the joint effect, i.e., when testing the system form of fit, it is crucial to examine whether the misfit represents an

[21] The discussion below will assume a system form of fit that contains multiple contingency factors with a single factor that represents one aspect of MCS; namely, CSD. However, the discussion is applicable to the other variations of the system form of fit, which include: (1) a single contingency factor with multiple factors that represent many aspects of OS or MCS; and (2) multiple contingency factors with multiple factors that represent many aspects of OS or MCS.

actual deviation from the expected direction, e.g., positive, of the association between all contingency factors, taken together, and optimal CSD. However, a procedure to determine the direction of the association between all contingency factors, taken together, and optimal CSD has not yet been developed. Hence, the only possible way to determine whether the misfit actually deviates from the expected direction of the association between all contingency factors, taken together, and optimal CSD is to examine whether each of the contingency factors is associated with optimal CSD in the way expected. If all or most of the contingency factors are associated with optimal CSD in the way expected, the expected direction of the association between all contingency factors, taken together, and optimal CSD can be assumed to be supported, and, therefore, the misfit can be assumed to represent an actual deviation from the expected direction of the latter association. Otherwise, the expected direction of the association between all contingency factors, taken together, and optimal CSD cannot be assumed to be supported, and, accordingly, the misfit cannot be assumed to indicate an actual deviation from the expected direction of the latter association.

It should be noted that the system form of fit differs from the configuration one, although both attempt to examine the overall influence of multiple fits between multiple contingency factors and CSD on the outcome (Donaldson, 2001; 2006; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Burkert et al., 2014).[22] The system form of fit asserts that there exist many fit points forming a fit continuum where companies are moving frequently, in a gradual way, from one fit to another. Hence, the system form of fit examines the overall impact of multiple fits between multiple contingency factors and CSD on the outcome through summing the individual effects of the multiple fits (Donaldson, 2001; Chenhall and

[22] Researchers have used different terms to refer to the system and configuration forms of fit described above. Drazin and Van de Ven (1985) used the term "system" to refer to the latter. Donaldson (2001) used the term "multifits" for the system form of fit and the term "system" for the configuration form of fit. Gerdin and Greve (2004) discussed the differences between the cartesianism and configurationalism approaches where the former includes the system form of fit, whereas the latter encompasses the configuration form of fit.

Chapman, 2006). In contrast to the system form of fit, the configuration one drops the fit continuum idea and assumes that only a few successful, broadly-separated archetypes of specific configurations representing the fit points exist, and that companies make infrequent large movements or quantum leaps from one configuration to another. Therefore, the configuration form of fit examines the overall influence of multiple fits between multiple contingency factors and CSD on the outcome by attempting to capture the holistic interdependencies between the contingency factors and CSD that is not grasped by simply summing the individual effects of the multiple fits (Donaldson, 2001; Chenhall and Chapman, 2006). Given the configuration form of fit's view about the number of fit points, how the fit points are structured and how companies move between them, it was considered by Donaldson (2001) not to form part of contingency theory (see Donaldson (2001) pp. 141-152 and pp. 198-200 for further details).

Difference-score models, including theoretical-Euclidian distance, empirical-Euclidian distance and residual analysis (e.g., Govindarajan, 1988; Selto et al., 1995; Pizzini, 2006; King et al., 2010; Gani and Jermias, 2012), are common statistical analysis techniques used to test for the system form of fit (Chenhall and Chapman, 2006). The usage of difference-score models in the context of the system form of fit differs from that in the context of the matching sub-form of fit in that, as noted above, the former involves including multiple contingency factors simultaneously rather than individual contingency factors separately. Having explained the various forms of fit of contingency theory, the next section will identify the main criticisms raised against contingency research on optimal MCS regarding the application of the theory and discuss how this research accounts for these criticisms.

3.4 Criticisms of the application of contingency theory

Contingency research on optimal MCS, of which CSD represents an aspect (Chenhall, 2003; 2007), has been criticised for its lack of an appropriate application of contingency theory. Contingency theory researchers have advised that future contingency research on optimal MCS should account for these criticisms in order to enhance the strength of the results and build knowledge in a systemic way (e.g., Otley, 1980; 2016; Fisher, 1995; 1998; Chapman, 1997; Hartmann and Moers, 1999; Chenhall, 2003; 2007; Hartmann, 2005). The next paragraph will outline these criticisms, and the following one will discuss how this research addresses each one.

The main criticisms of contingency research on optimal MCS can be summarised into six areas. First, there has been a failure to employ appropriate verbal statements for and proper statistical analysis techniques to test the contingency hypotheses, which cast doubt on the validity of the prior research's results (Hartmann and Moers, 1999; Hartmann and Moers, 2003; Hartmann, 2005). Second, real outcome measures have been omitted in favour of using the unrealistic outcome measure of company survival to express the optimality of MCS, i.e., utilising the selection form of fit (Otley, 1980; Fisher, 1998). Third, outcome measures related to financial performance have been used extensively (Otley, 2016), which is problematic, given: (1) the difficulty of isolating the effects of MCS from the effects of other factors on financial performance and the fact that the other factors can influence the relationship between MCS and financial performance (Kennedy and Affleck-Graves, 2001; Narayanan and Sarkar, 2002; Chenhall, 2003; Cinquini and Mitchell, 2005; Al-Omiri and Drury, 2007; Banker et al., 2008; Fei and Isa, 2011; Otley, 2016); and (2) the possibility that financial performance may act as a contingency factor that influences MCS (Otley, 2016). Fourth, there has been an examination of the influence of a limited number of contingency factors on optimal MCS (Otley, 1980; 2016), which might result in a failure to account fully for possible varying or conflicting demands that may arise if a wide range of contingency factors is considered (Fisher, 1998; Donaldson, 2001; Otley, 2016).[23] Fifth, there has been a lack of consistency not only in relation to the contingency factors examined (Otley, 1980; 2016) but also with regard to the measurement of both the contingency factors and the MCS variable (Otley, 1980; Chenhall, 2003), all of which hinder the accumulation of relevant research results and the building of a coherent body of knowledge. Sixth, robust measures related to MCS aspects that have ambiguous meaning - e.g., ABC and CSC - have not yet been developed, which does not assist researchers when researching issues related to these MCS aspects and assure consistency between studies (Chenhall, 2003). In addition, Chenhall (2003) emphasised the importance of a continuous improvement for these measures by accounting for changes in the meaning of the MCS variables, which can occur as a result of, for example, advances in information technology software.

This research attempts to overcome each of the above criticisms. For the first criticism, by consulting the prior literature (e.g., Hartmann and Moers, 1999; Chenhall and Chapman, 2006; Burkert et al., 2014), this research utilises not only appropriate verbal statements for the research hypotheses, but also proper statistical analysis techniques to test them. For the second criticism, this research adopts the interaction and system forms of fit that require the inclusion of real outcome measures that represent the optimality of MCS, in this research, CSD. For the third criticism, this research follows the recommendations made by the prior literature (e.g., Al-Omiri and Drury, 2007; Otley, 2016) by avoiding using financial performance and utilising, instead, outcome measures related to the effectiveness of MCS, in this research, CSD. For the fourth criticism, this research considers the impact of a wide range of contingency factors identified by the contingency-optimal MCS literature and, in particular, the contingency-optimal CSD literature. For the fifth criticism, this research

[23] See Fisher (1998) for possible solutions to designing a MCS when a company faces conflicting contingencies.

examines the effect of contingency factors that have been used in the contingency-optimal CSD literature and, where appropriate, utilises the same measures used for both the contingency factors and MCS, in this research, CSD. For the sixth criticism, this research develops a comprehensive multi-dimensional measure of one aspect of MCS; namely, CSC. Having identified the main criticisms related to the application of the theory by contingency research on optimal MCS and discussed how this research accounts for these criticisms, the next section will provide a justification for utilising contingency theory in this research.

3.5 Justification for adopting contingency theory

As provided in Section 1.2, the idea that optimal CSD is influenced by different factors was stressed in the context of ABC and CSC, meaning that the optimality of CSD is not simply subject to the CSD being ABC versus TCS or more complex versus less complex, but to the extent to which the CSD is appropriate to the internal and external situation, i.e., contingency factors, of the organisation (Kaplan and Cooper, 1998; Cagwin and Bouwman, 2002; Ittner et al., 2002; Pizzini, 2006; Maiga et al., 2014; Drury, 2015). This idea, as also noted in Section 1.2, conforms to the underlying idea of contingency theory. As described in this chapter, contingency theory emphasises that it is impossible to apply one universal optimal CSD that is equally applicable to all organisations; rather, optimal CSD is impacted by different contingency factors, such as the organisation's technology, environment and size (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014). Given the above, contingency theory was adopted in this research to contribute towards providing an appropriate understanding of the influences on optimal CSD.

3.6 Conclusion

This chapter sought to demonstrate different aspects of the theory utilised by this research to assist in furnishing a proper understanding of the influences on optimal CSD; namely, contingency theory. Accordingly, this chapter contributed towards realising the first and second main contributions of this research and, thus, acquiring the research aim (see Section 1.5).

This chapter provided a background of the theory and described its main concepts. In addition, it illustrated the most important element of the theory; namely, the forms of fit. Furthermore, this chapter identified the main criticisms raised against contingency research on optimal MCS, of which CSD represents a part, with respect to the application of the theory, and also discussed how this research endeavours to overcome these criticisms. Moreover, it provided a justification for using contingency theory in this research. Having illustrated contingency theory, the next chapter will review contingency studies on optimal CSD.

Chapter four: Literature review 3: A review of contingency studies on optimal costing system design (CSD)

4.1 Introduction

The objective of this chapter is to review contingency studies on optimal CSD with respect to the assignment of indirect costs to products. Accordingly, this chapter assists in realising the three main contributions of this research relating to, respectively, the application of contingency theory with respect to the adopted forms of fit, the statistical analysis techniques exploited to test for the matching sub-form of fit and the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5). Thus, it contributes towards achieving the research aim of investigating the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. In addition, this chapter assists in realising the four minor contributions of this research concerning, respectively, the operationalisation of CSD, the account of the effect of organisational factors related to the organisation's management and employees and the measurements of CSC and production complexity (PC) (see Section 1.5). Hence, it contributes towards successfully considering the main limitation of contingency research on optimal CSD and, therefore, accomplishing the research aim (see Section 1.5).

The reviewed studies are divided using, sequentially, two criteria; namely, the operationalisation used for CSD and the forms of fit utilised. The first criterion is employed first in order to divide the reviewed studies on those that operationalised CSD from the perspective of ABC adoption and the level of CSC, respectively. Subsequently, the second criterion is applied in order to classify the reviewed studies further on those that adopted the selection and interaction form of fit, respectively. The system form of fit, however, is not used to categorise the reviewed studies because, to the author's knowledge, no contingency study on optimal CSD has adopted it.

This chapter is organised as follows. Section 4.2 and Section 4.3 review contingency studies on ABC adoption and CSC, respectively. Section 4.4 discusses the main limitation of contingency research on optimal CSD concerning the lack of an appropriate application of contingency theory regarding the adopted forms of fit, which might have hindered this research strand from providing a proper understanding of the influences on optimal CSD. In addition, Section 4.4 discusses the four minor limitations of contingency research on optimal CSD, whose consideration is vital in order to address successfully the main limitation of such research and, therefore, attain the research aim. Furthermore, Section 4.4 discusses the importance of addressing the main and minor limitations and states how this research endeavours to overcome these. Section 4.5 concludes this chapter.

4.2 Contingency studies on ABC adoption

4.2.1 Overview

Most of the contingency research on optimal CSD has operationalised CSD from the perspective of ABC adoption. Contingency research on ABC adoption has attempted to contribute towards furnishing a proper understanding of the influences on optimal CSD by examining the effect of a wide range of contingency factors on the adoption of ABC as an optimal CSD (e.g., Bjørnenak, 1997; Gosselin, 1997; Krumwiede, 1998a; Clarke et al., 1999; Malmi, 1999; Hoque, 2000; Cagwin and Bouwman, 2002; Brown et al., 2004; Maiga et al., 2014). In addition, the findings of contingency research on ABC adoption have contributed to the commencement and advancement of contingency research on optimal CSD that operationalised CSD from the other perspective; namely, the level of CSC. Contingency research on ABC adoption has tended to adopt the selection form of fit and, to a lesser extent, the interaction form of fit. To the author's knowledge, however, the system form of fit has not been utilised.[24] This section reviews selection (Section 4.2.2) and interaction (Section 4.2.3) studies on ABC adoption, and briefly outlines their main findings.

4.2.2 Selection studies on ABC adoption

Most contingency studies on ABC adoption have utilised the selection form of fit to investigate the influence of a wide range of contingency factors on the adoption of ABC as an optimal CSD simply by examining the impact of the contingency factors on ABC adoption without linking the latter with an outcome representing the optimality of ABC as a CSD, i.e., optimality of CSD.[25] However, selection studies on ABC adoption have exploited different approaches when examining such an impact, in both developed and developing countries, including Saudi Arabia.[26] The main difference between the various approaches adopted by selection studies is related to the different views held by these studies on the process of ABC adoption. These different approaches can be summarised into four approaches.

4.2.2.1 The first approach

The first approach considered ABC adoption as a process that includes multiple stages, such as the initiation of interest, adoption as an idea and adoption as a practice stages. Although all selection studies that adopted the first approach shared the view that ABC adoption is a multi-stage process, they focused on different stages of the process when examining the influence of the contingency factors. Selection studies that adopted the first approach can be divided into three groups.

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[24] Chenhall and Langfield-Smith (1998) used the configuration form of fit in their study, which they called it "the system approach". As explained in Section 3.3.3, the configuration and system forms of fit differ, with the former not being considered part of contingency theory (Donaldson, 2001). Given this, the study of Chenhall and Langfield-Smith (1998) is not included in the review.

[25] A summary of selection studies on ABC adoption is provided in Appendix 4-1.

[26] As this research was conducted in Saudi Arabia, a developing country, it is important to consider contingency research on optimal CSD conducted in other developing countries that share, to a different extent, various characteristics, such as the national culture, that may impact optimal CSD. Examples of these developing countries include South East Asia countries, Arab countries and Gulf Council Cooperation (GCC) countries that include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates.

The first group of selection studies that adopted the first approach focused on more than one stage of the ABC adoption process when examining the impact of the contingency factors. These studies held the view that the influential contingency factors and their magnitude of influence differ between the various stages of the ABC adoption process. This view is based on the argument that, in practice, companies are not at the same stage of the ABC adoption process. This view was adopted first by Anderson (1995), and later used, albeit differently, by many selection studies in developed countries (Bjørnenak, 1997; Booth and Giacobbe, 1998; Krumwiede, 1998a; Brown et al., 2004; Brierley, 2008b; Schoute, 2011) and, to a lesser extent, in developing ones (Jusoh and Miryazdi, 2016). Most of these studies found that the influential contingency factors and their extent of influence differ between the various stages of the ABC adoption process (Booth and Giacobbe, 1998; Krumwiede, 1998a; Brown et al., 2004; Schoute, 2011; Jusoh and Miryazdi, 2016).[27] For example, Booth and Giacobbe (1998) found that PC has a positive effect on one stage, namely, the ABC adoption as an idea stage, but not the other stages, which are the initiation of interest in ABC and the ABC adoption as a practice stages. Another example is the study conducted by Brown et al. (2004), which found that top management support (TMS) has a positive influence on the initiation of interest stage, but not the adoption stage. In addition, the first group of selection studies that adopted the first approach produced other findings related to the impact of different contingency factors on different stages of the ABC adoption process. Examples of these contingency factors include competition (Jusoh and Miryazdi, 2016), cost structure, i.e., level of indirect costs (Bjørnenak, 1997; Booth and Giacobbe, 1998; Jusoh and Miryazdi, 2016), PC (Booth and Giacobbe, 1998; Krumwiede, 1998a; Jusoh and Miryazdi, 2016),

[27] Although the first group of selection studies that adopted the first approach held the same view that the contingency factors and their influence vary between different stages of the ABC adoption process, these studies were inconsistent with regard to the stages examined - e.g., initiation of interest, adoption as an idea, adoption as a practice, adoption, infusion and usage - and the definitions used for each stage, possibly due to the lack of agreement between researchers with regard to the stages of the ABC adoption process and their definition.

business-unit size (Brierley, 2008b; Krumwiede, 1998a) and TMS (Krumwiede, 1998a; Brown et al., 2004).

In contrast to the first group of selection studies, the second group that adopted the first approach focused on only one stage of the ABC adoption process, namely, ABC adoption, when examining the effect of different contingency factors. Therefore, the second group of selection studies that adopted the first approach did not aim to examine the influence of the contingency factors on the other stages of the ABC adoption process, e.g., initiation of interest, considering, used somewhat and used extensively. Nevertheless, these studies used the other stages of the ABC adoption process by combining them in different ways to define ABC adoption and non-adoption, as researchers have diverse views on the best ways of defining ABC adoption and non-adoption. Most of the selection studies on ABC adoption conducted in both developed countries (Innes and Mitchell, 1995; Nguyen and Brooks, 1997; Clarke et al., 1999; Innes, Mitchell and Sinclair, 2000; Cohen et al., 2005; Brierley, 2011) and developing ones (Chen et al., 2001; Al-Mulhem, 2002; Chongruksut and Brooks, 2005; Khalid, 2005; Maelah and Ibrahim, 2007; Chongruksut, 2009; Nassar et al., 2009; Al-Khadash and Mahmoud, 2010; Ahamadzadeh, Etemadi and Pifeh, 2011; Joshi, Bremser, Deshmukh and Kumar, 2011; Al-Omiri, 2012; Charaf and Bescos, 2013; Pokorná, 2015) fall under the second group of selection studies that adopted the first approach. These studies provided findings related to the effect of a wide range of contingency factors on ABC adoption. Examples of these contingency factors include competition (Nguyen and Brooks, 1997; Al-Omiri, 2012), cost structure (Al-Omiri, 2012), organisational culture (Charaf and Bescos, 2013), PC (Nguyen and Brooks, 1997; Chongruksut and Brooks, 2005; Khalid, 2005), business-unit size (e.g., Clarke et al., 1999; Al-Mulhem, 2002; Khalid, 2005; Brierley, 2011; Pokorná, 2015), TMS (Maelah and Ibrahim, 2007) and managers' knowledge and awareness of the importance of using ABC (Al-Khadash and Mahmoud, 2010).

Similar to the first and second groups of selection studies, the third group that adopted the first approach considered ABC adoption to be a multi-stage process, but failed to investigate the influences on: (1) the various stages of the ABC adoption process, as did the first group of selection studies; or (2) the ABC adoption stage, as did the second group of selection studies. The third group of selection studies that adopted the first approach aimed to identify whether an association exists between different contingency factors and ABC adoption, as measured as either a continuous variable related to the extent of usage (Al-Khadash and Feridun, 2006) or one categorical variable that includes five stages (Askarany, Yazdifar and Askary, 2010).[28] In contrast to the usage of the types of variables exploited by the first group of selection studies, e.g., a separate variable for each stage or ordinal variables, the usage of a categorical variable for ABC adoption by Askarany et al. (2010) is not appropriate to reveal the influence of the contingency factor on each of the various stages of ABC adoption. The findings of the third group of selection studies include a positive association between business-unit size and ABC adoption (Askarany et al., 2010).

4.2.2.2 The second approach

Similar to the first approach, the second approach considered ABC adoption to be a process that includes multiple stages. However, the main difference between the two approaches is that the first approach focused on ABC as a costing system only and disregarded other preliminary stages that are required in order for companies to be equipped to adopt such a complex costing system, whereas the second approach took a wider view of the ABC adoption process and accounted for other preliminary stages. In particular, the second approach considered ABC adoption to be the final stage of a process called activity management. The pre-activity management stages of ABC adoption include activity analysis

[28] Askarany et al. (2010) measured ABC adoption in two different ways, in accordance with the first and second approaches, respectively. Thus, the study conducted by Askarany et al. (2010) is included with both the first and the second approach’s selection studies.

adoption and activity cost analysis adoption (Gosselin, 1997; Baird et al., 2004). The former is a pre-stage of activity cost analysis adoption, and is concerned with determining the activities performed by the company in order to transform the company resources, such as materials and labour, into the final products. Activity cost analysis goes beyond activity analysis to determine the costs of the activities and the causes of their costs. Activity cost analysis is a cost driver analysis, which can be used for cost reduction purposes. Nonetheless, activity cost analysis does not involve allocating the activities' costs between products, as occurs under ABC. The second approach was adopted first by Gosselin (1997) and used later by other studies conducted in developed countries (Baird et al., 2004; Askarany et al., 2010). Selection studies that adopted the second approach provided findings regarding the influence of different contingency factors on the various stages of the ABC adoption process.[29] Examples of these contingency factors include business-unit strategy and structure (Gosselin, 1997), decision usefulness of cost information, organisational culture and business-unit size (Baird et al., 2004).

4.2.2.3 The third approach

The third approach was adopted by Malmi (1999). The innovative approach of this study is that it, first, divided ABC adoption in Finland into initial, take off and later phases. Then, it examined which of the Abrahamson's (1991) motives of efficient-choice, forced selection, fad and fashion can best explain ABC adoption in each phase. Malmi (1999) compared ABC adopters and non-adopters of the phase that can be best explained by the efficient-choice motive. The basic idea behind this approach is that companies that adopt ABC based on the efficient-choice motive should make the adoption decision based on a strong rationale, and should possess the characteristics of ABC adopters identified by the early ABC adoption

[29] It is important to note that selection studies that adopted the second approach were inconsistent regarding the activity management stages examined in each study. While Gosselin (1997) focused on the adoption of activity management as a whole and on the ABC adoption stage, Baird et al. (2004) and Askarany et al. (2010) focused on each of the activity management stages.

research (e.g., Cooper, 1988b; Estrin et al., 1994). Malmi (1999) found significant differences between ABC adopters and non-adopters, in that the former faced higher levels of competition, had higher levels of PC in terms of the number of products and were larger.

4.2.2.4 The fourth approach

The fourth approach is a simple approach, in that it did not consider ABC adoption to be a multi-stage process, as did the first and second approaches, nor account for the motives behind the adoption decision, as did the third approach. It considered ABC adoption to be a simple process, consisting of either adopting ABC or not adopting ABC. The fourth approach has been utilised in developed countries (Hoque, 2000; Askarany, Smith and Yazdifar, 2007; Kallunki and Silvola, 2008) and, to a greater extent, in developing ones (Mclellan and Moustafa, 2013; Rbaba'h, 2013; Rundora, Ziemerink and Oberholzer, 2013; John, 2014a; 2014b; Elhamma and Moalla, 2015). Selection studies that adopted the fourth approach provided many findings related to the impact of many contingency factors on ABC adoption. Examples of these contingency factors include Just-in-Time (JIT) and automation (Hoque, 2000), technological changes in manufacturing practices (Askarany et al., 2007), organisational life cycle stage (Kallunki and Silvola, 2008), business-unit age (Rundora et al., 2013), business-unit structure (Elhamma and Moalla, 2015), PC (John, 2014a) and business-unit size (Hoque, 2000; Kallunki and Silvola, 2008; Rundora et al., 2013; John, 2014b; Elhamma and Moalla, 2015).

To sum up, most of the contingency studies on ABC adoption have exploited the selection form of fit. Although selection studies on ABC adoption have held different views on the process of ABC adoption, they have provided evidence for the influence of different contingency factors, such as competition, cost structure, organisational culture, PC and business-unit size, on the adoption of ABC as an optimal CSD from the perspective of the selection form of fit.

4.2.3 Interaction studies on ABC adoption[30]

Compared to the selection form of fit, the interaction form of fit has not been widely used by contingency research on ABC adoption. Only a small number of contingency studies on ABC adoption have focused on the interaction form of fit (Frey and Gordon, 1999; Cagwin and Bouwman, 2002; Ittner et al., 2002; Banker et al., 2008; Xiao, Duh and Chow, 2011; Elhamma, 2012; Elhamma and Zhang, 2013; Krumwiede and Charles, 2014; Maiga et al., 2014).[31] These interaction studies have tended to adopt the moderation sub-form of fit and, to a lesser extent, the matching one.[32] The mediation sub-form of fit, however, has not been utilised.[33]

Interaction studies on ABC adoption have used the moderation sub-form of fit to investigate the influence of different contingency factors on the adoption of ABC as an optimal CSD. This was done by examining the moderation impact of different contingency factors on the relationship between ABC and different outcomes, such as operational and financial performance, expressing the optimality of ABC as a CSD, i.e., optimality of CSD. Apart from Cagwin and Bouwman (2002), most of the interaction studies have examined the moderation effect of a small number of contingency factors, a maximum of two. Cagwin and Bouwman (2002) investigated the moderator role of a wide range of contingency factors on the relationship between ABC and improvement in financial performance. The study found that ABC has a positive impact on improvement in financial performance when it is employed in companies that have high levels of PC and use other strategic initiatives, e.g., JIT. Hence, these findings support the moderator role of the contingency factors of PC and

[30] The findings of the studies reviewed in this section relating to the direct or indirect effects of ABC adoption on the outcomes, such as financial performance, are not reported because this approach of testing does not belong to contingency theory (Chenhall, 2003; 2007).
[31] A summary of the interaction studies on ABC adoption is provided in Appendix 4-2.
[32] Similarly, interaction studies on optimal MCS have tended to adopt the moderation sub-form of fit and, to a lesser extent, the matching one (Chenhall and Chapman, 2006; Burkert et al., 2014).
[33] To the author's knowledge, no contingency study on ABC adoption has adopted the mediation sub-form of fit where ABC adoption acts as the mediator variable between the contingency factors - i.e., independent variables - and the outcomes, i.e., dependent variable.

the usage of strategic initiatives on the relationship between ABC and improvement in financial performance.

Of the interaction studies that have examined the moderation effect of a small number of contingency factors, two have found that business-unit strategy moderates the relationship between ABC and financial performance (Frey and Gordon, 1999; Krumwiede and Charles, 2014). For example, Frey and Gordon (1999) found that ABC was significantly associated with a better return on investment in business-units that follow a differentiation rather than a cost leadership strategy. Besides business-unit strategy, other studies have found support for the moderator impact of other contingency factors, such as business-unit size (Elhamma, 2012) and the usage of enterprise resource planning (ERP) systems (Maiga et al., 2014).[34] Other studies, however, have failed to find support for the moderator effect of certain contingency factors, such as the usage of information/communication technology (Xiao et al., 2011) and world-class manufacturing practices (Banker et al., 2008).

As mentioned above, the matching sub-form of fit is under-utilised compared to the moderation one. Among the interaction studies on ABC adoption, only Ittner et al. (2002) used the former. The study utilised the matching sub-form of fit to investigate the influence of plant operational characteristics related to PC on the adoption of ABC as an optimal CSD. This was done by examining the association between plant operational characteristics related to PC and ABC as an optimal CSD, and whether the misfit between the two has a negative impact on different performance measures representing the optimality of ABC as a CSD, including manufacturing quality and cycle time, i.e., operational performance, return on assets – i.e., financial performance - and improvements in manufacturing costs, quality and cycle time. Ittner et al. (2002) found a weak positive effect of operational characteristics

[34] An ERP system represents an integrated information system, which can be defined as "enterprise wide packages that tightly integrate business functions into a single system with a shared database" (Maiga et al., 2014, p. 80)

related to PC on the adoption of ABC as an optimal CSD from the perspective of the matching sub-form of fit. More specifically, the study found that plant operational characteristics related to PC and the adoption of ABC as an optimal CSD are positively associated, but the misfit between the two has only a weak negative influence on one performance measure; namely, financial performance.

To sum up, only a few contingency studies on ABC adoption have used the interaction form of fit. Interaction studies on ABC adoption, mainly, have utilised the moderation sub-form of fit and, to a lesser extent, the matching one. As presented in this section, these studies have provided a strong/weak support for the influence of different contingency factors, such as PC and business-unit size, on the adoption of ABC as an optimal CSD from the viewpoint of the moderation/matching sub-forms of fit, respectively. Having reviewed and, briefly, provided the main findings of selection studies on ABC adoption in Section 4.2.2 and interaction studies on ABC adoption in this section, the next section will review and outline the main findings of contingency research on optimal CSD that operationalised CSD using the other perspective; namely, the level of CSC.

4.3 Contingency studies on CSC

4.3.1 Overview

Compared to contingency research on ABC adoption, the extent of contingency research on CSC is far lower. Only a few studies in developed countries (Abernethy et al., 2001; Drury and Tayles, 2005; Brierley, 2007; 2010; Al-Omiri and Drury, 2007; Schoute, 2009) and developing ones (Ismail and Mahmoud, 2012; Al-Omiri and Drury, 2013) have operationalized CSD from the perspective of the level of CSC. As mentioned in Section 2.4, these studies selected such an operationalisation due to many of the issues related to operationalising CSD with respect to ABC adoption, e.g., ignoring the fact both TCS and ABC can vary in their level of complexity. Similar to contingency research on ABC adoption, contingency research on CSC has endeavoured to assist in providing an appropriate understanding of the influences on optimal CSD through examining the influence of a wide range of contingency factors on the optimal level of CSC, i.e., optimal CSD. These contingency factors have been mainly adopted from the preceding contingency research on ABC adoption, given that ABC is considered a complex costing system (e.g., Cooper and Kaplan, 1988b; Innes and Mitchell, 1990b; Abernethy et al., 2001; Al-Omiri and Drury, 2007). In conformity with contingency research on ABC adoption, contingency research on CSC has tended to employ the selection form of fit and, to a lesser extent, the interaction one. To the author's knowledge, the system form of fit, however, has not been exploited. This section reviews selection (Section 4.3.2) and interaction (Section 4.3.3) studies on CSC and presents their main findings.

4.3.2 Selection studies on CSC

Most contingency studies on CSC have exploited the selection form of fit to investigate the influence of different contingency factors on the optimal level of CSC, i.e., optimal CSD.[35] This has been done by simply examining the impact of contingency factors on CSC without linking the latter with an outcome expressing the optimality of the level of CSC, i.e., the optimality of CSD. Most of the selection studies on CSC have adopted a deductive approach using a survey strategy, with the questionnaire as the data collection method (Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013; Brierley, 2007; Ismail and Mahmoud, 2012), while only one study adopted an inductive approach utilising a cross-sectional field studies strategy, with the interview as the data collection method (Brierley, 2010).

The first survey selection study on CSC was conducted in the United Kingdom (UK) by Drury and Tayles (2005). It examined the influence of different contingency factors on CSC and used the number of cost pools, the number of cost drivers and a composite measure of

[35] A summary of the selection studies on CSC is provided in Appendix 4-3.

both as CSC measures. Using multiple regression analysis, the results showed that, on the composite measure and the number of cost drivers CSC measures, PC-support diversity, business-unit size and the service and financial industries, compared to manufacturing, have a positive influence, whereas PC-the degree of customisation has a negative one. On the number of cost pools CSC measure, the results showed that PC-support diversity, business-unit size and the importance of cost information have a positive influence.

Besides the number of cost pools and cost drivers used by Drury and Tayles (2005), Al-Omiri and Drury (2007) added two dichotomous variables of ABC adoption versus non-adoption and absorption versus direct costing to measure CSC. They examined the impact of a wide range of contingency factors on the four CSC measures in a sample of UK business-units, using a survey strategy. Employing logistic and multiple regression analysis, the results showed that the importance of cost information and business-unit size have a positive effect on all CSC measures, whereas the level of competition and the financial industry, compared to manufacturing, have a positive influence on all CSC measures apart from the absorption versus direct costing CSC measure. Moreover, the study found that the extent to which innovative management accounting techniques are used and the service industry, compared to manufacturing, have a positive impact on the ABC adoption versus non-adoption CSC measure. Furthermore, the study found, for manufacturing companies, a positive correlation between the number of cost pools and the usage of lean production/JIT, and that ABC users have a significantly higher level of lean production/JIT usage compared to non-users.[36]

The third survey selection study on CSC was conducted by Brierley (2007) in the UK. This study examined the influence of different contingency factors on CSC using only two CSC measures; namely, the number of cost pools and cost drivers. Using multiple regression

[36] The result related to the usage of lean production/JIT for the number of cost pools is based on the correlation analysis, whereas that for ABC adoption versus non-adoption is based on the Mann-Whitney test.

analysis, the study found a positive impact of cost structure and business-unit size on the number of cost pools. Given the lack of a significant effect of any of the examined contingency factors on the number of cost drivers, Brierley (2007) added a modification to the CSC model to make it a path model, where the examined contingency factors have an indirect influence on the number of cost drivers through the number of cost pools. The results of the path model showed a positive impact of the number of cost pools on the number of cost drivers. However, Brierley (2007) failed to find any significant indirect effects of the contingency factors on the number of cost drivers.

Two survey selection studies on CSC were conducted in developing countries; namely, Egypt and Saudi Arabia. In Egypt, Ismail and Mahmoud (2012) examined the influence of different contingency factors on CSC, measured using a composite score of the number of cost pools, the number of cost drivers and a dichotomous variable of ABC adoption versus non-adoption. Exploiting multiple regression analysis, the study found that the importance of cost information was the only contingency factor that has a positive impact on CSC.

Using Al-Omiri and Drury's (2007) CSC measures, Al-Omiri and Drury (2013) investigated the influence of different contingency factors on CSC in Saudi Arabia. Utilising logistic and multiple regression analysis, the study results showed that business-unit size and the importance of cost information have a positive impact on all CSC measures, whereas the level of competition and the financial industry, compared to manufacturing, have a positive effect on all CSC measures except for the absorption versus direct costing CSC measure. In addition, the study found that cost structure and PC-support diversity have a positive influence on the ABC adoption versus non-adoption CSC measure, whereas the service industry, compared to manufacturing, has a positive impact on the number of cost pools. In addition to the aforementioned findings, which pertain to the whole sample, the study reported separate results for the manufacturing companies, which showed that the level of competition, cost structure, business-unit size, the importance of cost information and the extent of using innovative management accounting techniques have a positive effect on the ABC adoption versus non-adoption CSC measure.[37]

As pointed out earlier, Brierley (2010) is the only inductive study among the selection studies on CSC. Brierley (2010) conducted semi-structured interviews with 12 management accountants working in the UK manufacturing industry to obtain their opinions about the contingency factors that influence CSC. The interviews revealed that the existence of a parent company plays a vital role in determining the level of CSC. Brierley (2010) found that, when the business-unit has a parent company that specifies the CSD, then the parent company is the sole determinant of the level of complexity of the business-unit's costing system. On the other hand, when the business-unit lacks a parent company or the parent company does not specify the business-unit's costing system, the study found that both the importance of cost information in decision-making and the level of manufacturing technology have an indirect positive impact on CSC via the management demand for product cost information and the level of overhead costs, respectively. In addition, the study found that the availability of funds moderates the positive effect of the level of competition and PC-product customisation on CSC. More specifically, neither the level of competition nor PC-product customisation has a positive influence on CSC unless available funds exist. Otherwise, both contingency factors do not impact CSC.

To sum up, most contingency studies on CSC have employed the selection form of fit. Selection studies on CSC have provided support for the influence of different contingency factors, such as the level of competition, cost structure, PC and business-unit size, on the optimal level of CSC, i.e., optimal CSD, from the standpoint of the selection form of fit.

[37] Note that Al-Omiri and Drury (2013) used only ABC adoption to measure CSC when conducting the separate analysis related to the manufacturing industry.

4.3.3 Interaction studies on CSC

Compared to the selection form of fit, the interaction one has not been widely used by contingency research on CSC. Only two contingency studies on CSC have adopted the interaction form fit.[38] The first used the inductive approach, employing a case study strategy with the interview as the main data collection method (Abernethy et al., 2001). Abernethy et al. (2001) exploited the matching sub-form of fit to investigate the influence of PC on the optimal level of CSC, i.e., optimal CSD. This was done through examining the association between PC and the optimal level of CSC, and whether the misfit between PC and the optimal level of CSC has a negative impact on management satisfaction with the costing system as an outcome reflecting the optimality of the level of CSC. The study measured CSC along three dimensions; namely, the number of cost pools, the nature of cost pools and the type of cost drivers. The study found support for the positive effect of PC on the optimal level of CSC from the perspective of the matching sub-form of fit. More specifically, the study found that PC is positively associated with the optimal level of CSC and that a misfit between the two has a negative influence on manager satisfaction with the costing system. The manager satisfaction was high at four sites - HC1, HC2, FT1 and FT2 - in which a proper matching/fit was achieved. Three sites - HC1, HC2 and FT1 - have low levels of both PC and CSC, whereas the fourth site, FT2, has high levels of both constructs. Manager satisfaction was low, however, at one site, HC3, that has a mismatch/misfit between the level of PC and the optimal level of CSC, given that the levels of PC and CSC were high and low, respectively.

In addition, Abernethy et al. (2001) provided insights into the fit relationship between PC and CSC by finding that this relationship is moderated by the usage of flexible advanced manufacturing technologies (AMT). More specifically, the results revealed that, when PC is

[38] A summary of interaction studies on CSC is provided in Appendix 4-4.

high and the usage of flexible AMT is high, it is unnecessary to invest in ABC or to increase CSC in terms of all three dimensions used in the study to measure CSC. Increasing CSC regarding one dimension, namely, the number of cost pools, is sufficient in order to assign accurately overhead costs to products in such a situation. However, when PC is high and the usage of flexible AMT is low, the study found that that it is necessary to invest in ABC or to increase CSC in terms of all three dimensions. The study attributed this finding to the fact that using flexible AMT will transfer batch- and product-level overhead costs resulting from having high levels of PC into facility-level overhead costs, which cannot be accurately assigned even when using ABC or high complex costing systems.

The second interaction study was conducted by Schoute (2009) in the Netherlands. The study used a deductive approach, exploiting the survey strategy, with the questionnaire as the data collection method. The study adopted the moderation sub-form of fit to investigate the influence of the purpose of use on the optimal level of CSC, i.e., optimal CSD. This was done through examining whether the purpose of use moderates the relationship between CSC and the extent of using cost information in decision-making and user satisfaction with the costing system as outcomes representing the optimality of the level of CSC. The study used two CSC measures; namely, a composite measure of the number of cost pools and cost drivers and a composite measure of the number of cost pools and cost drivers, the nature of cost pools and the type of cost drivers. Schoute (2009) found support for the impact of the purpose of use on the optimal level of CSC from the viewpoint of the moderation sub-form of fit, as the purpose of use was found to moderate the relationship between CSC and the outcomes. More specifically, the results showed that at higher/lower levels of usage for product planning purposes, CSC negatively/positively affects the extent of cost information usage, whereas at higher/lower levels of usage for cost management purposes, CSC positively/negatively affects the extent of cost information usage and user satisfaction.

To sum up, only two contingency studies on CSC have adopted the interaction form of fit. As presented in this section, interaction studies on CSC have provided evidence for the influence of the contingency factors of PC and the purpose of use on the optimal level of CSC from the standpoint of the matching and moderation sub-forms of fit, respectively. Like contingency studies on ABC adoption, contingency studies on CSC have not employed the mediation sub-form of fit. Having reviewed contingency research on optimal CSD from the perspectives of ABC adoption and the level of CSC, the next section will discuss the main limitation and minor limitations of this research strand along with the importance of addressing these and furnish how this research attempts to overcome them.

4.4 Limitations of contingency studies on optimal CSD, the importance of addressing these and how this research attempts to overcome them

4.4.1 Overview

As presented in Sections 4.2 and 4.3, contingency research on optimal CSD has attempted to contribute towards providing a proper understanding of the influences on optimal CSD. Nevertheless, as briefly discussed in Section 1.3, this research strand has suffered from the main limitation related to the lack of an appropriate application of contingency theory in relation to the adopted forms of fit, which might have prevented it from furnishing an appropriate understanding of the influences on optimal CSD. In addition, contingency research on optimal CSD has four further minor limitations related to the two components investigated in this research; namely, the contingency factors and optimal CSD. Accordingly, considering the four minor limitations is critical for successfully addressing the main limitation of contingency research on optimal CSD and, thus, accomplishing the research aim (see Section 1.5). Sections 4.4.2 and 4.4.3 discuss, respectively, the main limitation and minor limitations. The discussion encompasses the importance of addressing these limitations and outlines how this research attempts to overcome them.

4.4.2 The main limitation of contingency research on optimal CSD: the lack of an appropriate application of contingency theory in relation to the adopted forms of fit

As explained in Section 3.3, the most important element of contingency theory is the concept of fit, and it is vital to understand the differences between the different forms of fit in order to utilise the forms of fit that best reflect the reality and the hypothesised relationships between the independent variables - i.e., the contingency factors - and the dependent variable - e.g., optimal CSD - and guard against any incorrect interpretations of the findings of prior research (Drazin and Van de Ven, 1985; Venkatraman, 1989; Donaldson, 2001; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Meilich, 2006; Klaas and Donaldson, 2009; Burkert et al., 2014). Contingency theory asserts that contingency factors, such as PC and business-unit size, influence optimal CSD (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014). As demonstrated in Section 3.3, the optimality of CSD is accounted for differently by the various forms of fit of contingency theory.

The selection form of fit holds the equilibrium assumption, which means that all surviving companies possess optimal CSD (Chenhall and Chapman, 2006; Meilich, 2006; Burkert et al., 2014). Hence, to express the optimality of CSD, the selection form of fit uses the unrealistic outcome measure of company survival rather than real outcome measures (Drazin and Van de Ven, 1985; Chenhall, 2003; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Meilich, 2006; Sousa and Voss, 2008). This is problematic because it is possible that companies differ with regard to the optimality of CSD as a result of being in different degrees of selection fit (Donaldson, 2001; 2006; Ittner and Larcker, 2001; Luft and Shields, 2003; Hartmann, 2005; Meilich, 2006; Burkert et al., 2014). As pointed out by Meilich (2006), the selection form of fit imposes the unrealistic assumption that companies operate in unforgiving environments in which any misfit between the contingency factor and optimal

CSD leads to companies' disappearance. In fact, the empirical evidence fails to support the equilibrium assumption held by the selection form of fit because differences in the optimality of MCS, including CSD, have been found between the surviving companies (e.g., Frey and Gordon, 1999; Cagwin and Bouwman, 2002; Ittner et al., 2002; Said, HassabElnaby and Wier, 2003; Gerdin, 2005b; King et al., 2010; Gani and Jermias, 2012; Chen and Jermias, 2014; Krumwiede and Charles, 2014; Maiga et al., 2014).

As described in Section 3.3.2, the interaction form of fit differs from the selection one in that the former does not rest on the equilibrium assumption, and so expects to find variations in the optimality of CSD between the surviving companies (Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Burkert et al., 2014). Accordingly, the interaction form of fit utilises real outcome measures rather than the unrealistic outcome measure of company survival to account for the optimality of CSD (Drazin and Van de Ven, 1985; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Sousa and Voss, 2008). As presented in Sections 4.2 and 4.3, most contingency studies on optimal CSD have adopted the selection form of fit and, to a lower extent, the interaction form of fit. Given that the interaction form of fit represents a more realistic form of fit, this research exploits it.

The question then becomes: which of the sub-forms of fit of the interaction form of fit is more realistic and appropriate for reflecting the relationship between the contingency factors and optimal CSD? As explained in Section 3.3.2, the interaction form of fit includes the matching, moderation and mediation sub-forms of fit. The mediation sub-form of fit assumes that CSD acts as a mediator variable of the relationship between the contingency factor and the outcome. The mediation sub-form of fit is unsuitable because it fails to reflect the relationship between the contingency factors and optimal CSD as hypothesised in the CSD literature (e.g., Cooper, 1988b) and also because many researchers have excluded it from contingency theory (see Section 3.3.2.3). Given this, hereafter, the mediation sub-form of fit will be excluded from any discussion pertaining to the interaction form of fit, and the focus will be on the other sub-forms of fit; namely, the matching sub-form of fit and the moderation one.

The matching sub-form of fit presumes that the relationship between CSD and the outcome is curvilinear that is impacted by the contingency factor, indicating that, for each level of the contingency factor, there is only one level of CSD that yields the maximum level of outcome (see Section 3.3.2.1) (Schoonhoven, 1981; Donaldson, 2001; Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014). The moderation sub-form of fit postulates a linear relationship between CSD and the outcome that changes at different levels of the contingency factor, meaning that the contingency factor influences the strength and/or form of the linear relationship between CSD and the outcome (see Section 3.3.2.2) (Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014). Compared to the moderation sub-form of fit, the matching sub-form of fit is a more realistic and appropriate sub-form of fit for reflecting the relationship between the contingency factors and optimal CSD, for two reasons.[39]

The first reason is that contingency theory perceives the matching sub-form of fit to be more realistic and appropriate than the moderation one because, as mentioned above, the former assumes that a curvilinear relationship exists between CSD and the outcome, whereas the latter postulates a linear relationship between CSD and the outcome (Donaldson, 2001; 2006; Chenhall and Chapman, 2006; Meilich, 2006). The curvilinear relationship between CSD and the outcome is more logical than the linear one, for three reasons. First, the linear relationship suggests that the optimal CSD level is either the maximum CSD level, if the linear relationship is positive, or the minimum CSD level, if the linear relationship is

[39] This, however, does not place the moderation sub-form of fit outside the scope of contingency theory because, as pointed out by Burkert et al. (2014), the moderation sub-form of fit and the matching one share the general idea that the contingency factor affects the relationship between CSD and the outcome.

negative, and that the misfit is represented by either an under-fit, if the optimal CSD level is at the maximum, or an over-fit, if the optimal CSD level is at the minimum. In addition, the linear relationship suggests optimal CSD levels that can be the same for different levels of the contingency factor, e.g., the maximum CSD level is the optimal CSD level for moderate and high levels of contingency factors. To Donaldson (2001; 2006), the optimal CSD levels suggested by the linear relationship do not reflect the actual optimal CSD levels for the various levels of the contingency factor, as they do not convey the idea of congruence or matching between the levels of the contingency factor and CSD characterising the concept of fit, which has been utilised by seminal contingency theory studies and is communicated by the curvilinear relationship.

Second, the curvilinear relationship portrays areas of shortage, i.e., under-fit, optimal and overabundance, i.e., over-fit, of CSD (Meilich, 2006), whereas the linear one shows regions of optimal and either shortage or overabundance. Third, organisational phenomena affect each other in a more or less obvious way, and each organisational phenomenon has benefits and drawbacks regarding the related outcomes (Meilich, 2006). Linear relationships presume that the balance of benefits and drawbacks is constant when, in fact, it is highly reasonable to expect that this balance fluctuates, as suggested by the curvilinear relationship (ibid).

The second reason supporting the matching sub-form of fit over the moderation one is that the CSD literature has emphasised the importance of having optimal CSD or, in other words, the significance of the cost-benefit consideration when designing the costing system (e.g., Cooper, 1988b; 1989a; 1989c; Cooper and Kaplan, 1991; Babad and Balachandran, 1993; Dopuch, 1993; Estrin et al., 1994; Innes and Mitchell, 1998; Kaplan and Cooper, 1998; Gordon and Silvester, 1999; Drury and Tayles, 2000; Homburg, 2001; Pizzini, 2006; Brierley, 2008a; Stuart, 2013; Drury, 2015). Optimal CSD or the cost-benefit consideration indicates that the relationship between CSD and the outcome is curvilinear. This is because optimal CSD or the design of a costing system that meets the cost-benefit consideration represents a point where the marginal/incremental cost, i.e., the costs of measurements, of improving the costing system by increasing its complexity equals the marginal/incremental benefit, i.e., reducing the costs of errors, from improving the costing system, and any excess or shortage in improving the costing system causes its design to become less optimal. In addition, the CSD literature has stressed that optimal CSD is influenced by different contingency factors, such as the level of competition, the proportion of indirect costs and the level of PC (Cooper, 1988b; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). Collectively, the above suggests that the relationship between the contingency factors and optimal CSD is in accordance with the matching sub-form of fit, which, as mentioned in Section 3.3.2.1 and earlier in this section, assumes a curvilinear relationship between CSD and the outcomes that is affected by the contingency factors.

The literature review identified only a few contingency studies on optimal CSD that adopted the interaction form of fit (Sections 4.2.3 and 4.3.3), most of which have used the moderation sub-form of fit rather than the matching one even though, as discussed in this section, the latter is more realistic and appropriate (Frey and Gordon, 1999; Cagwin and Bouwman, 2002; Banker et al., 2008; Schoute, 2009; Xiao et al., 2011; Krumwiede and Charles, 2014; Maiga et al., 2014). Only two contingency studies on optimal CSD utilised the matching sub-form of fit (Abernethy et al., 2001; Ittner et al., 2002). However, these studies are not without limitations, as both suffered from the limitation of examining the effect of a limited number of contingency factors, including PC (Abernethy et al., 2001) and the operational characteristics related to PC (Ittner et al., 2002), on optimal CSD. In addition, Abernethy et al. (2001) derived their findings based on a small number of cases, particularly five, while Ittner et al. (2002) operationalised CSD from the perspective of ABC adoption, which, as briefly discussed in Section 1.5 and will be elaborated on in Section 4.4.3.1, is less appropriate and problematic. Given that, as discussed in this section, the matching sub-form of fit is the most suitable sub-form of fit for reflecting the relationship between the contingency factors and optimal CSD, this research applies it. Nevertheless, as will be explained in Section 8.2.1, a problem exists, in that the recommended joint usage of PRA and RSM to test for the matching sub-form of fit has not been described in detail (Donaldson, 2006; Burkert et al., 2014). Given this issue, this research develops and employs a procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit.

Notwithstanding the superiority of the interaction form of fit over the selection one, the former, including the matching sub-form of fit, is a bivariate model, which means that it is concerned with the impact of each contingency factor, independent from the impacts of other contingency factors, on optimal CSD (see Section 3.3.2) (Meilich, 2006).[40] Thus, the advantage of accounting for the combined effect of all contingency factors on optimal CSD is absent. This, in turn, encourages the use of the system form of fit, which is distinguished from other forms and sub-forms of fit by the fact that it deals with the combined or joint influence of all contingency factors on optimal CSD (see Section 3.3.3) (Chenhall and Chapman, 2006; Burkert et al., 2014). Nonetheless, the system form of fit agrees with the interaction form of fit in refraining from making the equilibrium assumption and, hence, utilising real outcome measures rather than the unrealistic outcome measure of company survival to express the optimality of CSD (Drazin and Van de Ven, 1985; Chenhall, 2003; 2007). In addition, the system form of fit conforms with the matching sub-form of fit in assuming a curvilinear relationship between CSD and the outcome that is shifted by the contingency factor. To the author's knowledge, no contingency study on optimal CSD has adopted the system form of fit. Given the advantage of the system form of fit and lack of

[40] The selection form of fit is also a bivariate model (see Section 3.3.1) (Meilich, 2006).

contingency studies on optimal CSD that have used it, this research utilises the more realistic, appropriate and thorough system form of fit.

4.4.3 Minor limitations of contingency research on optimal CSD

As briefly discussed in Section 1.5, contingency research on optimal CSD suffers from four minor limitations that are vital to be accounted for in order to address successfully the main limitation of contingency research on optimal CSD and, accordingly, acquire the research aim. The discussion of these four minor limitations, together with the importance of addressing them and the attempts of this research to overcome them, is divided as follows. Section 4.4.3.1 includes the first minor limitation that is exclusive to contingency research on ABC adoption, while Section 4.4.3.2 focuses on the second and third minor limitations that are exclusive to contingency research on CSC. Section 4.4.3.3 comprises the fourth minor limitation, which concerns both sub-strands of contingency research on optimal CSD.

4.4.3.1 The minor limitation exclusive to contingency studies on ABC adoption: the usage of the less appropriate perspective of ABC adoption to operationalise CSD

The minor limitation of contingency research on ABC adoption, including selection and interaction studies, is concerned with the perspective utilised by this sub-strand of contingency research to operationalise CSD, which is ABC adoption. Operationalising CSD with respect to ABC adoption, using a dichotomous variable of ABC adoption versus non-adoption, is less appropriate and problematic, for two reasons. First, it overlooks the fact that both ABC and TCS have different levels of complexity (Drury and Tayles, 2000; 2005). ABC is designed to suit the needs of the adopted company, and, therefore, can vary between companies in terms of its nature, uses and purposes (Innes and Mitchell, 1998). According to Drury and Tayles (2005), ABC can be simple with a small number of aggregated cost pools and different types of cost drivers or complex with multiple disaggregated cost pools and multiple and different types of cost drivers. In the same vein, TCS can be simple containing a single cost pool and cost driver or complex containing a great number of cost pools and volume-based cost drivers. In support of this, contingency research on ABC adoption and CSC reported differences in the CSD, in terms of the number of cost pools and cost drivers, of the participating business-units (e.g., Cooper, 1989b; Innes and Mitchell, 1990b; 1995; 2000; Drury and Tayles, 1994; 2005; Bjørnenak, 1997; Cotton, Jackman and Brown, 2003; Cohen et al., 2005; Al-Omiri and Drury, 2007; 2013; Cinquini, Collini, Marelli and Tenucci, 2015). The above suggests that operationalising CSD in terms of ABC adoption ignores the diversity within CSD that exists in practice (Drury and Tayles, 2005), and, accordingly, threatens the validity of the findings.

Second, operationalising CSD in terms of ABC adoption neglects the fact that ABC is not viewed and understood similarly by practitioners, with the resulting issue of correctly determining ABC adopters from non-adopters when using the most widely-employed data collection method by contingency studies on ABC adoption; namely, the questionnaire (e.g., Malmi, 1996; Dugdale and Jones, 1997; Drury and Tayles, 2005). In relation to this, Dugdale and Jones (1997) conducted follow-up research in order to validate whether 12 respondents, who were found in Innes and Mitchell (1995) to use ABC cost information in stock valuation, were really ABC users who use ABC cost information for that purpose. They found that four of these respondents did not apply ABC, eight applied a weak version of ABC and only three fully applied ABC. Based on this finding, they concluded that the previous ABC adoption research results might have been exaggerated. In the same vein, Malmi (1996) found that 8.3% of the respondents who claimed that they were ABC users did not use non-volume-based cost drivers. In addition, Abernethy et al. (2001) found that one site, FT2, considered their costing system to be ABC when, in reality, it was a complex TCS. The above indicates that operationalising CSD with respect to ABC adoption can result in the incorrect determination of ABC adopters and non-adopters and, subsequently, invalid findings.

Given the problems associated with operationalising CSD from the perspective of ABC adoption, operationalising CSD from the perspective of the level of CSC is more appropriate. Using the level of CSC makes it possible to capture the variations of CSD employed in practice and avoiding the erroneous determination of ABC adopters and non-adopters in questionnaire studies, where the questionnaire is the most suitable data collection method. This, in turn, reduces the likelihood of obtaining invalid findings. Thus, this research operationalises CSD in terms of the level of CSC rather than ABC adoption.

4.4.3.2 The minor limitations exclusive to contingency studies on CSC

Contingency research on CSC, including selection and interaction studies, has suffered from two minor limitations; namely, the failure to examine the influence of organisational factors relating to the organisation's management and employees on optimal CSD (Section 4.4.3.2.1) and the lack of usage of a comprehensive multi-dimensional CSC measure that captures all of the CSC dimensions identified in the literature (Section 4.4.3.2.2).

4.4.3.2.1 The failure to examine the influence of organisational factors relating to the organisation's management and employees on optimal CSD

Although contingency studies on CSC have provided many findings regarding the influence of different contingency factors on the optimal level of CSC, i.e., optimal CSD, they have failed to examine the influence of organisational factors relating to the organisation's management and employees on optimal CSD. Examples of these factors include organisational culture, TMS, resistance to change by preparers and users of accounting information and employees' lack of relevant skills (e.g., Baird et al., 2004; Brown et al., 2004; Drury and Tayles, 2005; Al-Omiri and Drury, 2007). None of the contingency studies on CSC has examined the impact of such organisational factors on the optimal level of CSC (e.g., Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Brierley, 2007; Schoute, 2009; Ismail and Mahmoud, 2012).

This is an important omission given the importance of organisational factors related to the organisation's management and employees in empowering the adoption and success of innovative management accounting techniques, such as ABC, a complex costing system (e.g., Shields and Young, 1989; Innes and Mitchell, 1990a; Argyris and Kaplan, 1994; Shields, 1995; Krumwiede, 1998a; 1998b). Innes and Mitchell (1990a) pointed out that the process of changing to adopt innovative management accounting techniques is complex, requiring the interaction between three sets of factors; namely, motivator, catalyst and facilitator factors. Motivator - e.g., the level of competition, cost structure and production technology - and catalyst - e.g., poor financial performance and loss of market share - factors are concerned with creating or initiating the need for change, while facilitator factors - e.g., the availability of accounting staff, computing resources, close communication with the management and the level of autonomy granted by the parent company - play a role in facilitating the change process. The CSD literature has suggested that organisational factors relating to the organisation's management and employees, such as organisational culture and TMS, are important facilitator factors (e.g., Shields and Young, 1989; Argyris and Kaplan, 1994; Shields, 1995; Baird et al., 2004). Krumwiede (1998a) emphasised that companies that aim to reach high implementation stages, use ABC routinely and have successful ABC implementation should consider not only the influence of contextual factors, such as cost structure and PC, but also the impact of organisational factors relating to the organisation's management and employees, such as TMS and non-accounting ownership. This is due to the fact that market or product factors that create the need to adopt ABC might not lead to successful implementation and, therefore, companies should not neglect the effect of other organisational factors, including those relating to the organisation's management and employees (Krumwiede, 1998b).

In addition, the CSD literature has provided evidence for the effect of different organisational factors relating to the organisation's management and employees on the adoption and success of ABC, a complex costing system. Example of these organisational factors include organisational culture (e.g., Baird et al., 2004; 2007; Charaf and Bescos, 2013; Zhang et al., 2015) and TMS (e.g., Innes and Mitchell, 1991; Waeytens and Bruggeman, 1994; Shields, 1995; Bruggeman, Slagmulder and Waeytens, 1996; Foster and Swenson, 1997; McGowan and Klammer, 1997; Gunasekaran and Sarhadi, 1998; Krumwiede, 1998a; Anderson and Young, 1999; Liu and Pan, 2007; Maelah and Ibrahim, 2007; Byrne, 2011).

Given the importance of organisational factors, especially, those relating to the organisation's management and employees, this research tests the impact of two organisational factors relating to the organisation's management and employees, namely, organisational culture and TMS, on optimal CSD. The choice of these two organisational contingency factors was based on contingency research on ABC adoption and research on ABC success conducted in developed countries (e.g., Krumwiede, 1998a; Baird et al., 2004; 2007; Byrne, 2011), the evidence of the effect of organisational culture on ABC adoption reported in Morocco (Charaf and Bescos, 2013)[41] and the suggestion to examine the role of TMS in the adoption of advanced management accounting techniques in Saudi Arabia (El-Ebaishi, Karbhari and Naser, 2003).

4.4.3.2.2 The lack of usage of a comprehensive multi-dimensional CSC measure

Although contingency studies on CSC have identified six CSC dimensions (see Section 2.4), there is a lack of using a comprehensive multi-dimensional CSC measure that captures all six CSC dimensions identified in the literature. Some contingency studies on CSC have used some of the CSC dimensions, such as the number of cost pools and cost drivers, individually to develop single-dimensional CSC measures (e.g., Al-Omiri and Drury, 2007; 2013;

[41] Morocco is a developing Arabic country.

Brierley, 2007). Other contingency studies on CSC have exploited some of the CSC dimensions, together, to develop multi-dimensional CSC measures. For example, Drury and Tayles (2005) used a composite measure of the two CSC dimensions of the number of cost pools and cost drivers, while Schoute (2009) used, besides Drury and Tayles (2005) composite CSC measure, a composite measure of four CSC dimensions; namely, the number of cost pools and cost drivers, the nature of cost pools and the type of cost drivers. However, as mentioned in Section 2.4, there are two CSC dimensions that have been exploited neither as single-dimensional CSC measures nor among the dimensions of the multi-dimensional CSC measures. These dimensions are the approach used to assign both manufacturing and non-manufacturing overhead costs to cost pools in the first stage of the two-stage overhead assignment procedure - i.e., direct, cause-and-effect or arbitrary assignment - and the nature of the cost drivers used to allocate the costs accumulated in the cost pools between products in the second stage of the two-stage overhead assignment procedure, i.e., transaction, duration and intensity drivers.

Utilising a comprehensive multi-dimensional CSC measure is critical, since the likelihood of uncovering the true effect of the various contingency factors on the optimal level of CSC is more likely to be higher when CSC is measured using a comprehensive multi-dimensional measure than when measured by single-dimensional or incomprehensive multi-dimensional measures. Hence, this research develops, based on the prior literature, a comprehensive multi-dimensional CSC measure that covers all six of the identified CSC dimensions, confirms this measure by conducting an exploratory investigation at the commencement of the empirical work of this research and uses this measure along with others to measure CSC.

4.4.3.3 The minor limitation of contingency studies on both ABC adoption and CSC: the failure to use a sufficiently comprehensive multi-dimensional PC measure

Contingency research on optimal CSD, including selection and interaction studies on ABC adoption and CSC, has suffered from the minor limitation of the failure to use a sufficiently comprehensive multi-dimensional PC measure that accounts for multiple PC dimensions. The CSD literature has emphasised the significant role of PC in modifying optimal CSD (e.g., Kaplan, 1983; 1984a; 1984b; 1986a; Johnson and Kaplan, 1987; Cooper, 1988a; 1988b; Cooper and Kaplan, 1991; Jones, 1991; Estrin et al., 1994). Kaplan (1984a, p. 42) commented that "[y]esterday's internal costing and control practices cannot be allowed to exist in isolation from a company's manufacturing environment – not, that is, if the company wishes to flourish as a world-class competitor". The inability to provide relevant information for managerial decisions and control was among the main criticisms of cost accounting systems (Kaplan, 1986a), which was based on the premise that cost accounting and control practices and systems have not changed and cannot cope with the significant changes that have occurred within the production processes (e.g., Kaplan, 1983; 1984a; 1984b; Johnson and Kaplan, 1987). It has been emphasised that the cost accounting systems that were developed during the scientific management movement of the early twentieth century are irrelevant today because the manufacturing process has changed from mass-production, with a few standardised products and high direct labour content, to the production of multiple products and lower direct labour content (Kaplan, 1984a; 1984b).

Kaplan (1986a) conceptualised the problem of the mismatch between the production environments and cost accounting systems more narrowly by stating that cost accounting courses are designed on the basic production model, and that the changes in PC during the last 70 years have not modified the production model used to describe cost accounting practices. Kaplan (1984b; 1986a) emphasised the importance of understanding the link between cost accounting and PC because the choice of appropriate measures, aggregations and allocations is an art that must be practised, taking into consideration a company's strategic goals and any changes in its manufacturing processes. Similarly, researchers have stressed the importance of CSD reflecting the underlying economics of the production process to provide cost information that guides managers to make informed decisions, i.e., to be optimal CSD (e.g., Cooper and Kaplan, 1991; Jones, 1991).

The early ABC literature demonstrated that the system should be adopted if it is more likely to be the optimal CSD based on many conditions related to the production process and other factors (e.g., Cooper, 1988a; 1988b; 1989a; 1989c; Cooper and Kaplan, 1988a; Estrin et al., 1994). Volume diversity, set up diversity, complexity diversity, material diversity, size diversity and product customisation are examples of the conditions related to the production process. In fact, unless these conditions are met, companies do not need to invest in costly complex costing systems because they will not benefit from such systems (Cooper, 1988b). It was shown that that the optimality of CSD is not a function of using ABC or high complex costing systems, but of the extent to which ABC and the level of CSC are appropriate to PC (Abernethy et al., 2001; Cagwin and Bouwman, 2002).

Although the preceding discussion indicates the significance of PC to optimal CSD, it should be noted that there is no agreement in the literature about the dimensions of PC. Researchers have not provided a clear definition of what represents PC. For example, is PC meant to be the type of production process (Kaplan, 1984a; 1984b), the level of manufacturing support - e.g., the number of set-up and scheduling activities - that permits companies to diversify their products (Cooper and Kaplan, 1988a; 1991), or is it related to different forms of product diversity, such as size, volume and complexity (Cooper, 1988a)? In this regard, Karmarkar, Lederer and Zimmerman (1990) pointed out that, even though the physical processes of production are vital when designing cost accounting systems, the key physical characteristics of the production process remain unspecified.

Based on prior CSD literature, 11 PC dimensions have been identified, including: (1) product complexity (e.g., Banker et al., 1990; Foster and Gupta, 1990; Swenson, 1998); (2) product diversity, including it sub-dimensions of volume diversity, size diversity, support diversity, process diversity and the number of products and production lines (e.g., Hayes and Clark, 1985; Cooper, 1988a; 1988b; Estrin et al., 1994; Kaplan and Cooper, 1998; Krumwiede, 1998a; Swenson, 1998; Malmi, 1999; Abernethy et al., 2001; Drury and Tayles, 2005; Schoute, 2011); (3) product customisation (e.g., Kaplan, 1984a; 1984b; Cooper and Kaplan, 1991; Kaplan and Cooper, 1998; Drury and Tayles, 2005; Brierley, 2011); (4) frequency of introducing new products (Cooper, 1988b; Nguyen and Brooks, 1997; Ittner et al., 2002); (5) frequency of changes to products and production processes (Hayes and Clark, 1985; Miller and Vollmann, 1985; Cooper, 1988b; Cagwin and Bouwman, 2002); (6) production type, i.e., mass, batch and job production (Kaplan, 1984a; 1984b; Krumwiede, 1998a; Malmi, 1999; Ittner et al., 2002; Schoute, 2011); (7) the level of process standardisation, i.e., the use of common manufacturing processes (Swenson, 1998); (8) production objective, i.e., make-to-order versus make-to-stock (Malmi, 1999); (9) the percentage of subcontracting in the manufacturing process (Foster and Gupta, 1990); (10) type of products produced, i.e., mature versus new (Cooper and Kaplan, 1991); and (11) the size and sophistication of the support departments (Cooper and Kaplan, 1988a; 1991). It should be noted that the identified PC dimensions increase the complexity of the production environment and can cause distortion in products costs if less complex than required costing systems are used.

Although contingency research on optimal CSD has widely examined the influence of PC on optimal CSD, it has not utilised a sufficiently comprehensive multi-dimensional PC measure that covers multiple PC dimensions of those noted above. Operationalising CSD from the perspective of ABC adoption, several contingency studies have measured PC using only one dimension, such as product diversity (Booth and Giacobbe, 1998; Clarke et al., 1999; Al-

Mulhem, 2002; Brown et al., 2004; Khalid, 2005; Nassar et al., 2009; Ahamadzadeh et al., 2011; Rbaba'h, 2013; Jusoh and Miryazdi, 2016) or product customisation (Brierley, 2008b; 2011). Other contingency studies have accounted for many of the PC dimensions, but used a separate construct for each dimension (Bjørnenak, 1997; Nguyen and Brooks, 1997; Krumwiede, 1998a; Malmi, 1999; Chen et al., 2001; Ittner et al., 2002; Chongruksut and Brooks, 2005; Chongruksut, 2009; Schoute, 2011). To the author's knowledge, only Cagwin and Bouwman (2002) measured PC by one construct using more than one dimension. Nevertheless, the study utilised two dimensions only, namely, product diversity and frequency of changes to products and production processes, and, therefore, omitted many of the PC dimensions identified in the previous paragraph.

Operationalising CSD from the perspective of the level of CSC, Abernethy et al. (2001) covered only two PC dimensions; namely, product customisation and product diversity, including the sub-dimensions of size diversity, volume diversity and process diversity. Likewise, Drury and Tayles (2005) utilised only two PC dimensions, namely, product customisation and product diversity, including the sub-dimension of support diversity, using a separate construct for each PC dimension. Al-Omiri and Drury (2007; 2013) and Ismail and Mahmoud (2012) used only one PC dimension; namely, product diversity, including the sub-dimensions of support diversity and volume diversity. In the same vein, Brierley (2007) accounted for only one PC dimension; namely, product customisation.

Using a sufficiently comprehensive multi-dimensional PC measure is crucial, because the probability of disclosing the true impact of this important and well-researched contingency factor on optimal CSD is more likely to be higher when PC is measured using a sufficiently comprehensive multi-dimensional measure than when measured utilising single-dimensional or incomprehensive multi-dimensional measures. Accordingly, and given the lack of consensus about the PC dimensions, this research develops, based on prior literature and the exploratory investigation conducted at the beginning of the empirical work of this research, a sufficiently comprehensive multi-dimensional PC measure that covers the most indicative PC dimensions of those identified in the literature and uses this measure to measure PC.

4.5 Conclusion

The objective of this chapter was to review contingency studies on optimal CSD. Hence, this chapter contributed towards realising the three main contributions of this research and, therefore, attaining the research aim (see Section 1.5). In addition, this chapter contributed to realising the four minor contributions of this research (see Section 1.5). Accordingly, it assisted in successfully addressing the main limitation of contingency research on optimal CSD and, thus, acquiring the research aim (see Section 1.5).

The review included in this chapter covered studies that operationalised CSD from the perspectives of ABC adoption and the level of CSC. In addition, within each perspective of operationalising CSD, this review included studies that adopted the selection and interaction forms of fit. After reviewing these studies, this chapter discussed, jointly with its importance, the main limitation of contingency research on optimal CSD related to the lack of an appropriate application of contingency theory in relation to the adopted forms of fit, which may have prevented this research strand from furnishing an appropriate understanding of the influences on optimal CSD. In addition, it discussed, together with their importance, the four minor limitations that need to be accounted for in order to address the main limitation of contingency research on optimal CSD successfully and, hence, achieve the research aim. The four minor limitations include: (1) the usage of the less appropriate perspective of ABC adoption to operationalise CSD by contingency studies on ABC adoption; (2) the failure to examine the influence of organisational factors relating to the organisation's management and employees on optimal CSD; (3) the lack of usage of a comprehensive multi-dimensional CSC measure that captures all of the CSC dimensions identified in the literature by contingency studies on CSC; and (4) the failure to utilise a sufficiently comprehensive multi-dimensional PC measure that accounts for multiple PC dimensions of those discussed in the literature by contingency studies on both ABC adoption and CSC.

Furthermore, this chapter outlined how this research attempts to overcome the main and minor limitations. For the main limitation, this research applies contingency theory in a more appropriate manner through adopting the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory. For the minor limitations, this research: (1) operationalises CSD in terms of the level of CSC; (2) examines the impact of two organisational factors relating to the organisation's management and employees, namely, organisational culture and TMS, that have not been examined by contingency studies on CSC; (3) develops a comprehensive multi-dimensional CSC measure that captures all of the CSC dimensions identified in the literature and utilises this measure along with other CSC measures employed by the prior literature to measure CSC; and (4) develops a sufficiently comprehensive multi-dimensional PC measure that covers the most indicative PC dimensions of those discussed in the literature and uses this to measure PC. Considering the main and four minor limitations of contingency research on optimal CSD, the next chapter will illustrate the research model and develop the research hypotheses represented by the research model.

Chapter five: The research model

5.1 Introduction

This chapter aims to illustrate the examined research model for optimal CSD, which considers the main and four minor limitations of contingency research on optimal CSD discussed in the previous chapter. Because the research model accounts for the main limitation that may have prevented contingency research on optimal CSD from providing a proper understanding of the influences on optimal CSD, this chapter contributes to realising the main contributions of this research, particularly the first one relating to the application of contingency theory with respect to the adopted forms of fit and the third one concerning the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5). Accordingly, it assists in accomplishing the research aim of investigating the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. Because the research model accounts for the four minor limitations, the consideration of which is critical to address successfully the main limitation of contingency research on optimal CSD and, thus, attain the research aim, this chapter also contributes towards realising the four minor contributions of this research relating to, respectively, the operationalisation of CSD, the accounting for the effect of organisational factors related to the organisation's management and employees and the measurements of CSC and PC (see Section 1.5). Hence, it assists in successfully considering the main limitation of contingency research on optimal CSD and, subsequently, achieving the research aim (see Section 1.5).

This chapter is organised as follows. Section 5.2 reviews the costing system outcomes utilised by the CSD literature and describes why two of these were selected as surrogates for the optimality of CSD, i.e., the optimality of the level of CSC, in the research model. Section 5.3 presents and demonstrates the research model and discusses the main differences between it and the other models examined by other contingency studies on optimal CSD. Section 5.4 develops the research hypotheses symbolized by the research model, and Section 5.5 concludes this chapter.

5.2 Costing system outcomes

Contingency theory believes that contingency factors, such as competition and business-unit size, influence optimal CSD (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014). As demonstrated in Sections 3.3 and 4.4.2, in contrast to the selection form of fit that exploits the unrealistic outcome measure of company survival to indicate the optimality of CSD (Drazin and Van de Ven, 1985; Chenhall, 2003; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Meilich, 2006; Sousa and Voss, 2008), the usage of the interaction and system forms of fit makes it necessary to utilise real outcome measures to account for the optimality of CSD (Drazin and Van de Ven, 1985; Chenhall, 2003; 2007; Gerdin and Greve, 2004; Sousa and Voss, 2008; Burkert et al., 2014).

The best way to express the optimality of CSD is to use an outcome measure that reflects the extent to which CSD balances the costs of measurements and costs of errors. CSD that balances these costs is considered optimal, whereas other CSDs that have either high costs of measurements and low costs of errors, i.e., more complex than required costing systems, or low costs of measurements and high costs of errors, i.e., less complex than required costing systems, represent less optimal CSDs. However, it is difficult, either objectively or subjectively, to determine whether the CSD balances the costs of measurements and costs of errors or not, given the impossibility of accurately identifying these, particularly the latter (Cooper, 1988b). Given this, the optimality of CSD can be measured by utilising outcome measures that roughly indicate the extent to which the CSD balances the costs of measurements and costs of errors. To identify such outcome measures, prior interaction studies on optimal CSD can be consulted to identify the outcome measures exploited as representatives of the optimality of CSD.

To express the optimality of CSD, interaction studies on optimal CSD have utilised many outcome measures that have been employed to measure costing system success, which has been investigated widely by CSD studies (e.g., Shields, 1995; Swenson, 1995; Foster and Swenson, 1997; McGowan and Klammer, 1997; Anderson and Young, 1999; Friedman and Lyne, 1999; Byrne, 2011; Ismail and Mahmoud, 2012). In relation to the measures of costing system success, the literature lacks agreement about the exact outcome measures that reflect the success of a costing system and, hence, researchers have used different outcome measures to operationalise costing system success (Friedman and Lyne, 1999; Cinquini and Mitchell, 2005; Baird et al., 2007; Zhang et al., 2015). The most commonly used outcome measures are: (1) respondents' evaluation of costing system success, e.g., respondents' perception of the usefulness of cost information, users' attitudes towards the costing system and mangers' evaluation of the overall success or satisfaction with different technical characteristics of the costing system, such as accuracy and timeliness (e.g., Shields, 1995; Swenson, 1995; Foster and Swenson, 1997; McGowan and Klammer, 1997; Nguyen and Brooks, 1997; Krumwiede, 1998a; Anderson and Young, 1999; Innes et al., 2000; Abernethy et al., 2001; Chen et al., 2001; Cotton et al., 2003; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Askarany et al., 2007; Byrne, Stower and Torry, 2009; Nassar et al., 2009; Schoute, 2009; Byrne, 2011; Ismail and Mahmoud, 2012; Zhang et al., 2015); (2) the extent of costing system usage (e.g., Swenson, 1995; Foster and Swenson, 1997; Nassar et al., 2009; Schoute, 2009); and (3) the achievement of financial benefits in a direct or indirect way (e.g., Shields, 1995; Foster and Swenson, 1997; Frey and Gordon, 1999; Innes et al., 2000; Kennedy and Affleck-Graves, 2001; Cagwin and Bouwman, 2002; Cotton et al., 2003; Al-Khadash and Feridun, 2006; Maiga and Jacobs, 2007; 2008; Al-Khadash and Mahmoud, 2010; Elhamma, 2012; Krumwiede and Charles, 2014; Maiga et al., 2014).

Many researchers have pointed out the difficulty of assessing costing system success, and have illustrated the many drawbacks associated with the different outcome measures exploited in the literature (e.g., Friedman and Lyne, 1999; Cinquini and Mitchell, 2005). Accordingly, they have recommended using multiple outcome measures in order to better capture and gather strong evidence for claims of costing system success. Given this, this research chooses two outcome measures to reflect upon the optimality of CSD in the research model. The first is the respondents' perception of the usefulness and accuracy of cost information (USEFULNESS), which is related to the respondents' evaluation of costing system success measure, while the second is the extent of cost information usage in decision-making (USAGE), which is related to the extent of costing system usage measure. These two outcome measures were chosen because contingency studies on CSC have recommended their use when examining the impacts on optimal CSD, given that they are more realistic outcome measures for reflecting the optimality of CSD compared to other outcome measures, such as the achievement of financial benefits (Drury and Tayles, 2005; Al-Omiri and Drury, 2007). In relation to this and as noted in Section 3.4, many researchers, including those studying contingency-optimal MCS (e.g., Chenhall, 2003; Otley, 2016), contingency-optimal CSD (e.g., Al-Omiri and Drury, 2007; Banker et al., 2008) and costing system success (e.g., Friedman and Lyne, 1999; Cinquini and Mitchell, 2005), have highlighted several concerns regarding the use of the achievement of financial benefits, i.e., financial performance, as an outcome measure. Furthermore, one of these two outcome measures, namely, respondents' evaluation of costing system success, was used by the sole contingency study on CSC that used the matching sub-form of fit (Abernethy et al., 2001), which allows its findings to be compared with those of this research.

The USEFULNESS and USAGE outcome measures are assumed to reflect the extent to which the CSD, i.e., the level of CSC, balances the costs of measurements and the costs of errors, i.e., the optimality of CSD or the optimality of the level of CSC. Higher levels of USEFULNESS and USAGE mean that the CSD balances the costs of measurements and the costs of errors, whereas lower levels of USEFULNESS and USAGE indicate the reverse. Nonetheless, the lower levels of USEFULNESS and USAGE fail to convey whether there are high costs of measurements and low costs of errors resulting from operating with more complex than required costing systems or low costs of measurements and high costs of errors caused by using less complex than required costing systems. Having reviewed the various costing system outcomes used by the CSD literature and justified the two outcomes chosen to express the optimality of CSD, i.e., optimality of the level of CSC, in the research model, the next section will present and illustrate the research model and discuss the main differences between it and other models tested by other contingency studies on optimal CSD.

5.3 The research model

Based on contingency theory and the CSD literature, this research proposes a model that is concerned with examining the influence of different contingency factors on optimal CSD considering the main and four minor limitations of contingency research on optimal CSD (see Sections 1.5 and 4.4). The research model accounts for the main limitation because it is expected to be the reason for the lack of provision of an appropriate understanding of the impacts on optimal CSD, i.e., the research issue (see Sections 1.3 and 1.5). The research model accounts for the four minor limitations because these are associated with the two components investigated in this research - i.e., the contingency factors and optimal CSD - and, thus, need to be considered to address successfully the main limitation of contingency research on optimal CSD and, subsequently, accomplish the research aim (see Section 1.5).

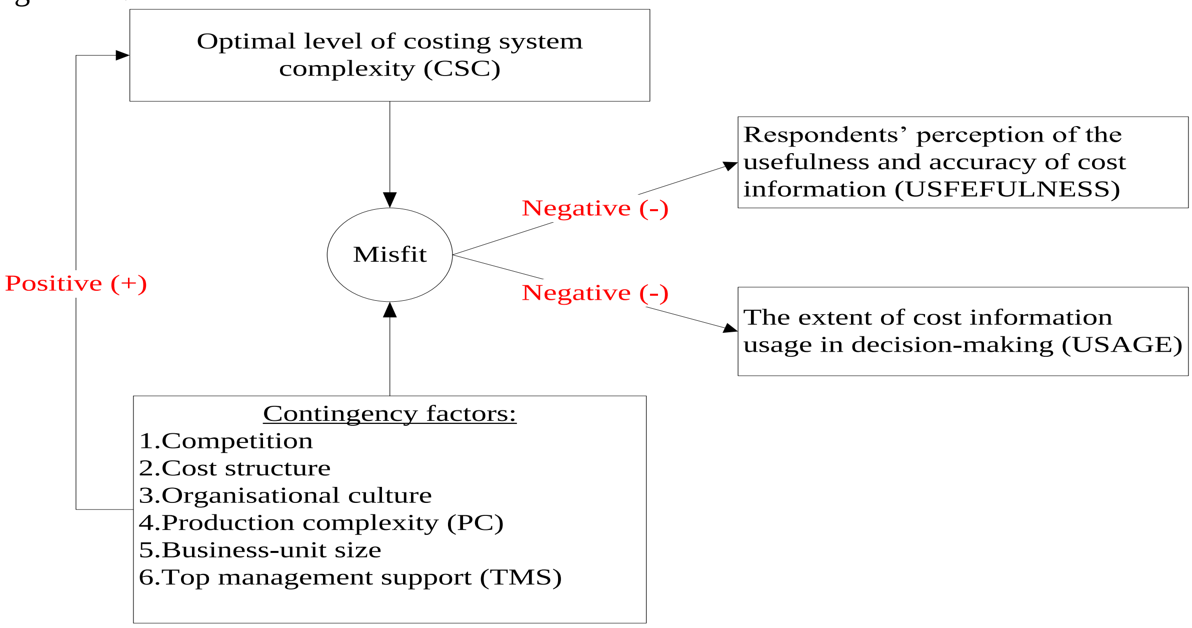
Although the research model accounts for the main and four minor limitations, its distinctive feature, through which the research model will be demonstrated, is its account for the main limitation pertaining to the lack of an appropriate application of contingency theory in relation to the adopted forms of fit (see Section 4.4.2). The research model aims to apply the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit when examining the influence of different contingency factors on optimal CSD (see Sections 3.3.2.1 and 3.3.3). From the perspectives of both the matching sub-form of fit and the system form of fit, this is done, as shown in Figure 5-1, by testing the impact of the misfit, including both over- and under-fit, between the various contingency factors and the optimal level of CSC on the two outcome measures of USEFULNESS and USAGE, which have been selected to represent the optimality of the level of CSC, i.e., optimality of CSD (see Section 5.2). As pointed out in Section 3.3.3, the matching sub-form of fit involves conducting this test separately for each contingency factor, whereas the system form of fit involves performing it only once, including all contingency factors. The model, as depicted in Figure 5-1 and will be specified in the hypotheses in Section 5.4, anticipates a negative effect of the misfit, including both over- and under-fit, between the various contingency factors and the optimal level of CSC on the two outcome measures. Thus, the misfit circle shown in Figure 5-1 is a symbol of the occurrence of the misfit rather than a separate construct that is influenced by the contingency factors and/or the optimal level of CSC.

In addition to testing the impact of the misfit on the outcome measures, examining the effect of the contingency factors on optimal CSD from the viewpoint of the matching sub-form of fit involves inspecting the direction of the association between each of the contingency factors and optimal CSD. The model, as depicted in Figure 5-1 and will be specified in the hypotheses in Section 5.4, anticipates a positive association between each of the contingency factors and the optimal level of CSC. As mentioned in Section 3.3.3, a procedure to determine the direction of the association between all contingency factors, taken together, and optimal CSD has not yet been developed. Hence, it can only be assumed that the expected direction of the association between all contingency factors, taken together, and optimal CSD is supported when all or most of the contingency factors are, individually, associated with optimal CSD in the way expected.

The research model differs and goes beyond other models tested by contingency research on optimal CSD by, as mentioned earlier in this section, accounting for the main and four minor limitations identified within this research strand. For the main limitation, the research model is distinguished from other models tested by contingency studies on both ABC adoption and CSC by applying the matching sub-form of fit, which was adopted by only two contingency studies on optimal CSD, and the system form of fit, which has not been used by contingency studies on optimal CSD. Regarding the minor limitations, the research model is distinct from other models tested by contingency studies on ABC adoption by operationalising CSD from the perspective of the level of CSC rather than ABC adoption. In addition, it differs from other models tested by contingency studies on CSC by: (1) including two organisational factors relating to the organisation's management and employees, namely, organisational culture and TMS, whose influence on the optimal level of CSC has not been investigated; and (2) using, in addition to the CSC measures utilised by the prior literature, a comprehensive multi-dimensional CSC measure developed and confirmed by this research. Furthermore, the research model is unlike other models tested by contingency studies on both ABC adoption and CSC in that it utilises a sufficiently comprehensive multi-dimensional PC measure developed by this research.

However, it should be noted that, if required, the research model visualised in Figure 5-1 is subject to minor modifications relating to the list of contingency factors and/or outcome measures. This will be determined after performing an exploratory investigation at the beginning of the empirical work of this research.[42] Having presented and explained the research model and differentiated it from other models examined by other contingency studies on optimal CSD, the next section will develop the research hypotheses denoted by the research model.

Figure 5-1: Research model



5.4 Development of hypotheses

This section develops the hypotheses represented by the research model (Figure 5-1), which are related to the influence of contingency factors on the optimal level of CSC from the

[42] Details about the exploratory empirical investigation will be provided in Section 6.3.1.

perspectives of the matching sub-form of fit and the system form of fit. It begins by developing the hypotheses related to the matching sub-form of fit (Section 5.4.1), which deal with the impact of each contingency factor, individually, on the optimal level of CSC from the viewpoint of the matching sub-form of fit. Based on these hypotheses, this section, then, presents the hypothesis relating to the system form of fit (Section 5.4.2), which is concerned with the joint effect of all contingency factors on the optimal level of CSC.

5.4.1 Matching sub-form of fit hypotheses

5.4.1.1 Competition

The external environment is considered one of the most important and earliest contingency factors whose influence on the optimal MCS design was examined (Chenhall, 2003; Abdel-Kader and Luther, 2008). Duncan (1972, p.314) described the external environment as " [t]he external environment consists of those relevant physical and social factors outside the boundaries of the organization or specific decision unit that are taken directly into consideration". There are various taxonomies and terminologies available for depicting the external environment, but it can be categorised into environmental dynamism, heterogeneity and hostility (Gordon and Miller, 1976; Miller and Friesen, 1983; Teo and King, 1997; Chenhall, 2003). Competition is part of the hostility aspect of the external environment (King et al., 2010).

Competition has been suggested to be one of the most important contingency factors that makes it vital for companies to have accurate product costs, which can be obtained by increasing CSC or adopting ABC (e.g., Cooper, 1988b; Jeans and Morrow, 1989; Nguyen and Brooks, 1997; Kaplan and Cooper, 1998; Drury and Tayles, 2005; Brierley, 2011).[43] Competition increases the need for more accurate costs and activity information in order to

[43] Besides the CSC literature, the hypotheses in this chapter are developed drawing on the ABC literature, as ABC is, generally, considered a more complex costing system (Cooper, 1988b; 1989b; 1990a; Cooper and Kaplan, 1988b; Innes and Mitchell, 1990b).

assist the control and pricing decision-making (Nguyen and Brooks, 1997). Khandwalla (1972) argued that competition forces companies to implement more cost controls and ensure that different functions of the company are operating as expected. Khandwalla (1972) found a positive association between the overall index of competition and the use of more complex control systems. In the same vein, Gordon and Miller (1976) proposed that an increased level of competition should be combined with highly complex costing and control systems. There are many possible reasons for the positive association between competition and CSC.

First, competition has been suggested to be the most influenced factor that increases the costs associated with making inferior decisions based on inaccurate cost information, i.e., the costs of errors, because there is a high probability that competitors will take the advantage of any errors made (Cooper, 1988b; Cooper and Kaplan, 1991). To be profitable in a highly-competitive environment, there is a higher need for more complex costing systems that have a higher probability of more accurately assigning costs to products in order to prevent competitors from taking advantage of erroneous decision-making based on inaccurate cost information (Cooper and Kaplan, 1991; Bjørnenak, 1997; Malmi, 1999; Drury and Tayles, 2005).

Second, market competition is a reality in most industries (Jeans and Morrow, 1989), and that highly competitive product markets are generally under pressure to decrease prices and, thus, have low-profit-margin products (Guilding and McManus, 2002). This, in turn, increases the importance of having more complex costing systems to generate more accurate product costs to determine, precisely, the profitability of products and avoid making erroneous decisions (Jeans and Morrow, 1989; Chen et al., 2001; Al-Omiri and Drury, 2007). Using less complex costing systems in highly competitive environments can lead to either the under- or over-costing of products (Drury and Tayles, 2005; Al-Omiri and Drury, 2007). Under-costing can cause loss-making products to appear as low-profit-margin products and, hence, encourage companies to continue producing them. In contrast, over-costing can cause low-profit-margin products to appear as loss-making products and, therefore, lead companies to discontinue producing them.

Third, intense competition encourages companies to follow a differentiation strategy in order to distinguish their products from those of their competitors (Mia and Clarke, 1999; Guilding and McManus, 2002). Differentiators typically produce a large number of products and have a high level of product customisation (Guilding and McManus, 2002; Drury and Tayles, 2005). This, in turn, increases the need to have more complex costing systems in order to assign accurately costs to the various products and determine whether the revenues resulting from following the differentiation strategy outweigh the associated costs (Drury and Tayles, 2005; Al-Omiri and Drury, 2007).

Fourth, intense competition places great pressure on companies that do not accept to compromise over their product quality. Although maintaining high quality levels is a legitimate goal, companies need to set competitive prices in order to compete in the market (Innes and Mitchell, 1990b; 1991). This creates internal pressure regarding cost control and reduction (Innes and Mitchell, 1991). Accordingly, a high level of understanding about the causes of costs, which can be gained by employing more complex costing systems, becomes crucial.

The influence of competition has been widely investigated by contingency studies on optimal CSD. By operationalising CSD from the perspective of ABC adoption, several contingency studies have found evidence for the positive impact of competition on ABC adoption (e.g., Nguyen and Brooks, 1997; Malmi, 1999; Al-Omiri and Drury, 2007; 2013; Jusoh and

Miryazdi, 2016),[44] whereas others have not (e.g., Booth and Giacobbe, 1998; Chen et al., 2001; Chongruksut and Brooks, 2005; Cohen et al., 2005; Brierley, 2008b; 2011). Moreover, Bjørnenak (1997) found a negative effect of competition on ABC adoption. These inconsistent findings are problematic, given the solid theoretical ground that supports a positive association between competition and CSC, and the findings of many case studies on ABC adoption that have suggested that increased competition is among the factors that encourage companies to consider adopting ABC (e.g., Innes and Mitchell, 1990b; 1991; Innes and Mevellec, 1994; Waeytens and Bruggeman, 1994; Brewer, 1998; Gunasekaran and Sarhadi, 1998; Granlund, 2001; Liu and Pan, 2007; Abdul Majid and Sulaiman, 2008; Duh, Lin, Wang and Huang, 2009). It is difficult to determine the exact reasons for the inconsistent results of contingency studies on ABC adoption, given that these studies are inconsistent in relation to one or more aspect, such as their view of the ABC adoption process, the definitions used for both ABC adoption and non-adoption, the measures utilised for the contingency factor, i.e., competition, the exploited statistical analysis techniques and the selected sample. This fact is applicable between and within studies that have and have not found a positive association between competition and ABC adoption.

By operationalising CSD from the perspective of the level of CSC, contingency studies have also reported inconsistent findings. While Al-Omiri and Drury (2007; 2013) found a positive influence of competition on the number of cost pools and cost drivers, other researchers did not (Drury and Tayles, 2005; Brierley, 2007).[45] This inconsistency may be attributed to the limited competition measures used by Drury and Tayles (2005) and Brierley (2007), a

[44] Although Al-Omiri and Drury (2007) and Al-Omiri and Drury (2013) were classified as contingency studies that operationalised CSD from the perspective of the level of CSC, both studies utilised the dichotomous variable of ABC adoption versus non-adoption as one of the four CSC measures used in these studies (see Section 4.3.2). Given this, it is more appropriate to report the two studies' results pertaining to this CSC measure with the results of contingency studies that operationalised CSD from the perspective of ABC adoption.

[45] Besides the number of cost pools and cost drivers, Drury and Tayles (2005) and Ismail and Mahmoud (2012) also failed to find a positive association between competition and their CSC composite measures (see Section 4.3.2).

composite of two items, compared to Al-Omiri and Drury's (2007; 2013) competition measure, a composite of four items.

The influence of competition on the optimal level of CSC requires further research, given: (1) the inconsistent results produced by contingency studies that tend to employ the selection form of fit; and (2) the high expectation of increased levels of competition faced by some Saudi business-units as a result of joining the WTO in 2005 (WTO, 2017), which has probably caused variations in the optimal level of CSC. Although the empirical results are contradictory, prior theory, as explained above, suggests that competition is positively related to the level of CSC. This positive relationship reflects the fit between the two constructs that yields the highest outcomes, suggesting a positive relationship between competition and the optimal level of CSC. Any misfit between these two factors is expected to have a negative impact on the outcomes.

To illustrate, although more complex than required costing systems provide more accurate product costs that can assist in making informed product-related decisions, i.e., less costly regarding errors, these costing systems, in terms of measurement, are more costly (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the measurements associated with these systems will probably exceed their benefits in terms of reducing the costs of errors, i.e., the benefit of these systems in relation to the provision of more accurate product costs that can assist in making informed product-related decisions. Therefore, it is doubtful that the more accurate product costs furnished by more complex than required costing systems will be perceived as useful and needed in decision-making at competition levels lower than those of more complex than required costing systems.

In contrast, despite being less costly in terms of measurement, less complex than required costing systems provide distorted product costs that can lead to making inferior product-related decisions, i.e., more costly with respect to errors (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the errors related to these systems will probably exceed their benefits in terms of reducing the costs of measurements. Accordingly, it is unlikely that the distorted product costs furnished by less complex than required costing systems will be considered useful or used in decision-making at competition levels higher than those of less complex than required costing systems. Thus, the following hypothesis will be tested:

Hypothesis 1: ***From the perspective of the matching sub-form of fit, competition is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between competition and the optimal level of CSC and a negative impact of the misfit between competition and the optimal level of CSC on the two outcomes.***

5.4.1.2 Cost structure

Considering the cost structure in relation to the level of overhead costs is a vital step before designing the costing system (Cooper, 1988b; Brierley et al., 2001; Drury, 2015). One of the main reasons that has prompted criticisms of TCS and the introduction of ABC, a complex costing system, as an alternative is the increased level of overhead costs as a result of the shift from a labour intensive-based manufacturing environment to an automated one, in which advanced technologies are utilised (Kaplan, 1984a; Johnson and Kaplan, 1987; Cooper and Kaplan, 1988a; 1988b; Cooper, 1988b; Kaplan and Cooper, 1998). It has been argued that, when companies incur higher levels of overhead costs as a result of producing their products, the importance of allocating these to products increases (Bjørnenak, 1997; Brierley, 2011).

Changes to the cost structure caused by growing levels of overhead costs to total costs can increase the costs of errors associated with poor decision-making based on distorted product costs (Cooper, 1988b). Therefore, the management of high levels of overhead costs is vital and this can be done by using more complex costing systems as they provide cost information that promotes the understanding of the relationship between overhead costs and products (Cooper, 1988b; Cooper and Kaplan, 1988b).

When reviewing research in Europe, Brierley et al. (2001) found that overhead costs represent a relatively small proportion of the total costs and that direct material costs constitute the majority of the total costs. They pointed out how the claims regarding the increase in overhead costs were not observed by all empirical studies conducted in Europe, and, accordingly, concluded that investing in complex costing systems may not be justified or necessary when the level of overhead costs is low. In accordance with Brierley et al.'s (2001) conclusion, Kaplan and Cooper (1998) argued that, if the level of overhead costs, excluding facility-level, is low, then the need to adopt and use ABC is unjustifiable and less complex costing systems will be suitable for calculating product costs. This is because, when overhead costs represent a small proportion of the total costs, using less complex costing systems causes no or very little distortion in product costs (Nguyen and Brooks, 1997; Booth and Giacobbe, 1998; Charaf and Bescos, 2013).

The influence of cost structure has been widely examined by contingency studies on optimal CSD. By operationalising CSD from the perspective of ABC adoption, some contingency studies have found support for the positive impact of cost structure on ABC adoption (e.g., Bjørnenak, 1997; Al-Omiri, 2012; Al-Omiri and Drury, 2013; Jusoh and Miryazdi, 2016), whereas others have not (e.g., Nguyen and Brooks, 1997; Clarke et al., 1999; Malmi, 1999; Chen et al., 2001; Al-Mulhem, 2002; Brown et al., 2004; Chongruksut and Brooks, 2005; Cohen et al., 2005; Khalid, 2005; Al-Omiri and Drury, 2007; Brierley, 2008b; 2011; Nassar et al., 2009; Ahamadzadeh et al., 2011; Charaf and Bescos, 2013; Rbaba'h, 2013). In addition, Pokorná (2015) found a negative effect of cost structure on ABC adoption. These inconsistent findings are problematic, given that cost structure is among the main reasons that prompted the modification of optimal CSD by increasing its complexity, and that many case studies on ABC adoption have found that cost structure is among the reasons that prompted companies to consider it (e.g., Merz and Hardy, 1993; Innes and Mitchell, 1990b; Innes and Mevellec, 1994; Duh et al., 2009). These diverse results might be attributed to inconsistency regarding one or more of the aspects mentioned in Section 5.4.1.1 between and within contingency studies on ABC adoption that have and have not found a positive association between cost structure and ABC adoption.

By operationalising CSD from the perspective of the level of CSC, contingency studies have also provided inconsistent findings. Brierley (2007) found a positive influence of cost structure on the number of cost pools, whereas other researchers did not (Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013). This may be attributed to the fact that, while Brierley (2007) used the percentage of manufacturing overhead costs to total manufacturing costs, the other studies used the percentage of total overhead costs to total costs to measure cost structure. In relation to the number of cost drivers, none of the contingency studies on CSC found a positive impact of cost structure on CSC.[46]

Given the contradictory results provided by contingency studies that utilised the selection form of fit only, further research on the effect of cost structure on the optimal level of CSC using multiple measures of cost structure is needed. Although the empirical results are inconsistent, prior theory, as discussed above, suggests that the level of overhead costs is positively associated with the level of CSC. This positive association reflects the fit between

[46] Also, Drury and Tayles (2005) and Ismail and Mahmoud (2012) failed to find an association between cost structure and their CSC composite measures (see Section 4.3.2).

the two constructs that provides the highest outcomes, indicating a positive association between the level of overhead costs and the optimal level of CSC. Any misfit between these two factors is expected to have a negative influence on the outcomes.

To demonstrate, even though more complex than required costing systems furnish more accurate product costs that can assist in making informed product-related decisions, i.e., less costly regarding errors, these costing systems, in terms of measurement, are more costly (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the measurements associated with these systems will probably exceed their benefits in terms of reducing the costs of errors, i.e., the benefit of these systems in relation to the provision of more accurate product costs that can assist in making informed product-related decisions. Thus, it is unlikely that the more accurate product costs provided by more complex than required costing systems will be perceived as useful and needed in decision-making when the indirect costs are at levels lower than those of more complex than required costing systems.

On the other hand, in spite of being less costly in terms of measurement, less complex than required costing systems furnish inaccurate product costs that can lead to making inferior product-related decision, i.e., more costly with respect to errors (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the errors related to these systems will probably exceed their benefits in terms of reducing the costs of measurements. Hence, it is implausible that the inaccurate product costs provided by less complex than required costing systems will be considered useful or used in decision-making at indirect costs levels higher than those of less complex than required costing systems. Therefore, the following hypothesis will be tested:

Hypothesis 2: ***From the perspective of the matching sub-form of fit, the level of overhead costs is expected to have a positive influence on the optimal level of CSC that yields the***

highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between the level of overhead costs and the optimal level of CSC and a negative impact of the misfit between the level of overhead costs and the optimal level of CSC on the two outcomes.

5.4.1.3 Organisational culture

Organisational culture represents "the pattern of shared and stable beliefs and values that are developed within a company across time" (Gordon and DiTomaso, 1992, p. 784). These shared beliefs and values make everyone in the company to head in the same direction (Higginson and Waxler, 1993). According to Schein (1990), the concept of organisational culture has been paid great consideration in recent years by academics and practitioners. However, Chenhall (2007, p. 188) noted that "[l]ittle work has been completed in the area of organisational culture and MCS design". Many researchers have asserted the importance of organisational culture, as it can affect the design of MCS (e.g., Fisher, 1995; Chenhall, 2003; 2007; Henri, 2006; Otley, 2016), including the costing system (e.g., Shields and Young, 1989; Argyris and Kaplan, 1994; Malmi, 1997; Bhimani, 2003; Baird et al., 2004; 2007; Moisello, 2012).

Organisational culture can have an impact on the implementation, sustainment and success of any change implemented by companies, e.g., accounting, technology and structure (Schwartz and Davis, 1981; Shields and Young, 1989; Scapens and Roberts, 1993; Argyris and Kaplan, 1994; Cooper, 1994; Schneider, Brief and Guzzo, 1996; Bhimani, 2003; Ke and Wei, 2008; Baird, Jia Hu and Reeve, 2011; Baird, Schoch and Chen, 2012). When making changes in the company, organisational culture provides employees with a common frame of reference (Ke and Wei, 2008). To implement a sustainable, successful change, it is crucial for the cultural assumptions of the change to be compatible with or fit the company's organisational culture (Schwartz and Davis, 1981; Romm, Pliskin, Weber and Lee, 1991; Schneider et al., 1996; Goddard, 1997; Bhimani, 2003; Ke and Wei, 2008; Ax and Greve, 2016). Bhimani (2003) argued and found that organisational culture affects the optimal design of novel management accounting systems, as the desired outcomes of these systems were obtained when consistency exists between the cultural requirements of these systems and the organisational culture. Similarly, Romm et al. (1991) and Ke and Wei (2008) asserted that it is necessary to have an organisational culture that fits the cultural assumptions embedded within the management information systems, e.g., ERP, in order to exploit the systems' benefits.

In addition, organisational culture influences the success of companies, as successful companies have distinguished and strong cultures that enable them to obtain and maintain world leadership positions (Schwartz and Davis, 1981; Shields and Young, 1989; Gordon and DiTomaso, 1992; Higginson and Waxler, 1993). Schwartz and Davis (1981) noted that companies should make the organisational elements of structure, systems, people's skills and culture internally consistent and combatable with their strategy in order to obtain high levels of performance in a competitive environment.

Organisation culture has been argued to be associated with optimal CSD. Ansari and Lawrence (1999, p. 28) pointed out that "[a] cost measurement system both reflects and reinforces an organization's culture". Shields and Young (1989) emphasised the importance of establishing an organisational culture that accords with the cost management system in order for the latter to be implemented successfully and accomplish the desired effects. Argyris and Kaplan (1994) explained the strategies for changing the organisational culture and, therefore, overcoming the employees' resistance to ABC implementation and success. Employees' resistance can result from a lack of compatibility between the organisational culture and any changes undertaken in the company, e.g., the costing system (Ax and Greve, 2016), which was noted by Skinner (1998) and found by Malmi (1997) to be among the main reasons for ABC failure.

The findings of prior literature indicate that organisational culture is associated with optimal CSD in two ways. First, organisational culture can facilitate the adoption and implementation of the intended CSD (Baird et al., 2004; Chongruksut, 2009; Charaf and Bescos, 2013). In relation to CSC, this suggests that founding a suitable organisational culture is crucial in order to be able to reach the purposed level of CSC, which is assumed to be optimal for the company in meeting the requirements of other contingency factors, such as cost structure. Second, organisational culture can influence costing system success (Baird et al., 2007; Zhang et al., 2015), and compatibility between the cultural assumptions of CSD and organisational culture affects costing system success (Malmi, 1997; Bhimani, 2003; Eldenburg, Soderstrom, Willis and Wu, 2010). In relation to CSC, this means that organisational culture and the cultural demands of a certain level of CSC need to fit each other in order for the costing system to accomplish its objectives and, thus, succeed, i.e., for the CSD to be optimal, supporting the vital role of organisational culture as a facilitator factor.

Organisational culture encompasses many dimensions (e.g., Hofstede, Neuijen, Ohayv and Sanders, 1990; O'Reilly, Chatman and Caldwell, 1991). Contingency studies on optimal CSD have examined the influence of different dimensions, such as innovation, outcome orientation, team orientation, attention to detail and tight versus loose control, that have been argued to be associated with the adoption, implementation and success of all activity management stages, including ABC (e.g., Baird et al., 2004; 2007; Baird, 2007; Zhang et al., 2015). The impact of the organisational culture dimensions of outcome orientation, attention to detail and tight versus loose control on the optimal level of CSC are examined in this research, due to their expected positive effect on the optimal level of CSC. This expectation is based on their significant influence on ABC adoption and implementation (Baird et al., 2004; Charaf and Bescos, 2013) and success (Baird et al., 2007; Zhang et al., 2015).

The first dimension, outcome orientation, refers to the extent to which a company is competitive, emphasises actions, achievements and results as important values and has high expectations regarding performance (Baird et al., 2004; 2007; Charaf and Bescos, 2013). Companies with a more outcome-oriented organisational culture are more likely to value ABC that is claimed to improve processes and enhance competitiveness and performance (Baird et al., 2004). The second dimension, attention to detail, indicates the extent to which a company focuses on details and emphasises precision and carefulness (Baird et al., 2007; Charaf and Bescos, 2013). Companies with a more detail-oriented organisational culture are more likely to value ABC that provides detailed cost information that is claimed to be more accurate than that provided by TCS (Baird et al., 2007). Another possible explanation of the relationship between each of the outcome orientation and attention to detail cultural dimensions and the optimal level of CSC is the impact of these dimensions on the usage of total quality management (TQM). Baird et al. (2011) argued that companies with a more outcome-oriented organisational culture seek to enhance their competitive advantage through enhancing the quality of their products, and, therefore, they are expected to use TQM that improves quality performance. Similarly, Baird et al. (2011, p. 792) pointed out that companies with a more detail-oriented organisational culture are expected to use TQM because it provides a lot of detail by "using statistical process control methods, evaluating measures of non-conformance and the cost of quality, and conducting cause-and-effect analysis". The usage of TQM, in turn, is highly likely to increase the success of ABC implementation because TQM will conduct part of the process analysis required when implementing the system (Krumwiede, 1998a; Moisello, 2012).

The third dimension, tight versus loose control, refers to the extent to which a company focuses on controlling its activities and costs (Baird et al., 2004). Chenhall (2007) emphasised the importance of accounting for the control dimension of organisational culture when studying innovative aspects of MCS, such as ABC, because this influences the implementation process. Companies with a tighter control, i.e., more control-focused, organisational culture have a cost-conscious environment (Hofstede, 1998), and also emphasise cost control and detailed planning, budgeting and the costing system (Merchant and Van der Stede, 2003; Baird et al., 2004). Baird et al. (2004) argued that companies that possess such characteristics are more likely to use ABC that involves the detailed identification of the amount of costs assigned to activities and so, subsequently, to products.

The influence of organisational culture has been investigated by only three contingency studies on optimal CSD operationalised from the perspective of ABC adoption (Baird et al., 2004; Chongruksut, 2009; Charaf and Bescos, 2013).[47] A positive effect of outcome orientation (Baird et al., 2004; Charaf and Bescos, 2013) and tight control (Baird et al., 2004) on ABC adoption was found. However, attention to detail was not found to be associated with ABC adoption (Charaf and Bescos, 2013). Besides these three contingency studies, two studies examined the influence of organisational culture on ABC success (Baird et al., 2007; Zhang et al., 2015), and both found that outcome orientation is positively associated with ABC success. However, attention to detail was only found by Baird et al. (2007) to be positively related to ABC success. The inconsistent findings in relation to attention to detail may be attributed to the different ABC success measures used by the two studies. To the author's knowledge, no contingency study has examined the impact of organisational culture on optimal CSD operationalised from the perspective of the level of CSC.

[47] Chongruksut (2009) examined the impact of four dimensions of organisational culture, namely, innovation, support, the rule and the goal, on the adoption of advanced management accounting tools, including ABC. The study, however, did not test, separately, the influence of the organisational culture's dimensions on ABC adoption, making it difficult to draw any conclusions in this regard.

Given the importance of organisational culture as a facilitator factor and the lack of research on the association between organisational culture and the optimal level of CSC, further research is needed. As pointed out above, prior theory and the findings of contingency studies on ABC adoption and studies on ABC success suggest that the cultural dimensions of outcome orientation, attention to detail and tight control are positively related to the level of CSC. This positive relationship reflects the fit between each cultural dimension and the level of CSC that produces the highest outcomes, suggesting a positive relationship between each cultural dimension and the optimal level of CSC. Any misfit between each cultural dimension and the optimal level of CSC is expected to have a negative influence on the outcomes.

Taking the tight versus loose control cultural dimension as an example, it is more likely that the degree of control will be positively associated with situations that increase the costs of errors, e.g., the level of competition, since the magnitude of cost-consciousness and emphasis on cost control and detailed planning, budgeting and the costing systems required at higher levels of costs of errors increases as the extent of control tightens (Hofstede, 1998; Merchant and Van der Stede, 2003; Baird et al., 2004). Although more complex than required costing systems provide more accurate product costs that can assist in making informed product-related decisions, i.e., less costly regarding errors, these costing systems, in terms of measurement, are more costly (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the measurements associated with these systems will probably outweigh their benefits in terms of reducing the costs of errors, i.e., the benefit of these systems in relation to the provision of more accurate product costs that can assist in making informed product-related decisions. Therefore, it is unlikely that the more accurate product costs furnished by more complex than required costing systems will be perceived as useful and used in decision-making when the control levels are looser than those of more complex than required costing systems.

Taking the attention to detail cultural dimension as an example, it is more likely that the extent of attention to detail will be positively associated with situations that increase the costs of errors, e.g., the level of indirect costs, due to the fact that the demand for highly detailed cost information required at higher levels of costs of errors increases as the extent of attention to detail increases (Baird et al., 2007). Despite being less costly in terms of measurement, less complex than required costing systems provide distorted product costs that can lead to making inferior product-related decisions, i.e., more costly with respect to errors (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the errors related to these systems will probably outweigh their benefits in terms of reducing the costs of measurements. Accordingly, it is unlikely that the distorted product costs furnished by less complex than required costing systems will be considered useful or used in decision-making at attention to detail levels higher than those of less complex than required costing systems. Thus, the following hypotheses will be tested:

Hypothesis 3a: ***From the perspective of the matching sub-form of fit, an outcome orientation culture is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between an outcome orientation culture and the optimal level of CSC and a negative impact of the misfit between an outcome orientation culture and the optimal level of CSC on the two outcomes.***

Hypothesis 3b: ***From the perspective of the matching sub-form of fit, an attention to detail culture is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive***

influence entails two elements; namely, a positive association between an attention to detail culture and the optimal level of CSC and a negative impact of the misfit between an attention to detail culture and the optimal level of CSC on the two outcomes.

Hypothesis 3c: ***From the perspective of the matching sub-form of fit, a tight control culture is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between a tight control culture and the optimal level of CSC and a negative impact of the misfit between a tight control culture and the optimal level of CSC on the two outcomes.***

5.4.1.4 Production complexity (PC)

It has been argued that PC has an impact on optimal CSD (e.g., Kaplan, 1984b; 1986a; Cooper and Kaplan, 1991; Malmi, 1999; Cagwin and Bouwman, 2002). Optimal CSD should reflect the various processes undertaken by the company (Cooper and Kaplan, 1991; Jones, 1991; Schoute, 2011). PC increases the amount of indirect costs, especially batch- and product-level ones, because it is typically associated with the production of a wide variety of products and involves highly complex production tasks (Swenson, 1998; Cooper and Kaplan, 1999). In addition, companies with high levels of PC have a higher probability of having distorted product costs if less complex costing systems are used (Nguyen and Brooks, 1997; Booth and Giacobbe, 1998; Krumwiede, 1998a). Thus, many researchers have asserted the importance of having more complex costing systems when the manufacturing processes are complex in order to calculate their costs and assign them to products in an accurate manner (e.g., Karmarkar et al., 1990; Nguyen and Brooks, 1997; Malmi, 1999; Abernethy et al., 2001; Drury and Tayles, 2005; Schoute, 2011). For example, Malmi (1999) pointed out that, in situations of high levels of PC, more complex costing systems that have a large number of cost pools and cost drivers are needed in order to determine more accurately the amount of resources consumed by the various products.

As noted in Section 4.4.3.3, the CSD literature lacks consensus regarding the dimensions of PC. The review of the CSD literature identified 11 PC dimensions that increase the complexity of the production environment, and can result in distorted product costs if less complex than required costing system are used (see Section 4.4.3.3). Given the above, the discussion of how each PC dimension relates to PC and the optimal level of CSC is held until the most indicative PC dimensions of those identified in the literature are determined, by conducting an exploratory investigation at the beginning of the empirical work of this research.[48] Nevertheless, the general discussion of the impact of PC on the optimal level of CSC provided in this section makes it possible to state a matching sub-form of fit's hypothesis for PC, which will be restated after determining the most suggestive PC dimensions and discussing how each one affects PC and the optimal level of CSC.[49] The matching sub-form of fit's hypothesis of PC is:

Hypothesis 4: ***From the perspective of the matching sub-form of fit, PC is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between PC and the optimal level of CSC and a negative impact of the misfit between PC and the optimal level of CSC on the two outcomes.***

5.4.1.5 Business-unit size

Prior literature suggested a positive association between business-unit size and the usage of more complex MCS (e.g., Szendi and Shum, 1999; Drury and Tayles, 2005; Chenhall, 2007;

[48] Details about the exploratory empirical investigation will be provided in Section 6.3.1.
[49] The matching sub-form of fit's hypothesis pertaining to PC will be restated in Section 6.3.1.3.2.

Abdel-Kader and Luther, 2008). In relation to CSD, prior research provided four possible reasons for the positive influence of business-unit size on CSC. First, large business-units have more resources - e.g., staff, time and computing facilities - than small ones, which enables them to afford the costs associated with designing, implementing and operating highly complex costing systems (Nguyen and Brooks, 1997; Booth and Giacobbe, 1998; Chen et al., 2001; Al-Mulhem, 2002; Baird et al., 2004; Chongruksut and Brooks, 2005; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Chenhall, 2007; Abdel-Kader and Luther, 2008; Rbaba'h, 2013; Elhamma and Moalla, 2015; Pokorná, 2015). The availability of resources is crucial for designing, implementing and operating complex costing systems, given that these are associated with costs related to, for example, collecting, storing and processing a large amount of data required to obtain more accurate product costs (Cooper, 1988b; Babad and Balachandran, 1993; Banker and Potter, 1993; Dopuch, 1993; Estrin et al., 1994; Cooper and Kaplan, 1999; Homburg, 2001; Pizzini, 2006).

Second, larger business-units have more extensive communication channels, a higher number of information sources and the required infrastructure to employ highly complex costing systems (Bjørnenak, 1997). Third, large business-units benefit from the economics of scale advantage (Nguyen and Brooks, 1997; Khalid, 2005; Wu and Boateng, 2010) and, therefore, have the ability to afford the high costs associated with CSC by spreading these across a large number of outputs (Brown et al., 2004; Wu and Boateng, 2010). Fourth, the wide variety of activities performed by large business-units increases the diversity of their products, services and customers, which, in turn, prompts a need to use more complex costing systems (Clarke et al., 1999; Chen et al., 2001; Al-Mulhem, 2002; Drury and Tayles, 2005; Chenhall, 2007; Rbaba'h, 2013). In contrast, small business-units are more likely to have lower levels of product diversity and a smaller number of production departments, making simple costing systems suitable for them (Drury and Tayles, 2005).

The influence of business-unit size has been widely investigated by contingency studies on optimal CSD. By operationalising CSD from the perspective of ABC adoption, some contingency studies have found support for the positive impact of business-unit size as measured by the amount of sales revenue (e.g., Innes and Mitchell, 1995; Nguyen and Brooks, 1997; Krumwiede, 1998a; Clarke et al., 1999; Malmi, 1999; Hoque, 2000; Innes et al., 2000; Chen et al., 2001; Al-Mulhem, 2002; Khalid, 2005; Al-Omiri and Drury, 2007; 2013; Brierley, 2008b; 2011) and the number of employees (e.g., Nguyen and Brooks, 1997; Malmi, 1999; Hoque, 2000; Brierley, 2008b; 2011; Chongruksut, 2009; Nassar et al., 2009; Askarany et al., 2010; Rundora et al., 2013; Elhamma and Moalla, 2015; Pokorná, 2015) on ABC adoption. However, other contingency studies have failed to find evidence for the positive effect of business-unit size as measured by the amount of sales revenue (e.g., Gosselin, 1997; Cohen et al., 2005; Ahamadzadeh et al., 2011) and the number of employees (e.g., Gosselin, 1997; Baird et al., 2004; Chongruksut and Brooks, 2005; Cohen et al., 2005; Schoute, 2011; Rbaba'h, 2013) on ABC adoption. Furthermore, Joshi et al. (2011) reported a negative association between business-unit size as measured by the number of employees and ABC adoption. Moreover, while Cagwin and Bouwman (2002) and Krumwiede and Charles (2014) did not provide support for the moderator role of business-unit size, Elhamma (2012) did so, in that the positive association between ABC and performance was found to be stronger in large business-units compared to small ones.[50]

The inconsistent findings relating to business-unit size are problematic, given the strong reasons suggesting a positive association between business-unit size and CSC and the findings of many case studies on ABC adoption, which have identified that factors that are surrogates for business-unit size - e.g., the adequacy of resources and training - are vital in order to implement the system successfully (e.g., Gunasekaran and Sarhadi, 1998; Granlund,

[50] Cagwin and Bouwman (2002) measured business-unit size by the amount of sales revenue, whereas Elhamma (2012) and Krumwiede and Charles (2014) measured it by the number of employees.

2001; Abdul Majid and Sulaiman, 2008; Duh et al., 2009). These different results may be attributed to inconsistency regarding one or more of the aspects mentioned in Section 5.4.1.1 between and within contingency studies on ABC adoption that have and have not found a positive association between business-unit size and ABC adoption.

By operationalising CSD from the perspective of the level of CSC, contingency studies have provided strong evidence for the positive impact of business-unit size on CSC. When business-unit size is measured by the amount of sales revenue, contingency studies have been consistent in finding a positive effect of business-unit size on the number of cost pools (Drury and Tayles, 2005; Brierley, 2007; Al-Omiri and Drury, 2007; 2013). However, on the number of cost drivers, while most contingency studies found a positive influence of business-unit size (Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013),[51] Brierley (2007) did not. When business-unit size is measured by the number of employees, Brierley (2007) found that business-unit size has a positive effect on the number of cost pools, but not cost drivers.[52]

Although strong evidence has been found for the positive influence of the amount of sales revenue on the optimal level of CSC, further research is needed to confirm its influence. In addition, the limited research and support for the positive impact of the number of employees on the optimal level of CSC warrants further research. Even though contingency studies on ABC adoption have provided some contradictory results regarding the effect of business-unit size, prior theory, as demonstrated above, and the results of contingency studies on CSC suggest that business-unit size, as measured by either the amount of sales revenue or number of employees, is positively related to the level of CSC. This positive relationship reflects the

[51] Drury and Tayles (2005) also found a positive association between sales revenue and their CSC composite measure (see Section 4.3.2).
[52] Ismail and Mahmoud (2012) failed to find support for the positive effect of business-unit size as measured by the number of employees on their CSC composite measure (see Section 4.3.2).

fit between the two constructs that yields the highest outcomes, indicating a positive relationship between business-unit size and the optimal level of CSC. Any misfit between business-unit size and the optimal level of CSC is expected to have a negative influence on the outcomes.

To explain, it is more likely that business-unit size will be positively associated with situations that increase the costs of errors, e.g., the level of PC, because the complexity of structure and production, which are positively related to the costs of errors, increases as the business-unit size increases (e.g., Drury and Tayles, 2005; Chenhall, 2007). Although more complex than required costing systems furnish more accurate product costs that can assist in making informed product-related decisions, i.e., less costly regarding errors, these costing systems, in terms of measurement, are more costly (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the measurements associated with these systems will probably outweigh their benefits in terms of reducing the costs of errors, i.e., the benefit of these systems in relation to the provision of more accurate product costs that can assist in making informed product-related decisions. Thus, it is doubtful that the more accurate product costs provided by more complex than required costing systems will be perceived as useful and needed in decision-making at business-unit sizes lower than those of more complex than required costing systems.

In contrast, despite being less costly in terms of measurement, less complex than required costing systems furnish distorted product costs that can cause making inferior product-related decisions, i.e., more costly with respect to errors (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the errors related to these systems will probably outweigh their benefits in terms of reducing the costs of measurements. Hence, it is unlikely that the distorted product costs provided by less complex than required costing systems will be considered useful or used in decision-making at business-unit sizes higher than those of less complex than required costing systems. Therefore, the following hypothesis will be tested:

Hypothesis 5: ***From the perspective of the matching sub-form of fit, business-unit size is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between business-unit size and the optimal level of CSC and a negative impact of the misfit between business-unit size and the optimal level of CSC on the two outcomes.***

5.4.1.6 Top management support (TMS)

TMS represents "the active and open promotion that upper level executives, such as the Chief Executive Officer or the Chief Financial Officer, give to an innovation" (Brown et al., 2004, p. 336). It is considered to be a crucial factor that contributes towards the success of implementing innovations (Kwon and Zmud, 1987; Grover, 1993; Premkumar and Potter, 1995; Sharma and Yetton, 2003; Dong, Neufeld and Higgins, 2009), including ABC (e.g., Shields, 1995; Foster and Swenson, 1997; McGowan and Klammer, 1997; Krumwiede, 1998a; Anderson and Young, 1999; Baird et al., 2007; Maiga and Jacobs, 2007; Byrne, 2011). Krumwiede (1998a) stated that business-units that lack sufficient management support will not use ABC or its use will be limited. In fact, the lack of TMS can be considered the major cause of ABC implementation failure (Waeytens and Bruggeman, 1994; Granlund, 2001; Byrne, 2011).

The importance of any change undertaken in the business-unit, including the costing system (Maiga and Jacobs, 2007; Brown et al., 2004), is signalled by the top management. Therefore, TMS is important when making any change in the business-unit, such as adopting and implementing new systems or modifying or upgrading existing ones, for many reasons.

First, TMS contributes towards reducing risks and avoiding failure (Grover, 1993; Premkumar and Potter, 1995; Krumwiede, 1998a; 1998b; Brown et al., 2004), because the top management will permit access to the business-unit's resources - e.g., financial, human and technical - that are required to complete the implementation of a new system, modify/upgrade existing ones and solve any associated organisational issues regarding the adoption and change process (Shields, 1995; Anderson and Young, 1999; Brown et al., 2004; Baird et al., 2007; Dong et al., 2009). Second, the top management can perform many activities - e.g., involving users in the new, modified or upgraded system's design and implementation process from the early stage, redesigning training courses when needed and soliciting user feedback in a continuous manner - to increase users' skills and knowledge of the system and so, subsequently, its usage (Sharma and Yetton, 2003; Dong et al., 2009). Third, the top management can create incentives that are linked to the project of implementing new systems or modifying/upgrading the existing ones (Sharma and Yetton, 2003; Maiga and Jacobs, 2007; Dong et al., 2009). These incentives, in turn, will motivate users to accomplish the project's objectives.

Fourth, TMS for a new, modified or upgraded system increases user appreciation of its benefits in terms of achieving the business-unit's goals and meeting its needs, and, thus, contributes towards nurturing a positive attitude towards the system among its users (McGowan and Klammer, 1997). Fifth, the top management, through developing new coordination mechanisms, can provide the required political assistance to implement a new system or modify/upgrade an existing one, and remove any obstacle that might hinder the change process (Shields, 1995; Sharma and Yetton, 2003). Sixth, the top management can make changes to the performance goals to avoid the new/modified/upgraded system being rejected when performance declines as a result of the change process (Sharma and Yetton, 2003). Seventh, the top management can provide a clear vision of the intended objectives through formal communications, clarifying confusion, involving users in the early stage of system development and creating a strong feeling of ownership and commitment that is required to ensure that lower-level managers have a common understanding of the new/modified/upgraded system's objectives (Dong et al., 2009).

The influence of TMS has been examined by only contingency studies on optimal CSD that operationalised CSD from the perspective of ABC adoption, whose results provided support for the positive impact of TMS on various stages of ABC adoption (Krumwiede, 1998a; Brown et al., 2004; Maelah and Ibrahim, 2007). In addition, studies on ABC success have been consistent in providing evidence for the positive effect of TMS on ABC success (e.g., Shields, 1995; Foster and Swenson, 1997; McGowan and Klammer, 1997; Anderson and Young, 1999; Baird et al., 2007; Maiga and Jacobs, 2007; Byrne, 2011). Furthermore, many case studies on ABC adoption have found TMS to be positively associated with ABC adoption (e.g., Bruggeman et al., 1996; Liu and Pan, 2007; Innes and Mitchell, 1991) and success (e.g., Innes and Mitchell, 1991; Gunasekaran and Sarhadi, 1998; Liu and Pan, 2007; Abdul Majid and Sulaiman, 2008; Duh et al., 2009).[53] Moreover, Waeytens and Bruggeman (1994) found that the lack of TMS was the reason for ABC implementation failure, while Granlund (2001) found that the lack of continuous TMS was among the stability factors that prevented changes being made to the costing system. To the author's knowledge, no contingency study has examined the influence of TMS on optimal CSD operationalised from the perspective of the level of CSC.

Given the importance of TMS as a facilitator factor, the lack of research and as a response to calls made by many researchers to investigate the impact of organisational factors relating to the organisation's management and employees, such as TMS, on the optimal level of CSC

[53] Duh et al. (2009) reported the experience of a company that was in the analysis stage regarding ABC adoption, and that ABC was not officially implemented due to several reasons, such as the revision of the strategy and the lack of linkage to performance evaluation and incentives.

(Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Brierley, 2007), the effect of TMS on this area merits investigation. Prior theory, as illustrated above, and the findings of contingency studies on ABC adoption and success indicate that TMS is positively associated with CSC. This positive association reflects the fit between TMS and the level of CSC that produces the highest outcomes, conveying a positive association between TMS and the optimal level of CSC. Any misfit between TMS and the optimal level of CSC is expected to have a negative influence on the outcomes.

To illustrate, it is more likely that the extent of TMS will be positively associated with conditions that increase the costs of errors, e.g., the level of indirect costs, because the extent of TMS increases as the management's desire to have accurate product costs required at higher levels of costs of errors increases. Even though more complex than required costing systems provide more accurate product costs that can assist in making informed product-related decisions, i.e., less costly regarding errors, these costing systems, in terms of measurement, are more costly (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the measurements associated with these systems will probably outweigh their benefits in terms of reducing the costs of errors, i.e., the benefit of these systems in relation to the provision of more accurate product costs that can assist in making informed product-related decisions. Therefore, it is unlikely that the more accurate product costs furnished by more complex than required costing systems will be perceived as useful and needed in decision-making at TMS levels lower than those of more complex than required costing systems.

On the other hand, in spite of being less costly in terms of measurement, less complex than required costing systems provide inaccurate product costs that can lead to making inferior product-related decision, i.e., more costly with respect to errors (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the errors related to these systems will probably outweigh their benefits in terms of reducing the costs of measurements. Accordingly, it is unlikely that the distorted product costs furnished by less complex than required costing systems will be considered useful or used in decision-making at TMS levels higher than those of less complex than required costing systems. Thus, the following hypothesis will be tested:

Hypothesis 6: ***From the perspective of the matching sub-form of fit, TMS is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes, namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between TMS and the optimal level of CSC and a negative impact of the misfit between TMS and the optimal level of CSC on the two outcomes.***

5.4.2 System form of fit hypothesis

As explained in Section 3.3.3, the system form of fit deals with the influence of all of the contingency factors, taken together, on the optimal level of CSC, i.e., joint effect. To this end, the system form of fit tests the magnitude and sign of the impact of the misfit between all of the contingency factors, taken together, and the optimal level of CSC on the outcome. This, partially, agrees with the way in which the matching sub-form of fit tests the effect of the contingency factors on the optimal level of CSC (see Section 3.3.3). Accordingly, and based on the discussion provided in Section 5.4.1 regarding the positive association between each of the contingency factors and the optimal level of CSC and the negative influence of the misfit between the two, the following hypothesis will be tested:

Hypothesis 7: ***The degree of misfit between the contingency factors of (1) competition, (2) cost structure, (3) organisational culture, (4) PC, (5) business-unit size and (6) TMS, taken***

together, and the optimal level of CSC is expected to be negatively related to two outcomes; namely, USEFULNESS and USAGE.

5.5 Conclusion

This chapter aimed to demonstrate the research model for optimal CSD, which accounts for the main and four minor limitations of contingency research on optimal CSD. Because the research model considers the main limitation that might have prevented contingency research on optimal CSD from furnishing an appropriate understanding of the influences on this phenomenon, this chapter assisted in realising the main contributions of this research, specifically, the first and the third ones and, therefore, acquiring the research aim (see Section 1.5). Because the research model considers the four minor limitations that are vital to be accounted for in order to address successfully the main limitation of contingency research on optimal CSD and, accordingly, achieve the research aim, this chapter also assisted in realising the four minor contributions of this research (see Section 1.5). Thus, it contributed towards successfully addressing the main limitation of contingency research on optimal CSD and, hence, attaining the research aim (see Section 1.5).

This chapter reviewed the various costing system outcomes used by the CSD literature and provided the reasons for selecting two outcomes to represent the optimality of CSD, i.e., optimality of the level of CSC, in the research model. Furthermore, it presented and described the research model and compared it with other models tested by other contingency studies on optimal CSD. Moreover, this chapter developed the research hypotheses indicated by the research model. Having illustrated the research model, the next chapter will explain the research methodology and methods.

Chapter six: Research methodology and methods

6.1 Introduction

This chapter seeks to describe the methodology and methods utilised to conduct this research. Effectively, this chapter assists in realising the three main contributions of this research relating to, respectively, the application of contingency theory with respect to the adopted forms of fit, the statistical analysis techniques exploited to test for the matching sub-form of fit and the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5). Thus, it contributes towards achieving the research aim of investigating the influence of different contingency factors on optimal CSD where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. Furthermore, this chapter assists in realising the four minor contributions of this research concerning, respectively, the operationalisation of CSD, the account of the effect of organisational factors related to the organisation's management and employees and the measurements of CSC and PC (see Section 1.5). Hence, it contributes to successfully considering the main limitation of contingency research on optimal CSD and, therefore, accomplishing the research aim (see Section 1.5).

To achieve the research aim, this research develops and empirically tests a research model that symbolises a set of hypotheses regarding the effect of different contingency factors on optimal CSD, accounting for the main limitation of contingency research on this area through: (1) applying the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory and; (2) developing and employing a procedure encompassing the recommended joint usage of PRA and RSM to test for the matching sub-form of fit (see Sections 1.3, 1.5, 4.4.2, 5.3 and 5.4).

To address the main limitation of contingency research on optimal CSD successfully and, accordingly, acquire the research aim, the research model also accounts for the four minor limitations of this research strand (see Sections 1.5, 4.4.3 and 5.3). Developing and employing a statistical testing procedure for the matching sub-form of fit, i.e., the second main contribution, indicate the necessity of collecting quantitative data from a large number of cases. Likewise, testing the research model - i.e., research hypotheses - and, thus, providing generalizable findings on the effect of the contingency factors on optimal CSD from the standpoints of the matching sub-form of fit and the system form of fit, i.e., the third main contribution, requires performing statistical analysis of quantitative data collected from a large number of cases, which are deemed representative of a large population (Saunders, Lewis and Thornhill, 2009; Collis and Hussey, 2014; Creswell, 2014). Given the demands of realising the second and third main contributions and, ultimately, to attain the research aim, the survey strategy was selected because it allows researchers to collect a large amount of data related to large populations in a fast, inexpensive, efficient and accurate manner, and then statistically analyse these data in order to determine whether any relationships exist between the variables (Zikmund, 2000; Ryan, Scapens and Theobald, 2002; Saunders et al., 2009; Bryman and Bell, 2011; Collis and Hussey, 2014).

For the selected research strategy, i.e., the survey, the underlying ontological assumption related to the researchers' view of the social world is objective, in that the social world is viewed in a similar way to the world of physics and chemistry, i.e., as a set of specified relationships between a group of variables (Morgan and Smircich, 1980; Tomkins and Groves, 1983; Hopper and Powell, 1985; Ryan et al., 2002; Bryman and Bell, 2011; Collis and Hussey, 2014). Accordingly, social entities are considered to have an existence that is external to and independent of the social actors (Hopper and Powell, 1985; Ryan et al., 2002; Saunders et al., 2009; Bryman and Bell, 2011).

For the chosen research strategy, i.e., the survey, the underpinning epistemological assumption concerning researchers' views on what is deemed acceptable knowledge in the field of study, i.e., how researchers gain knowledge, is also objective and leans towards positivism rather than interpretivism (Morgan and Smircich, 1980; Tomkins and Groves, 1983; Hopper and Powell, 1985; Ryan et al., 2002; Saunders et al., 2009; Bryman and Bell, 2011; Collis and Hussey, 2014). This is because the application of natural science principles and procedures, i.e., the scientific approach's principals and procedures, is considered appropriate when studying the social world (ibid). More specifically, using the survey strategy typically entails collecting quantitative data from large samples to analyse these data via statistical analysis techniques in order to test hypotheses developed from prior literature and offer generalisations regarding the findings of the hypotheses (Ryan et al., 2002; Saunders et al., 2009).

The remainder of this chapter is organised as follows. Section 6.2 provides information about the research population, sampling frame and sample. Section 6.3 details the application of the survey strategy adopted in this research. This strategy involved two stages; namely, the exploratory stage (Section 6.3.1) and the model-testing one (Section 6.3.2). Each stage was conducted to realise, primarily, the second and/or third main contributions of this research whose realisation, as mentioned above, necessities the adoption of the survey strategy. Jointly, both stages contribute towards accomplishing the research aim. Section 6.4 concludes this chapter.

6.2 Research population, sampling frame and sample

The research population contains the group of units, elements or cases from which a sample is selected and is intended to represent (Sekaran, 2000; De Vaus, 2002; Saunders et al., 2009; Bryman and Bell, 2011; Dillman, Smyth and Christian, 2014). The population of this research included all business-units that work in the Saudi manufacturing industry, including all sectors except for the oil and natural gas production and extraction sector (see Section 1.6).

The sampling or population frame is a complete list of all of the units, elements or cases in the population from which the study sample is selected (Sekaran, 2000; De Vaus, 2002; Saunders et al., 2009; Bryman and Bell, 2011; Dillman et al., 2014). The database of the Institute of Management Accountants (IMA) in Saudi Arabia was used as the sampling frame for this research, for two reasons. First, the IMA members are interested in the management and cost accounting profession and, consequently, presumed to hold positions in their business-units that allow them to participate in this research. Second, the IMA sampling frame did not suffer from the problems found with other possible sampling frames, i.e., databases. In particular, the Saudi Industrial Property Authority (MODON) and the Royal Commission for Jubail and Yanbu (RCJY) databases failed to include information about the business-units' addresses and the accounting and finance departments' contact details.[54] The MCI database lacked accuracy and was in the process of being updated.[55] Although the SIDF database included full information about the business-units' addresses and the accounting and finance departments' contact details, it only encompassed business-units that received government funding, i.e., those with special characteristics.

The main drawback of the IMA database, which also applies to all of the other databases mentioned above, is that it was impossible to exclude business-units that work within the the oil and natural gas production and extraction sector. However, this was not an issue, given that only one company in Saudi Arabia, namely, Saudi Aramco, operates in this sector, and the data collection methods utilised under the adopted survey strategy made it possible to

[54] In addition, the RCJY database only included business-units that are located in two Saudi industrial cities; namely, Jubail and Yanbu.
[55] Another potential database is the General Authority of Statistics database, but this is linked to the MCI database, and, therefore, was outdated during the data collection period.

identify the manufacturing sector of the business-units.[56] Hence, obtaining responses from the oil and natural gas production and extraction sector did not represent a threat to this research.

As shown in Table 6-1, the sampling frame for this research included IMA members who work in the Saudi manufacturing industry or other industries that engage in manufacturing, including construction, mining, agriculture, pharmaceuticals and biotechnology. The IMA advised the researcher that the other industries that are engaged in manufacturing, e.g., pharmaceuticals, are highly likely to have members who work in manufacturing business-units, as these members might have chosen to provide, in their profile information, the industry that reflects the nature of their products rather than manufacturing.

Table 6-1: Information about the IMA sampling frame

Industry type	**Number of members**
Construction, Mining, Agriculture	217
Manufacturing	258
Pharmaceuticals and Biotechnology	26
Total	**501**

Source: IMA Middle East chapter.

After determining the sampling frame, it is important to decide upon the sample. The objective of sampling is to collect information about some of the population's members who are listed in the sampling frame (De Vaus, 2002). Given that the number of IMA members is moderate (see Table 6-1), and these members can be reached by e-mail, it was decided to use the whole sampling frame as a sample. Having provided information about the research population, sampling frame and sample, the next section will detail the application of the adopted survey strategy.

[56] Further details about the data collection methods will be provided in Sections 6.3.1.1 and 6.3.2.1.

6.3 The application of the survey strategy

In this research, the utilised survey strategy involved two stages; namely, the exploratory and model-testing stages. Sections 6.3.1 and 6.3.2 will provide details about each of these stages, respectively.

6.3.1 Exploratory stage

6.3.1.1 Overview

Exploratory research is beneficial for obtaining a better understanding about the research problem, which, in turn, facilitates more rigorous research (Oppenheim, 1992; Sekaran, 2000; Zikmund, 2000). In addition, exploratory research assists in providing new ideas and hypotheses, and developing new constructs (Oppenheim, 1992). In this research, including an exploratory stage that involves collecting and analysing qualitative data was considered an important preliminary stage of the survey strategy adopted to attain the research aim. This is because performing an exploratory stage contributes towards realising the third main contribution of this research concerning the results of testing the matching sub-form of fit and the system form of fit's hypotheses and, accordingly, achieving the research aim. In particular, completing an exploratory stage of the survey strategy was crucial to acquire information that assists in ensuring: (1) that the research model includes only relevant contingency factors that affect optimal CSD; and (2) that the selected outcome measures - i.e., USEFULNESS and USAGE - in the research model are appropriate representatives of the optimality of CSD. Besides the third main contribution, performing an exploratory stage assists in realising the third and fourth minor contributions of this research relating to the measurements of CSC and PC and, thus, undertaking a successful consideration of the main limitation of contingency research on optimal CSD and so, subsequently, attaining the research aim. More specifically, conducting an exploratory stage of the survey strategy was critical to gather information to assist with measuring the CSC and PC constructs.

The specific objectives in performing the exploratory stage of the survey strategy can be summarised under four objectives. First, to obtain initial insights about the hypothesised relationships and the value of including the contingency factors in the research model and to collect further information about any contingency factor/s that might be specific to the Saudi manufacturing industry. Second, to acquire information about the objectives or outcomes that business-units seek to achieve through using the costing system, i.e., the outcomes representing the optimality of CSD. Third, to obtain information relating to the level of CSC in the Saudi manufacturing industry and the participants' understanding of CSC and perception of its dimensions, i.e., confirming that the identified CSC dimensions cover all of the construct's dimensions (see Section 4.4.3.2.2). Fourth, to gain information about the level of PC in the Saudi manufacturing industry and develop a sufficiently comprehensive multi-dimensional PC measure that covers the most indicative PC dimensions of those identified in the literature (see Section 4.4.3.3).[57]

Semi-structured interviews were conducted to collect the data during the exploratory stage. The interview is "a method for collecting data in which selected participants (the interviewees) are asked questions to find out what they do, think, or feel" (Collis and Hussey, 2014, p, 207). The interview rather than another data collection method, e.g., the questionnaire, was used in the exploratory stage, since it allows the use of a large number of open-ended questions, complex questions, probes and prompts, all of which are required to accomplish the objectives of conducting the exploratory stage of the adopted survey strategy (Blumberg, Cooper and Schindler, 2008; Saunders et al., 2009; Collis and Hussey, 2014). To exploit the benefits fully and reduce the limitations of the adopted data collection method

[57] In addition to these objectives, the exploratory stage aimed to collect information about the extent of usage of and benefits gained from AMT and the extent to which the respondents can differentiate between different levels of cost, i.e., unit, batch, product and facility-level. This information was obtained with the aim of testing other relationships that were not included in the research model, but, due to the limited space, these relationships were not tested and, thus, left for future research.

during the exploratory stage, i.e., semi-structured interviews, an interview guide (see Appendix 6-1) for the exploratory interviews was constructed, taking into consideration the recommendations of many researchers (e.g., Lillis, 1999; Sekaran, 2000; Easterby-Smith, Thorpe and Jackson, 2008; Saunders et al., 2009; King and Horrocks, 2010; Bryman and Bell, 2011). In particular, all of the questions in the interview guide were linked to the objectives of the exploratory stage and based on prior literature. In addition, leading, sensitive and complex questions were avoided, and the interview guide included probes to obtain further details about the interviewee's initial answer, and prompts to provide further clarification of the question when the interviewee expressed any uncertainty. The interview guide was divided into four parts. The first part included questions about the costing system and CSC. The second part contained questions related to PC and its influence on CSC. The third part encompassed questions about AMT and its benefits. The fourth part covered questions related to the influence of the contingency factors on CSC and the outcomes of the costing system.[58]

The IMA e-mailed all members who work in the selected industries to invite them to participate in the exploratory interviews (see Table 6-1). Eight members, i.e., manufacturing business-units, agreed to participate.[59] Twenty interviews with the eight manufacturing business-units were conducted during the period between 15 December 2014 to 10 January 2015, each lasting from thirty minutes to three hours. All of the interviews were face-to-face, audio-recorded - with the interviewees' permission - and transcribed. In addition, all of the

[58] In addition to the six contingency factors included in the research model, the fourth part of the interview guide included questions related to the influence of three additional contingency factors, including the importance of cost information in decision-making, business-unit nationality and AMT, on CSC. These three factors were not included in the research model (see Section 5.3), each for a different reason. For the importance of cost information in decision-making, it was decided to use it to improve the measurement of the USAGE outcome measure (see Section 6.3.2.1.2.1). Regarding business-unit nationality, it is impossible to test a matching sub-form of fit hypothesis for this construct using PRA and RSM because it is a dichotomous variable (Burkert et al., 2014). With respect to AMT, there were no clear reasons for whether or not AMT is directly related to CSC.

[59] None of these business-units operate in the oil and natural gas production and extraction sector (see Table 6-2); for a discussion on the issue of gaining responses from which, see Section 6.2.

interviews were conducted in the interviewees' workplace except for one, where the interviewee preferred to be interviewed in a café instead. Factory tours were undertaken at seven of the eight interviewed manufacturing business-units. Table 6-2 displays information about the business-units, interviewees and the number of interviews conducted with each business-unit. To analyse the qualitative data obtained during the exploratory stage, this research used template analysis (e.g., Crabtree and Miller, 1999; King, 1998; 2004; King, Carroll, Newton and Dornan, 2002; King and Brooks, 2017), which belongs to the general technique of thematic analysis (e.g., Attride-Stirling, 2001; Braun and Clarke, 2006; Vaismoradi, Turunen and Bondas, 2013).[60] Having provided an overview of the exploratory stage of the survey strategy, the next section will, briefly, discuss the results of this stage.

6.3.1.2 The results of the exploratory stage

The results of the semi-structured interviews produced many important findings and so, accordingly, assisted in accomplishing the four specific objectives of the exploratory stage of the survey strategy (see Section 6.3.1.1). This section presents the main findings related to each objective.

6.3.1.2.1 First objective: obtaining initial insights about the hypothesised relationships and information about the most relevant contingency factors

The results of the semi-structured interviews supported the positive relationship between all of the contingency factors included in the research model and CSC (see Section 5.3). As mentioned in Section 5.4.1, this positive relationship reflects the fit between the contingency factors and the level of CSC that produces the highest outcomes, indicating a positive association between the contingency factors and the optimal level of CSC. Any misfit between these two is expected to have a negative impact on the outcomes. In other words, the results of the semi-structured interviews supported the positive effect of the contingency

[60] More details about the template analysis technique, and the template used in this, are provided in Appendix 6-2.

Table 6-2: Details about the exploratory interviews

Business-unit number	Interviewees[a]	Total number of interviews	Business-unit information
1	Cost accountant (1)	1	. Glass-processing factory. . 150 employees.
2	1. Controller (1) 2. Production manager (1)	2	. Food (Bakery factory). . 150 employees.
3	1. Finance manager (3) 2. Operations manager (1)	4	. Carton factory. . 350 employees.
4	1. Finance manager (2) 2. Production manager (1)	3	. Plastic and aluminium product factory. . 120 employees.
5	1. Chief accountant (2) 2. Production manager (1)	3	. Beverages (Soft drinks and juice factory). . 75 employees.
6	1. Finance manager (2) 2. Production manager (1)	3	. Medical products factory. . 500 employees.
7	1. Finance manager (1) 2. Cost and production controller (2)	3	. Precast factory. . 600 employees.
8	1. Controller (1)	1	. Advanced fabric factory. . 170 employees.
Total		**20**	

a. Number of interviews is shown in brackets.

factors included in the research model on the optimal level of CSC.

In addition to the contingency factors included in the research model, the results of the semi-structured interviews found an additional contingency factor, namely, top management knowledge and awareness of the importance of cost information in decision-making (TMKA), to be a crucial factor in positively affecting CSC and, accordingly, the optimal level of CSC through TMS. This means that having TMKA is a crucial pre-condition for obtaining TMS, which, in turn, makes it possible to increase CSC.

> *"[...] the awareness and the understanding of the top management drive this [top management support]. As long as the top management is aware of the importance of cost information, they will provide the support and motivation to increase the costing system complexity."* **Finance manager of business-unit 3**

> *"[...] if the management is aware of the importance of cost information, it will provide the required resources and qualified staff to upgrade the costing system to be more detailed."* **Chief accountant of business-unit 5**

6.3.1.2.2 Second objective: acquiring information about the outcomes that best represent the optimality of CSD

The results of the semi-structured interviews suggested that most of the objectives and outcomes that the business-units intend to accomplish by using the costing system are concerned with obtaining accurate and useful cost information that assists in making informed decisions. This indicates that the selected outcome measures - i.e., USEFULNESS and USAGE - are suitable surrogates for the optimality of CSD (see Section 5.2).

6.3.1.2.3 Third objective: obtaining information regarding the level of CSC, the participants' understanding of CSC and their perception of CSC's dimensions

The results of the semi-structured interviews suggested that all of the business-units use formal costing systems, and that, although the level of CSC varies, most of them use the two-stage procedure to assign overhead costs to products. In addition, the results revealed that only one business-unit plans to implement ABC, while none of the remaining seven business-units has implemented or planned to implement ABC. Furthermore, the results conveyed that most of the participants link CSC to the complexity involved in assigning indirect costs to products, which agrees with the definition of CSC used in this research (see Section 2.4). Moreover, the results showed that the participants agree with the CSC literature in that: (1) CSC contains six dimensions of the number of cost pools and cost drivers, the nature of cost pools and cost drivers, the type of cost drivers and the method of assigning overhead costs to the cost pools (see Section 2.4); and (2) ABC is a highly complex costing system. This, in turn, confirms that the identified CSC dimensions cover all of the construct's dimensions and, hence, allows CSC to be measured using these dimensions.

6.3.1.2.4 Fourth objective: gaining information about the level of PC and developing a sufficiently comprehensive multi-dimensional PC measure

The results of the semi-structured interviews showed that the level of PC varies between business-units, as some of the business-units evaluated their production environment as simple, while others assessed it to be complex. Regarding the measurement of PC, the results revealed that, among the 11 PC dimensions identified in Section 4.4.3.3, the five dimensions of product complexity, product diversity, product customisation, the frequency of introducing new products and the frequency of making changes to products and manufacturing processes are the most indicative PC dimensions. The six remaining possible PC dimensions identified in Section 4.4.3.3 were considered by the participants to be either irrelevant or strongly related to the five most indicative PC dimensions.

In addition to the five most indicative PC dimensions that were identified as best representing the construct, the results of the semi-structured interviews uncovered one additional PC dimension that was not derived initially from prior literature, bringing the total number of the most indicative PC dimensions to six. This PC dimension is the production period of products, and was pointed out by the production manager of business-unit 5. A further literature review revealed that this PC dimension was used by the case study conducted by Duh et al. (2009) to study ABC adoption and implementation in a Taiwanese textile company. Having briefly discussed the results of the exploratory stage, the next section will provide the implications of these results.

6.3.1.3 Implications of the results of the exploratory stage

The results of the exploratory stage reported in the previous section have five main implications. First, the contingency factors included in the research model are relevant and positively influence CSC and, hence, the optimal level of CSC. Second, TMKA is an additional contingency factor that is indirectly related to CSC and, therefore, the optimal level of CSC through TMS. Third, the optimality of CSD can be represented by the USEFULNESS and USAGE outcome measures. Fourth, the CSC construct includes six dimensions. Fifth, the PC construct is best represented by six PC dimensions.

The second implication necessitates: (1) making a minor amendment to the research model by adding the TMKA contingency factor; (2) developing an additional matching sub-form of fit hypothesis related to TMKA and labelling this new hypothesis “Hypothesis 7”; and (3) changing the content and order of the system form of fit hypothesis to include the additional contingency factor - i.e., TMKA - and labelling it “Hypothesis 8” rather than “Hypothesis 7”. The fifth implication requires a more detailed discussion of how each of the six identified PC dimensions relates to PC and the optimal level of CSC and, then, a restatement of the matching sub-form of fit hypothesis relating to PC, i.e., Hypothesis 4. Section 6.3.1.3.1 presents the required changes for the second implication, while those of the fifth implication are provided in Section 6.3.1.3.2.

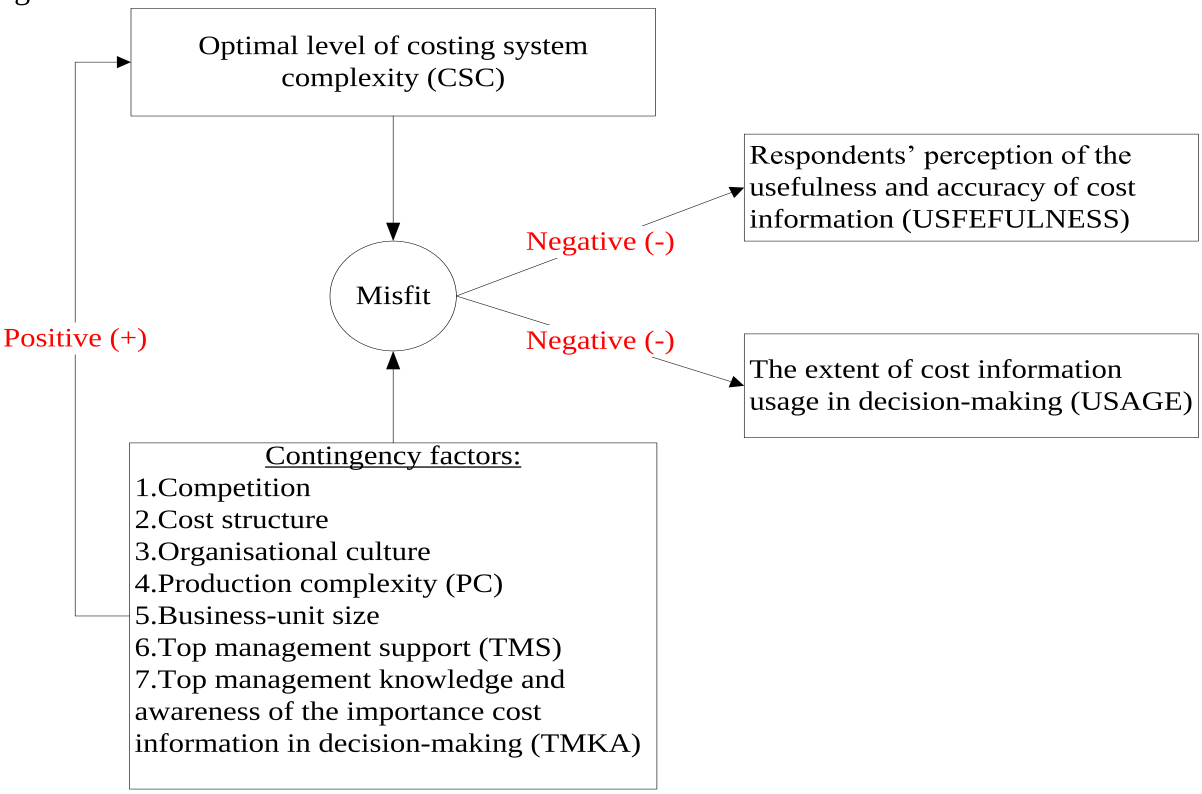
6.3.1.3.1 Second implication’s changes

As noted in the previous section, the second implication of the results of the exploratory stage indicated that TMKA is an additional contingency factor that is indirectly related to CSC and, thus, the optimal level of CSC through TMS. This, in turn, makes three changes necessary; namely, a minor modification to the research model (Section 6.3.1.3.1.1), developing an additional matching sub-form of fit hypothesis (Section 6.3.1.3.1.2) and altering the content and order of the system form of fit hypothesis (Section 6.3.1.3.1.3).

6.3.1.3.1.1 Making a minor modification to the research model

The second implication of the exploratory stage's results leads to a slight modification to the research model by adding the TMKA contingency factor. Figure 6-1 shows the modified version of the research model that was initially proposed in Figure 5-1 in Section 5.3.

Figure 6-1: The modified research model



6.3.1.3.1.2 Developing an additional matching sub-form of fit hypothesis

The second implication of the exploratory stage's results requires the development of an additional matching sub-form of fit hypothesis regarding the influence of TMKA, and labelling this new hypothesis "Hypothesis 7", as an additional hypothesis to the six matching sub-form of fit hypotheses provided in Section 5.4.1.

As indicated in Section 5.4.1.6, the CSD literature found evidence for the positive impact of TMS on optimal CSD and ABC success. The top management has the required authority to perform crucial roles, such as strategic planning, goal-setting, approving new techniques and processes - e.g., strategic initiatives - and providing the resources needed to implement any plan or change, including those related to management accounting (Al-Khadash and Feridun, 2006; Wu and Boateng, 2010). Making any organisational change, e.g., implementing innovations or new rules, is often associated with a high degree of top management involvement until the intended change has been successfully implemented (Wu and Boateng, 2010). However, it should be noted that TMS depends greatly on the top management's knowledge and awareness of the benefits of any change undertaken within the business-unit. Shields (1995) pointed out that TMS would not be obtained unless the top management feels that the administrative innovation, such as ABC, is valuable, and, when this occurs, they will direct their resources, goals and strategies to support the adoption and implementation of these innovations. Al-Khadash and Feridun (2006) argued that, although TMS is crucial in order to implement any initiatives, including ABC, it is the level of the top management's knowledge and awareness of the importance and benefits of these initiatives that drives its support. In the Saudi context, El-Ebaishi et al. (2003) noted that among the most crucial factors that determine the use of management accounting techniques is the management's attitude towards these, which needs to be enhanced by educating managers about the importance and benefits of using these techniques in order for them to be employed and utilised. Zhang et al. (2015) highlighted that ABC success depends greatly on TMS, which can be fostered by increasing the top management's knowledge of the benefits of this technique.

Although the results of the exploratory stage (Section 6.3.1.2.1) and the preceding discussion suggest an indirect relationship between, on the one hand, TMKA and, on another hand, CSC and ABC adoption and success, where TMS acts as a mediator variable, contingency studies have tested the direct impact of TMKA on optimal CSD operationalised from the perspective of ABC adoption (Al-Khadash and Feridun, 2006; Al-Khadash and Mahmoud, 2010). Both contingency studies argued that, when the management awareness of the importance of using ABC is high, the level of utilising the system is higher compared to situations when the level of management awareness is low. However, only Al-Khadash and Mahmoud (2010) found support for this argument. The inconsistency of the results of these two studies may be attributed to the way in which ABC adoption was measured. While Al-Khadash and Feridun (2006) operationalised ABC adoption as a continuous variable, Al-Khadash and Mahmoud (2010) measured ABC adoption using a dichotomous variable. To the author's knowledge, no contingency study has examined the effect of TMKA on optimal CSD operationalised from the perspective of the level of CSC.

Given the importance of TMKA as a facilitator factor, the lack of research, the support of the direct influence of TMKA on ABC adoption and the fact that the matching sub-form of fit examines the impact of the contingency factor on optimal CSD without involving mediator variables, the mediator role of TMS will not be accounted for when examining the influence of TMKA on the optimal level of CSC. Nonetheless, both the direct and indirect effects of TMKA will be considered when testing the system form of fit's hypothesis (see Sections 9.3 and 9.4). Prior theory, as discussed above, and the findings of contingency studies on ABC adoption suggest that TMKA is positively related to CSC. This positive relationship reflects the fit between TMKA and the level of CSC that generates the highest outcomes, suggesting a positive relationship between TMKA and the optimal level of CSC. Any misfit between these two factors is expected to have a negative influence on the outcomes.

To illustrate, it is more likely that the extent of TMKA will be positively associated with conditions that increase the costs of errors, e.g., the level of indirect costs, because the ability to survive the costs of errors increases as the extent of the TMKA required to deal with these increases. Although more complex than required costing systems provide more accurate product costs that can assist in making informed product-related decisions, i.e., less costly regarding errors, these costing systems, in terms of measurement, are more costly (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the measurements associated with these systems will probably outweigh their benefits in terms of reducing the costs of errors, i.e., the benefit of these systems in relation to the provision of more accurate product costs that that can assist in making informed product-related decisions. Thus, it is doubtful that the more accurate product costs furnished by more complex than required costing systems will be perceived as useful and needed in decision-making at TMKA levels lower than those of more complex than required costing systems.

In contrast, despite being less costly in terms of measurement, less complex than required costing systems provide distorted product costs that can lead to make inferior product-related decisions, i.e., more costly with respect to errors (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the errors related to these systems will probably outweigh their benefits in terms of reducing the costs of measurements. Hence, it is unlikely that the distorted product costs furnished by less complex than required costing systems will be considered useful or used in decision-making at TMKA levels higher than those of less complex than required costing systems. Therefore, the following hypothesis will be tested:

Hypothesis 7: ***From the perspective of the matching sub-form of fit, TMKA is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between TMKA and the optimal level of CSC and a negative impact of the misfit between TMKA and the optimal level of CSC on the two outcomes.***

6.3.1.3.1.3 Altering the content and order of the system form of fit's hypothesis

Given that the second implication of the exploratory stage's results entailed adding the contingency factor of TMKA, this also necessitates changing the content of the system form of fit hypothesis to incorporate this additional contingency factor. In addition, it requires the re-labelling of the original Hypothesis 7 as Hypothesis 8 (see Section 5.4.2) because the matching sub-form of fit hypothesis relating to TMKA becomes Hypothesis 7 (see Section 6.3.1.3.1.2). Thus, the modified system form of fit's hypothesis is:

Hypothesis 8: ***The degree of misfit between the contingency factors of (1) competition, (2) cost structure, (3) organisational culture, (4) PC, (5) business-unit size, (6) TMS and (7) TMKA, taken together, and the optimal level of CSC is expected to be negatively related to two outcomes; namely, USEFULNESS and USAGE.***

6.3.1.3.2 Fifth implication's changes

It was mentioned in Section 5.4.1.4 that the matching sub-form of fit's hypothesis of PC will be restated after determining the most indicative PC dimensions and, subsequently, discussing how each PC dimension influences PC and the optimal level of CSC. Effectively, this represents the exploratory stage's results pertaining to PC, the implication of these - i.e., fifth implication - and the associated changes caused by the implication of these results. The exploratory stage's results pertaining to PC identified that the six PC dimensions of product complexity, product diversity, product customisation, the frequency of introducing new products, the frequency of making changes to products and manufacturing processes and production period are the most indicative PC dimensions (see Section 6.3.1.2.4). The implication of these results is that the PC construct is best measured by these six PC dimensions (see the fifth implication in Section 6.3.1.3). The discussion of how each of the six PC dimensions affects PC and the optimal level of CSC, followed by the restatement of

Hypothesis 4, are provided in this section, representing the changes necessitated by the fifth implication.

The first PC dimension is product complexity (e.g., Banker et al., 1990; Foster and Gupta, 1990; Swenson, 1998). It has been argued that PC increases as the complexity of products increases (Swenson, 1998), and that rises in product complexity increase the probability of product cost distortions if less complex than required costing systems are used (Brown et al., 2004). Product complexity can be increased by many factors, such as the high number of unique componenets, parts and proccesses needed by products (Foster and Gupta, 1990; Swenson, 1998). High levels of product complexity increase the need for more complex costing systems that can more accurately assign overhead costs to products (e.g., Cooper and Kaplan, 1991; Nguyen and Brooks, 1997; Krumwiede, 1998a; Brown et al., 2004; Jusoh and Miryazdi, 2016), and this is attributed to many possible reasons. First, producing complex products may require the existence of special supervisors and quality control staff during the manufacturing process, which calls for determining the amount of resources consumed each time the manufacturing process of these complex products is performed (Cooper and Kaplan, 1991). Second, producing highly complex products needs performing more activities, which requires efforts to be made by a larger number of support departments (Cooper and Kaplan, 1988b; Estrin et al., 1994; Nguyen and Brooks, 1997; Malmi, 1999). Third, complex products can increase the percentage of overhead costs (Nguyen and Brooks, 1997; Krumwiede, 1998a; Jusoh and Miryazdi, 2016), especially batch- and product-level ones (Swenson, 1998).

The influence of product complexity has been examined by only two contingency studies on optimal CSD operationalised from the perspective of ABC adoption (Nguyen and Brooks, 1997; Chongruksut, 2009). While Nguyen and Brooks (1997) found a positive association between product complexity and ABC adoption, Chongruksut (2009) did not. To the author's knowledge, no contingency study has examined the impact of the product complexity dimension on optimal CSD operationalised from the perspective of the level of CSC.

The second PC dimension is product diversity (e.g., Hayes and Clark, 1985; Cooper, 1988a; 1988b; Estrin et al., 1994; Kaplan and Cooper, 1998; Krumwiede, 1998a; Swenson, 1998; Malmi, 1999; Abernethy et al., 2001; Drury and Tayles, 2005; Schoute, 2011), which encompasses many sub-dimensions, such as volume, size, support and process diversity, as well as the number of products and production lines (see, for example, Cooper, 1988a and Drury and Tayles, 2005). Expanding the range of products adds complexity to the production environment, since large, more sophisticated support departments will be needed (Cooper and Kaplan, 1988a). Thus, product diversity is considered to be the main driver for PC (Malmi, 1999) and the major reason behind product cost distortions if less complex than required costing systems are used (e.g., Cooper, 1988a; 1988b; Cooper and Kaplan, 1991; Estrin et al., 1994; Bjørnenak, 1997; Abernethy et al., 2001; Brown et al., 2004; Nassar et al., 2009). It has been argued that high levels of product diversity necessitate the use of more complex costing systems in order to capture more accureatly the differences in the resource consumption by the various products (e.g., Cooper, 1988a; 1988b; Kaplan and Cooper, 1998; Abernethy et al., 2001; Brown et al., 2004; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; 2013; Nassar et al., 2009; Schoute, 2011; Jusoh and Miryazdi, 2016). Simple costing systems that use a small number of cost pools and cost drivers, however, are highly unlikely to be able to capture the various degrees of resource consumption by the various products (Drury and Tayles, 2005). This is attributed to the fact that, when product diversity is high, products consume the business-unit's activity resources at levels that are not commensurate with their production volume (Cooper, 1988a; 1989a; Abernethy et al., 2001; Al-Omiri and Drury, 2007; Schoute, 2011). In addition, when the level of product diversity is low, the process of assigning overhead costs to products is easier and can be achieved using less complex costing systems (Chen et al., 2001; Al-Mulhem, 2002; Jusoh and Miryazdi, 2016). Furthermore, product diversity causes an increase in the percentage of non-volume-based overhead costs (Cooper, 1988a; 1988b; Nguyen and Brooks, 1997; Krumwiede, 1998a), especially those related to the batch and product levels (Swenson, 1998; Abernethy et al., 2001).

The influence of different sub-dimensions of product diversity - e.g., support, volume, process, size, number of products/production lines - has been examined by contingency studies on optimal CSD. By operationalising CSD from the perspective of ABC adoption, some contingency studies have found a positive effect of product diversity on ABC adoption (e.g., Krumwiede, 1998a; Malmi, 1999; Al-Mulhem, 2002; Chongruksut and Brooks, 2005; Khalid, 2005; Al-Omiri and Drury, 2013; Jusoh and Miryazdi, 2016), whereas others have not (e.g., Bjørnenak, 1997; Nguyen and Brooks, 1997; Clarke et al., 1999; Chen et al., 2001; Brown et al., 2004; Al-Omiri and Drury, 2007; Chongruksut, 2009; Nassar et al., 2009; Ahamadzadeh et al., 2011; Rbaba'h, 2013). In addition, Schoute (2011) found that the overall influence of product diversity on ABC adoption is curvilinear and negatively moderated by AMT.[61] Operationalising CSD from the perspective of the level of CSC, Drury and Tayles (2005) found a positive impact of product diversity on all of the CSC measures used (see Section 4.3.2), whereas others did not (Al-Omiri and Drury, 2007; 2013; Ismail and Mahmoud, 2012).

The third PC dimension is product customisation (e.g., Kaplan, 1984a; 1984b; Cooper and Kaplan, 1991; Kaplan and Cooper, 1998; Drury and Tayles, 2005; Brierley, 2011). Product customisation exists when different products are produced within the product family, which

[61] Schoute (2011) used two measures for ABC adoption. One is related to the initial adoption of the system, whereas the other to the usage of the system. The curvilinear relationship was found with both ABC measures, whereas the moderation influence of AMT was found with the usage measure.

is more likely to occur in various volumes (Brierley, 2011). Product customisation adds complexity to the manufacturing environment, given that the manufacturing processes for customised products vary (Drury and Tayles, 2005). In addition, customised products typically require large number of manufacturing processes to produce them (Brierley, 2011). It has been argued that high levels of product customisation impose a great need for more complex costing systems that can more accurately calculate the costs of customised products (e.g., Cooper and Kaplan, 1991; Bjørnenak, 1997; Kaplan and Cooper, 1998; Chen et al., 2001; Drury and Tayles, 2005; Brierley, 2007; 2008b; 2011). This is attributed to the fact that customised or low volume products use a disproportionate amount of resources (Brierley, 2011), and the difficulty in setting standard costs for these products (Drury and Tayles, 2005). In addition, producing customised products requires the performance of a larger number of manufacturing activities, and results in higher levels of non-volume-based overhead costs (Brierley, 2011); however, Bjørnenak (1997) and Drury and Tayles (2005) noted that, when the level of product customisation is too high, then the costs of implementing and operating extremely complex costing systems may also be too high. In this situation, therefore, companies might find it, based on the cost-benefit consideration, more appropriate to work with less complex costing systems.

The influence of product customisation has been examined by contingency studies on optimal CSD. Operationalising CSD from the perspective of ABC adoption, some contingency studies have not found any association between product customisation and ABC adoption (e.g., Malmi, 1999; Chen et al., 2001; Brierley, 2008b; 2011), whereas others have found a negative relationship between the two (Bjørnenak, 1997; Schoute, 2011).[62] Operationalising CSD from the perspective of the level of CSC, Brierley (2007) did not find any association between product customisation and the number of cost pools and cost drivers. Similarly,

[62] Schoute (2011) found the negative association with the usage measure of ABC adoption.

Drury and Tayles (2005) did not find any relationship between product customisation and the number of cost pools, but Drury and Tayles (2005) found a negative association between product customisation and the number of cost drivers and their composite CSC measure.

The fourth and fifth PC dimensions are related to the frequency of introducing new products and the frequency of making changes to products and manufacturing processes, respectively (e.g., Miller and Vollmann, 1985; Cooper, 1988b; Cooper and Kaplan, 1991; Banker, Potter and Schroeder, 1995; Nguyen and Brooks, 1997; Cagwin and Bouwman, 2002). Both of these dimensions have been considered to be associated with PC (Nguyen and Brooks, 1997; Cagwin and Bouwman, 2002; Ittner et al., 2002) and among the main reasons causing product cost distortion if less complex than required costing systems are used (Cooper, 1988b). This is due to the fact that introducing new products or making changes to existing products and manufacturing processes can cause confusion in the factory (Hayes and Clark, 1985). When new products are introduced or changes made to existing products and manufacturing processes at a high frequency, more complex costing systems are needed (Cooper, 1988b; Nguyen and Brooks, 1997; Ittner et al., 2002). In particular, frequently introducing new products or making changes to existing products and manufacturing processes may cause the pattern of resource consumption to vary significantly between products, which, in turn, requires a CSD that can capture the frequent changes in the economics of production (Cooper, 1988b). Also, change transactions are associated with increased overhead costs, particularly the product-level overhead costs related to processing more engineering change orders (Miller and Vollmann, 1985; Cooper and Kaplan, 1991).

The influence of the fourth and fifth PC dimensions has not been widely examined by contingency studies on optimal CSD.[63] Operationalising CSD from the perspective of ABC

[63] The fourth dimension was used by Ittner et al. (2002) when testing the impact of plant operational characteristics related to PC on the adoption of ABC adoption as an optimal CSD, whereas the fifth dimension

adoption, Chongruksut and Brooks (2005) failed to find an effect of the frequency of introducing new products on ABC adoption. Similarly, Nguyen and Brooks (1997) failed to find an influence of the frequency of both introducing new products and changes in products and manufacturing processes on ABC adoption. To the author's knowledge, no contingency study has examined the impact of the fourth and fifth PC dimensions on optimal CSD operationalised from the perspective of the level of CSC.

The sixth PC dimension is related to the production period of products. PC can be indicated by the actual production time needed to produce products because, when the degree of complexity is high, the processing time is long (Duh et al., 2009). In addition, products that take a long time to produce may need to pass through many production stages or require additional support from support departments, all of which contribute towards increasing the complexity of the production environment (Cooper and Kaplan, 1988a; Abernethy et al., 2001). Accordingly, when the production time is long, more complex costing systems that use many cost pools with each is established for each production stage and more different types of cost drivers are needed to assign the costs of the manufacturing and support resources to products. To the author's knowledge, no contingency study on optimal CSD has examined the effect of production period on optimal CSD.

Besides the findings of the selection studies on optimal CSD pointed out above, interaction studies have provided insights regarding the influence of PC in this area. Operationalising CSD from the perspective of ABC adoption, Cagwin and Bouwman (2002) used one construct that captured two PC dimensions, namely, product diversity and the frequency of making changes to products and manufacturing processes, and found that PC has an impact on the adoption of ABC as an optimal CSD from the standpoint of the moderation sub-form

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was utilised by Cagwin and Bouwman (2002) as one dimension of their multi-dimensional PC construct. The results of these and other interaction studies on optimal CSD in relation to PC will be discussed later in this section.

of fit. More specifically, PC was found to moderate the association between ABC and improvement in financial performance, in that the positive association between these two constructs is stronger at higher compared to lower levels of PC. Ittner et al. (2002) utilised separate constructs for different PC dimensions and advanced manufacturing practices, which they called plant operational characteristics, and found that these plant operational characteristics related to PC have a weak positive effect on the adoption of ABC as an optimal CSD from the viewpoint of the matching sub-form of fit. In particular, the study found that plant operational characteristics related to PC and the adoption of ABC as an optimal CSD are positively associated, and that the misfit between the two has only a weak negative influence on financial performance. Operationalising CSD from the perspective of the level of CSC, Abernethy et al. (2001) used two PC dimensions, namely, product diversity and product customisation, to evaluate the level of PC at the five sites included in their study, and found that PC has a positive effect on the optimal level of CSC from the standpoint of the matching sub-form of fit. More specifically, the study found that PC has a positive association with the optimal level of CSC, and that the misfit between the two has a negative influence on manager satisfaction with the costing system.

Overall, there were some inconsistent findings in relation to the impact of PC on optimal CSD. These inconsistent findings are problematic, given that the CSD literature has emphasised the positive association between PC and CSC, and that the findings of many case studies on ABC adoption have also suggested that an increased level of PC is among the reasons why companies consider adopting ABC (e.g., Gietzmann, 1991; Bhimani and Pigott, 1992; Innes and Mitchell, 1991; Merz and Hardy, 1993; Innes and Mevellec, 1994; Bruggeman et al., 1996; Brewer, 1998; Gunasekaran and Sarhadi, 1998; Duh et al., 2009). The main possible reason behind this contradiction is that PC was measured differently across studies. When studies used the same PC dimension, e.g., product diversity, the possible reason for the conflicting results is that the PC dimension itself was operationalised differently across studies. For example, studies have differed in relation to the sub-dimensions utilised to measure product diversity, e.g., volume, process and support. Other possible reasons for the inconsistent results include the lack of consistency in relation to both the employed statistical analysis techniques and the selected sample.

Given the inconsistent results, further research on the effect of PC on the optimal level of CSC, using a sufficiently comprehensive multi-dimensional PC measure, is needed. Although the empirical results are contradictory, prior theory, as explained above, suggests that PC is positively associated with the level of CSC. This positive association reflects the fit between the two constructs that generates the highest outcomes, suggesting a positive association between PC and the optimal level of CSC. Any misfit between these two factors is anticipated to have a negative influence on the outcomes.

To demonstrate, even though more complex than required costing systems furnish more accurate product costs that can assist in making informed product-related decisions, i.e., less costly regarding errors, these costing systems, in terms of measurement, are more costly (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the measurements associated with these systems will probably outweigh their benefits in terms of reducing the costs of errors, i.e., the benefit of these systems in relation to the provision of more accurate product costs that that can assist in making informed product-related decision. Therefore, it is improbable that the more accurate product costs provided by more complex than required costing systems will be perceived as useful and needed in decision-making at PC levels lower than those of more complex than required costing systems.

On the other hand, in spite of being less costly in terms of measurement, less complex than required costing systems furnish inaccurate product costs that can cause making inferior product-related decisions, i.e., more costly with respect to errors (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). The costs of the errors related to these systems will probably outweigh their benefits in terms of reducing the costs of measurements. Accordingly, it is implausible that the inaccurate product costs provided by less complex than required costing systems will be considered useful or used in decision-making at PC levels higher than those of less complex than required costing systems. Thus, the following hypothesis will be tested:

Hypothesis 4: ***From the perspective of the matching sub-form of fit, PC is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between PC and the optimal level of CSC and a negative impact of the misfit between PC and the optimal level of CSC on the two outcomes.***

Having detailed the exploratory stage, the next section will shed light on different facets of the model-testing stage of the adopted survey strategy.

6.3.2 Model-testing stage

In this research, conducting a model-testing stage that involves: (1) collecting quantitative data drawn from a large number of cases required to perform the required statistical analysis to the research model, i.e., research hypotheses; and (2) analysing these data using proper statistical analysis techniques, lays at the core of the survey strategy adopted to achieve the research aim (see Sections 1.5 and 6.1). This is because performing a model-testing stage contributes towards realising the second and third main contributions of this research concerning, respectively, the statistical analysis techniques exploited to test for the matching sub-form of fit and the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5) and, therefore, achieving the research aim. This section provides information about different aspects of the model-testing stage of the utilised survey strategy, including the data collection method (Section 6.3.2.1), the assessment of non-response bias (Section 6.3.2.2) and the applied statistical analysis techniques (Section 6.3.2.3).

6.3.2.1 Data collection method

The questionnaire was the data collection method used for the model-testing stage. The questionnaire is "a list of carefully structured questions, which have been chosen after considerable testing with a view to eliciting reliable responses from a particular group of people" (Collis and Hussey, 2014, p, 205). In business and management research, the questionnaire method has been intensively used within the survey strategy (Saunders et al., 2009). The questionnaire method was used in the model-testing stage because it facilitates the collection of the required data for the model-testing stage of the utilised survey strategy (Section 6.3.2). More specifically, the questionnaire allows researchers to collect responses from large samples, and it is a time-saving and inexpensive method when collecting responses from such samples (Zikmund, 2000; Blumberg et al., 2008; Saunders et al., 2009; Bryman and Bell, 2011; Collis and Hussey, 2014).

There are different types of questionnaire, and the choice between them depends on many factors, such as the importance of reaching a particular respondent, sample size, response rate, the number and types of questions and the resources available (Saunders et al., 2009). Mail or paper, online or web, e-mail and delivery-and-collection are different types of self-administrated questionnaires, whereas phone and structured interviews are interviewer-administrated questionnaires (Zikmund, 2000; Saunders et al., 2009). In addition, researchers can use what is known as a mixed-mode questionnaire (de Leeuw, 2005; Dillman et al., 2014), which involves using either: (1) a single mode for contacting respondents - e.g., e-mail - and offering a single questionnaire mode that differs from the contact mode, e.g., paper; (2) a single contact mode - e.g., e-mail - and offering multiple questionnaire modes, e.g., online and paper; (3) multiple contact modes - e.g., e-mail and postal letter - and offering a single questionnaire mode, e.g., online; or (4) multiple contact modes - e.g., e-mail and postal letter - and offering multiple questionnaire modes, e.g., online and paper (de Leeuw, 2005; Dillman et al., 2014).

In the model-testing stage, the mixed-mode questionnaire using one contact mode - e-mail - and offering multiple questionnaire modes - online and paper - was utilised due its benefits (de Leeuw, 2005; Dillman et al., 2014). First, it assists in reducing the total costs of the questionnaire through collecting the highest possible number of responses using the cheaper online questionnaire mode first before shifting to the more expensive paper questionnaire mode. Second, it has a dramatic impact on increasing the speed at which responses are obtained through utilising the quicker online questionnaire mode first before switching to the slower paper questionnaire one. Third, it has a significant effect on improving the response rate by offering respondents multiple ways, i.e., questionnaire modes, to respond and, hence, reducing the likelihood of non-response bias that occurs when respondents fail to represent the population.

To exploit the benefits fully and reduce the limitations, e.g., non-response, of the utilised data collection method in the model-testing stage, i.e., questionnaire, it was designed, constructed, pre-tested and administrated according to “The Tailored Design Method” (Dillman et al., 2014). The next sections illustrate different aspects of the questionnaire, including design (Section 6.3.2.1.1), content and usage to measure constructs (Section 6.3.2.1.2), pre-testing and translation-checking (Section 6.3.2.1.3) and administration (Section 6.3.2.1.4).

6.3.2.1.1 Questionnaire design

As mentioned in the previous section, the mixed-mode questionnaire involved using one mode of contact, namely, e-mail, and offering two modes of questionnaire; namely, an online mode and a paper one. Appendices 6-3, 6-4 and 6-5 contain, respectively, the English cover letter, the final English paper questionnaire and extracts from the final English online questionnaire. Both the online and paper modes of the questionnaire were designed according to "The Tailored Design Method" (Dillman et al., 2014). Most of Dillman et al's. (2014) design-related guidelines were followed. Examples of the design-related guidelines that were followed are presented in Table 6-3 (for a full list, see Appendix 6-6).

Table 6-3: Examples of the design-related guidelines followed in preparing the questionnaire

General guidelines related to the visual presentation of the questions and the questionnaire pages and screens: 1. Using darker and larger print for the questions stems and lighter and smaller print for the answer choices and spaces. 2. Locating the instructions in the places where they will be used. 3. Avoiding presenting questions side by side on one page. 4. Minimising the complexity of grids and matrices by, for example, horizontally highlighting every other row in the grid or matrix and hiding the gridlines.
Specific guidelines for designing the online questionnaire: 1. Creating interesting and informative welcome and closing screens that display certain information. 2. Allowing respondents to save their responses to the questionnaire and complete it later.
Specific guidelines for designing the paper questionnaire: 1. Constructing the questionnaire in a booklet format. 2. Creating interesting and informative front and back cover pages.
Specific design-related guidelines for applying the mixed-mode questionnaire: 1. Using the same question, answer format and wording across questionnaire modes. 2. Using similar visual formats across the modes.

6.3.2.1.2 Questionnaire content and measurement of constructs

Each question should be formed with great care to ensure the validity of the responses obtained (Saunders et al., 2009). Similarly, ordering the questions effectively encourages the respondents to complete the questionnaire and reduces any undesired effects, such as measurement errors caused by the influence of early questions on the answers to later questions (Dillman et al., 2014).[64] Considerable care was taken regarding the formatting and ordering of the questionnaire's questions. In particular, the questions were formed and ordered based on Dillman et al's. (2014) question forming/ordering guidelines. Examples of the guidelines that were followed when forming and ordering the questions are presented in Table 6-4 (for a full list, see Appendix 6-7).

Table 6-4: Examples of the forming/ordering question-related guidelines followed in preparing the questionnaire

Guidelines related to question formation: 1. Using complete sentences to ask the questions. 2. Specifying in the question stem the type of response desired. 3. Stating both the positive and negative sides in the question stem, e.g., agree/disagree, when using bipolar ordinal scales, i.e., those that measure graduation along two opposite dimensions, such as agree/disagree. Adding "if at all" to the question stem when using unipolar ordinal scales, i.e., those that measure graduation along one dimension where the zero point represents one end of the scale, e.g., very successful to not at all successful.
Guidelines related to ordering the questions 1. Grouping related questions together in one section. 2. Placing sensitive and objectionable questions near the end of the questionnaire.

The online version of the questionnaire contained 13 screens, including the welcome and closing screens, whereas the paper version contained 12 pages, including the front and back cover pages. The questionnaire included questions that were adopted or adapted from prior literature and also some that were developed by the researcher. There were 27 questions in total, which encompassed six short open-ended, 19 closed-ended and two partially closed-ended questions. Open-ended questions allow respondents to answer the question in their own way, whereas closed-ended questions provide a number of answer choices from which

[64] Measurement error can be defined as "the difference between the true value of a variable and the value obtained by a measurement" (Hair, Hult, Ringle and Sarstedt, 2017, P. 107).

respondents need to make a selection (Saunders et al., 2009; Dillman et al., 2014). Partially closed-ended questions are a mixture of open- and close-ended questions that include a set of answer choices and an “other” answer choice (Dillman et al., 2014). The latter allows respondents who cannot find a suitable answer choice among the set of answer choices offered to provide an appropriate answer to the question. Besides the 27 questions, the questionnaire included a space for respondents to write comments about the questionnaire or their costing system. In addition, it contained questions related to the respondents' willingness to participate in a follow-up interview, desire to receive a summary of the research results, willingness to receive follow-up questions about the answers provided on the questionnaire and contact information (Appendix 6-4 includes the final English paper questionnaire).

The questionnaire consisted of four sections. Section A included questions related to the usefulness of product cost information in decision-making. Section B encompassed questions related to business-unit costing system, TMS and TMKA.[65] Section C contained questions related to business-unit external and production environment. Section D comprised questions related to the business-unit and its culture. Section 6.3.2.1.2.1 discusses the questions relating to and the measurement of the constructs included in the research model, while Section 6.3.2.1.2.2 provides information about the other questions included on the questionnaire.

6.3.2.1.2.1 Questions relating to and measurement of constructs included in the research model

Competition (COMP): The objective of question 12 (Q12) was to collect information about the level of competition. This question was adapted from Khandwalla (1972), Drury and

[65] Section B also included one question, question 11 (Q11), about the importance of cost information in decision-making. This question is related to the usefulness of product cost information in decision-making, and, thus, should have been included in section A. However, the researcher was advised by an academic to move Q11 to another section to prevent any confusion among respondents due to the inclusion of Q11 and question 1 (Q1), which is about the extent of cost information usage in decision-making, within the same section.

Tayles (2000) and Brierley (2007). The three items of Q12 were measured on a five-point Likert-scale (endpoints 1 = very weak to 5 = very intense).

Cost structure: Question 21 (Q21) aimed to obtain information about cost structure. Respondents were asked to state the percentage of three types of cost; namely, direct manufacturing, indirect manufacturing and non-manufacturing costs. Cost structure was measured as the percentage of indirect manufacturing costs to total manufacturing costs (CostStructure-MANUFACTURING) and as the percentage of the sum of indirect manufacturing costs and non-manufacturing costs to total costs (CostStructure-COMBINED).

Organisational culture: The objective of question 19 (Q19) and question 20 (Q20) was to acquire information about different dimensions of the organisational culture, i.e., business-unit culture. In particular, Q19 sought to gather information about the outcome orientation (CultureOutcome) and attention to detail (CultureDetail) cultural dimensions, whereas Q20 aimed to collect information about the tight versus loose control (CultureControl) cultural dimension. Q19 was adopted from Baird et al. (2004; 2007),[66] whereas Q20 was adopted from Baird et al. (2004). The eight items of Q19 and Q20 were measured on a five-point Likert-scale (endpoints 1 = not at all to 5 = to a very great extent).

Production complexity (PC): Question 14 (Q14) and question 15 (Q15) sought to obtain information about the level of PC using the six PC dimensions identified in the exploratory stage as being the most indicative ones (see Section 6.3.1.2.4). In particular, Q14 aimed to acquire information about one PC dimension, namely, product customisation, whereas Q15 sought to gather information about the remaining five PC dimensions. Q14 was adapted from Brierley (2007; 2011), whereas Q15 was developed by the researcher based on prior literature, with some of the items being adapted from prior literature (Krumwiede, 1998a;

[66] The first five items of Q19 related to the outcome orientation dimension were adopted from Baird et al. (2004; 2007), whereas the last three items of Q19 related to the attention to detail dimension were adopted from Baird et al. (2007).

Cagwin and Bouwman, 2002).[67] The answer choices for Q14 ranged from 1 = "at least 95% of products are standardised" to 5 = "at least 95% of products are customised", whereas the 12 items of Q15 were measured on a five-point Likert-scale (endpoints 1 = not at all to 5 = to a very great extent). Q14 and Q15 were combined to measure PC.

Business-unit size: The objective of question 23 (Q23) and question 24 (Q24) was to collect information about business-unit size in terms of the amount of sales revenue (SizeRevenue) and the number of employees (SizeEmployees). The answer choices for Q23 ranged from 1 = "less than 10 million riyals" to 9 = "more than 500 million riyals". Regarding Q24, respondents were asked to state the number of employees in their business-unit.

Top management support (TMS): Question 8 (Q8) aimed to obtain information about the level of top management support for the costing system. The question was adapted from Grover (1993), Premkumar and Potter (1995) and Krumwiede (1998a). The three items of Q8 were measured on a five-point Likert-scale (endpoints 1 = strongly disagree to 5 = strongly agree).

Top management knowledge and awareness of the importance of cost information in decision-making (TMKA): The objective of question 9 (Q9) was to acquire information about the level of knowledge and awareness among the top management regarding the importance of cost information in decision-making. The question was developed by the researcher. The three items of Q9 were measured on a five-point Likert-scale (endpoints 1 = strongly disagree to 5 = strongly agree).

Costing system complexity (CSC): Question 5 (Q5), question 6 (Q6) and question 7 (Q7) sought to gather information about the level of CSC, with the objective of constructing four CSC measures. In particular, Q5 aimed to collect information about the first CSC measure

[67] Items e, h and l were adapted from Krumwiede (1998a), whereas item k was adapted from Cagwin and Bouwman (2002).

related to the number of cost pools (CSC-CostPools), whereas Q6 sought to obtain information about the second CSC measure concerning the number of cost drivers (CSC-CostDrivers). Both questions were adapted from prior contingency studies on CSC (Drury and Tayles, 2000; 2005; Brierley, 2007). Respondents were asked to state the number of both cost pools (Q5) and cost drivers (Q6). In addition to CSC-CostPools and CSC-CostDrivers, the information obtained via Q5 and Q6 was used to construct a composite measure (CSC-COMPOSITE) of the number of cost pools and cost drivers, as a third CSC measure. CSC-COMPOSITE was developed using a similar approach to Drury and Tayles (2005). However, CSC-COMPOSITE, as used in this research, included 16 points, whereas Drury and Tayles' (2005) CSC composite measure contained 15 points. The one point difference between the two CSC composite measures represents direct costing users that were excluded from Drury and Tayles' (2005) CSC composite measure. Table 6-5 shows the number of cost pools and cost drivers and the corresponding composite score. Q7 aimed to acquire information about the six CSC dimensions to develop a fourth CSC measure (CSC-DEVELOPED) that is comprehensive and multi-dimensional. This question was developed by the researcher based on prior literature (see Sections 2.4 and 4.4.3.2.2) and confirmed by the results of the exploratory stage (see Section 6.3.1.2.3). The six items of Q7 were measured on a five-point Likert-scale (endpoints 1 = strongly disagree to 5 = strongly agree).

It should be noted that respondents who use direct costing or absorption (plant-wide), as indicated when answering question 4 (Q4) relating to the method used for the assignment of overhead costs to products, were not required to answer Q5, Q6 and Q7.[68] This does not prevent the use of the total number of respondents when conducting statistical analysis involving Q5 (CSC-CostPools) and Q6 (CSC-CostDrivers) because, implicitly, the answers to both questions for respondents who use direct costing and absorption (plant-wide) are 0

[68] Q4 aimed to collect information about the method that business-units use to assign overhead costs to products. Further details about Q4 will be provided in Sections 6.3.2.1.2.2 and 7.4.1.3.

and 1, respectively. Similarly, the total number of respondents can be used when performing analysis relating to CSC-COMPOSITE because this CSC measure was constructed using the information provided in response to Q5 and Q6. However, the total number of respondents cannot be used when carrying out statistical analysis pertaining to Q7 (CSC-DEVELOPED) because this question does not apply to respondents who do not assign overhead costs to products, i.e., direct costing users, or who use a single cost pool and cost driver, i.e., absorption (plant-wide) users, to assign overhead costs to products. Thus, only respondents who use the other methods of overhead assignment, as indicated when answering Q4, were included in the statistical analysis involving CSC-DEVELOPED.

Table 6-5: Composite scores for the number of cost pools and drivers

Number of cost pools	**Composite score**	**Number of cost drivers**	**Composite score**
0	0	0	0
1	1	1	1
2-3	2	2	2
4-5	3	3	3
6-10	4	4	4
11-20	5	5	5
21-30	6	6	6
31-50	7	7-10	7
More than 50	8	More than 10	8

Respondents' perceptions of the usefulness and accuracy of cost information (USEFULNESS): The objective of question 2 (Q2) was to gather information about the respondents' perceptions of the usefulness and accuracy of cost information. Q2 was adapted from Drury and Tayles (2000), Pizzini (2006) and Brierley (2008a). The three items of Q2 were measured using a five-point Likert-scale (endpoints 1 = strongly disagree to 5 = strongly agree).

The extent of cost information usage in decision-making (USAGE): Question 1 (Q1) sought to collect information about the extent of cost information usage in decision-making, whereas question 11 (Q11) aimed to obtain information about the importance of cost information in decision-making. Q1 was adapted from Brierley, Cowton and Drury (2006) and Schoute (2009), whereas Q11 was adopted from Brierley et al. (2006). The nine items, i.e., decisions, of both Q1 and Q11 were measured on a five-point Likert-scale (endpoints for Q1 are 1 = not at all to 5 = to a very great extent, while the endpoints for Q11 are 1 = very unimportant to 5 = very important). In addition, a zero point of "Do not make this type of decision" that represents the irrelevance of the decision to the business-unit was included.

Following the approach used by many researchers to measure outcome constructs expressing the optimality of MCS, such as financial performance (e.g., Govindarajan, 1984; Govindarajan and Gupta, 1985; Abernethy and Guthrie, 1994; Chong and Chong, 1997; Chenhall and Langfield-Smith, 1998; Krumwiede and Charles, 2014), this research used Q1 and Q11 to measure USAGE. In the first step, a total importance score was calculated for each respondent by adding the importance scores of all decisions, i.e., Q11 items. In the second step, an importance weight of each decision was calculated by dividing the importance score of each decision, i.e., Q11 items, by the total importance score calculated in the first step. In the third step, the usage score of each decision, i.e., Q1 items, was multiplied by the importance weight of that decision obtained in the second step. In the fourth step, a total usage score for each respondent was calculated by summing the products of the usage score and importance weight calculated in the third step.

6.3.2.1.2.2 Other questions

The questionnaire included questions that aimed to obtain additional information about different aspects of the business-units. Three questions sought to acquire further information about the business-units' costing systems; namely, question 3 (Q3), Q4 and question 10 (Q10). These questions were included as a mean of confirming the answers of each other, and mainly, to verify the answers of questions related to CSC, i.e., Q5, Q6 and Q7.[69] Five questions aimed to gather further information about the business-unit production environment and characteristics - questions 13 (Q13), 22 (Q22), 25 (Q25), 26 (Q26)[70] - as well as the role/position of the respondent in the business-unit, question 27 (Q27).

In addition, the questionnaire contained questions that sought to collect information about other constructs that were not included in the research model to test other relationships, but, for word-length constraint reasons, these were not tested, but saved instead for future research, questions 16 (Q16), 17 (Q17) and 18 (Q18). Additional information about the "other questions" reported in this section is provided in Appendix 6-8.

6.3.2.1.3 Questionnaire pre-testing and translation-checking

Pre-testing the questionnaire is a vital step because it allows any problems to be uncovered and solved that, if not detected before the questionnaire is sent out to potential respondents, might have caused measurement errors and increased the percentage of non-response (De Vaus, 2002; Blair, Czaja and Blair, 2014; Dillman et al., 2014). Pre-testing entitles the questionnaire being reviewed by experts, conducting cognitive interviews and pilot-testing the questionnaire (Dillman et al., 2014).

Expert reviews are important for garnering suggestions about how to enhance the quality of the questionnaire with regard to its content and design (Saunders et al., 2009; Dillman et al., 2014). Cognitive interviews aim to evaluate whether respondents understand the questions

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[69] For example, selecting answer choice 1 "Currently using ABC" for Q10 should correspond to choosing answer choice 4 "Overhead costs are assigned to cost pools (i.e., activities rather than production departments or machines), and then overhead costs are allocated between products based on cost drivers. Some of these cost drivers are related to the production volume (e.g., number of labour hours), whereas others are not (e.g., the time to set up machines for production)" of Q4. Another example is that the multiple cost pools and cost drivers that are provided when answering Q5 and Q6, respectively, should correspond to selecting any answer choice for Q4 apart from answer choices 1 related to direct costing and 2 pertaining to absorption (plant-wide) costing.

[70] Although the type of production was not considered as one of the most indicative PC dimensions identified in Section 6.3.1.2.4, a question about the production type (Q13) was included on the questionnaire to obtain descriptive information about the characteristics of the business-units production environments. Q26 not only obtained information about the manufacturing sector of the business-units, but also made it possible to identify if the business-units operate in the oil and natural gas production and extraction sector. Section 6.2 includes a discussion related to the issue of acquiring responses from this sector.

correctly - i.e., as intended by the researcher - and whether questions can be answered accurately (Dillman et al., 2014). This is achieved by asking respondents to answer the questionnaire in the presence of the researcher, verbalising their thoughts as they do so (Blair et al., 2014; Dillman et al., 2014). Pilot-testing involves conducting a mini-study to test the questionnaire on a group from the targeted population to identify any problems with the questionnaire or the implementation procedure that can then be avoided when conducting the main study (Dillman et al., 2014).

In this research, pre-testing the questionnaire followed Dillman et al.'s (2014) guidelines (for a full list, see Appendix 6-9) and was conducted in three stages. Embedded within the pre-testing process was the translation-checking. The questionnaire was created first in English and then translated to Arabic. Translating the questionnaire into Arabic was crucial, given that Arabic is the official language of Saudi Arabia. The researcher undertook the translation, which was checked by academics who have obtained a PhD degree from countries, such as the UK, the USA and Australia. These academics, however, could not perform back-translation, i.e., from Arabic to English, due to the lack of available time to do so. Appendices 6-10, 6-11 and 6-12 include the Arabic cover letter, final Arabic paper questionnaire and extracts from the final Arabic online questionnaire, respectively. The following paragraphs illustrate the three stages of the pre-testing process and point out where the translation-checking took place.

The first pre-testing stage aimed to obtain expert reviews and conduct cognitive interviews. In particular, the first pre-testing stage tested an initial draft of the questionnaire,[71] and involved interviewing six academics, who are experts in the field,[72] and four IMA members

[71] Appendix 6-13 contains the initial draft of the English paper questionnaire.
[72] Four academics were interviewed face-to-face, and two were interviewed by phone.

in order to obtain their feedback and suggestions.[73] In addition, the first pre-testing stage included conducting cognitive interviews with three IMA members to evaluate whether they understood the questions of the initial draft of the questionnaire correctly.[74] Many useful suggestions regarding, for example, the clarity, type and location of the questions, the clarity and order of the answer choices, the clarity and location of the descriptive information included in the questionnaire and the layout of the questionnaire were obtained from the first pre-testing stage. Regarding the translation-checking, four of the six academics interviewed during the first pre-testing stage checked the Arabic translation of the initial draft of the questionnaire, and provided valuable feedback that enhanced the quality of the Arabic translation. As a result of the feedback and suggestions obtained from the expert reviews, cognitive interviews and translation-checking during the first pre-testing stage, two versions of the questionnaire were prepared and tested in the second stage of the pre-testing process. The two versions were similar regarding most of the questions and design, the only differences being the wording of some of the descriptive information and the inclusion of an additional question related to the descriptive information in the second version.[75]

The second pre-testing stage involved obtaining expert reviews. In particular, it sought to identify which of the two versions of the questionnaire was clearer and obtain any suggestions and feedback regarding improving it. The questionnaire was reviewed by two academics, who are experts in the field, and eight IMA members.[76] The researcher conducted phone interviews with the two academics and eight IMA members to discuss their opinions and suggestions. The results of the second stage of pre-testing revealed that the first version of the questionnaire was clearer, and it was suggested to change the location of part of the descriptive information in the first version. Thus, the first version of the questionnaire was

[73] The IMA Saudi Arabia-Eastern Province Chapter arranged the interviews with the four IMA members.
[74] The IMA Saudi Arabia-Eastern Province Chapter arranged these interviews.
[75] The two versions of the English paper questionnaire are shown in Appendix 6-14.
[76] The IMA Saudi Arabia-Eastern Province Chapter arranged the interviews with the eight IMA members.

modified to produce the final questionnaire, which was used in the third pre-testing stage. In relation to translation-checking, the two academics interviewed checked the Arabic translation of the two versions of the questionnaire tested during the second pre-testing stage. They suggested making minor wording and grammatical changes to the two versions of the questionnaire. Those pertaining to the first version were incorporated when preparing the final questionnaire.

The third stage of the pre-testing aimed to pilot-test the final questionnaire. In particular, it involved examining the implementation process of the IMA mailer system and the online questionnaire to ensure that the IMA mailing system and the website containing the online questionnaire function adequately.[77] The IMA sent an e-mail that included a link to the online questionnaire to four of its members. The four IMA members received the e-mail and completed the online questionnaire successfully. The pilot-test, however, did not involve the paper questionnaire. This is because of the expectation that most responses would be obtained through the online questionnaire, given that the paper one, to save costs and improve speediness, was planned to be offered at the last stage of administrating the questionnaire, as will be illustrated in the next section.

6.3.2.1.4 Questionnaire administration

The questionnaire was administered in accordance with most of Dillman et al's (2014) administration-related guidelines, examples of which are shown in Table 6-6 (for a full list, see Appendix 6-15). As mentioned in Section 6.3.2.1, the mixed-mode questionnaire exploiting one mode of contact - e-mail - and offering multiple modes of questionnaire - online and paper - was employed during the model-testing stage. The IMA emailed its members (n = 501) to invite them to complete an online questionnaire; the final reminder

[77] SmartSurvey was the website used to establish and collect the answers to the online questionnaire (https://www.smartsurvey.co.uk).

stated that a paper questionnaire could be mailed to respondents upon request. The IMA sent four e-mails that included an invitation to complete the questionnaire and three reminders. The web address for the online questionnaire was included in all four e-mails, and an option to receive the paper questionnaire by post upon request was included in the third reminder. This questionnaire administration procedure resulted in a very low response rate of 5.99%, i.e., 30 responses. This, in turn, forced the researcher to change the sampling frame and sample, and also disregard the data obtained from the IMA members, i.e., the 30 responses, which was excluded from any further data analysis. Section 6.3.2.1.4.1 discusses the modifications made to the sampling frame and sample, while Section 6.3.2.1.4.2 explains the administration of the questionnaire to the modified sample.

Table 6-6: Examples of administration-related guidelines followed in administrating the questionnaire

1. Using multiple contacts and varying the message between them; recommended four contacts.
2. Being precise in the timing of making contacts; recommended time interval of 1 week, 2 weeks and 10 days between the four contacts.
3. Sending a token appreciation with the survey request.
4. Designing a cover letter with care - i.e., including the most important information, such as the research purpose, a request to complete the questionnaire, information about confidentiality and instructions on returning the questionnaire to convince respondents to complete it - and sending it with the questionnaire **(Paper questionnaire)**.

6.3.2.1.4.1 Modifications to the research sampling frame and sample

After evaluating the available sampling frames mentioned in Section 6.2, the MODON along with RCJY databases were chosen as a modified sampling frame during the model-testing stage of the adopted survey strategy. The MODON and RCJY databases, together, were deemed the best choice compared to the MCI database, which was in the process of being updated, and the SIDF database, which only included business-units that received government funding. The MODON and RCJY databases complemented each other because the former covered all Saudi industrial cities apart from two, namely, Jubail and Yanbu, which were the only two industrial cities included in the RCJY database.

However, the MODON and RCJY databases did not include information about business-units addresses or full contact details. This had an implication for the distribution of the questionnaire, in that the researcher had to enter the field by himself to make the initial contact with and obtain the contact details of the business-units. This, in turn, influenced the size of the sample that could be obtained. In particular, a large sample size could not be used given the high costs and extended time period that would have been required for the researcher to be able to reach a large number of business-units located in different industrial cities. Hence, the researcher followed two procedures to obtain the sample and reach the business-units. The first procedure was applied with the MODON database, whereas the second was utilised with the RCJY database. Table 6-7 demonstrates these two procedures

6.3.2.1.4.2 Administrating the questionnaire to the modified sample

Like the initial sample, i.e., IMA members, the mixed-mode questionnaire was also utilised with the modified sample, i.e., business-units selected from the MODON and RCJY databases. The mixed-mode questionnaires used with both samples involved offering multiple questionnaire modes, i.e., online and paper. However, the mixed-mode questionnaire employed with the modified sample differed from that used with the initial sample in that the former involved exploiting multiple contact modes - visits, phone calls and e-mails - rather than a single contact mode - e-mail - and offering multiple questionnaire modes - i.e., online and paper - concurrently rather than sequentially.[78] The administration of the questionnaire to the modified sample was in accordance with most of Dillman et al's

[78] The mixed-mode questionnaire using multiple contact modes - visits, phone calls and e-mails - and offering multiple questionnaire modes - online and paper - was used due to its two benefits. First, using multiple contact modes - i.e., visits, phone calls and e-mails - makes it possible to cover populations that cannot be covered using a single contact mode (Dillman et al., 2014). Second, it has a significant impact on improving the response rate

Table 6-7: Procedures followed to draw the sample and reach business-units

Procedure 1: MODON	**Procedure 2: RCJY**
Step 1: 1. The three largest industrial cities managed by MODON - Riyadh 2, Jeddah 1 and Dammam 2 - were selected. These cities are located in distant geographical areas within Saudi Arabia. 2. A random sample of 80 business-units was drawn from each city. The researcher attempted to visit the 80 business-units during a period of a week, as specified for each city, i.e., average 16 business-units per day.[79] 3. When it proved impossible to meet with potential respondents during the visit, the researcher obtained the business-unit phone number and telephoned them at a later date to reach potential respondents. **Step 2:** 1. Besides the three largest industrial cities, two additional industrial cities - Hofouf 1 and Dammam 1 - that are located near to the home town of the researcher were selected. 2. A random sample of 30 business-units from Hofouf 1 and 50 from Dammam 1 were drawn. The researcher attempted to visit the business-units included in the sample during the 2-day period allocated to Hofouf 1 and three days assigned to Dammam 1, i.e., average 16 business-units per day. 3. When it proved impossible to meet potential respondents during the visit, the researcher obtained the business-unit phone number and telephoned at a later date to reach potential respondents.	1. The researcher was unable to visit Jubail or Yanbu industrial cities. 2. A random sample of 40 business-units was drawn from each city. The researcher telephoned the finance managers of the business-units to identify and contact the potential respondent from each business-unit.[80]

by offering respondents multiple ways, i.e., questionnaire modes, to respond and, therefore, reducing the probability of non-response bias that may arise when respondents are unrepresentative of the population.

[79] MODON provided the researcher with maps of each industrial city visited, which included information related to the name and location of each factory, i.e., business-unit.

[80] Although the phone numbers were not included in the RCJY database, the researcher made considerable efforts to acquire these from RCJY.

(2014) administration-related guidelines.[81] The maximum number of contacts made with potential respondents was four.

The initial contact was divided into two steps. The first step involved visiting or telephoning the business-unit. During the visits and phone calls, the researcher made great efforts to identify the person responsible for the overhead assignment procedure, with a deep knowledge about the business-unit, i.e., potential respondents.[82] Following that, this research and its objectives were briefly described to the potential respondent. In addition, the contact information, particularly the e-mail address, of the potential respondent was taken.

The second step included e-mailing potential respondents on the same day of the visit or phone call.[83] The e-mail included the web addresses, i.e., links, of the English and Arabic online questionnaires and attachments of the English and Arabic paper questionnaires along with the cover letter. In addition, the e-mail included a letter from King Faisal University, the researcher's sponsor, as a mean of confirming the credibility of the research and to encourage potential respondents to complete the questionnaire.[84]

The second contact was a first reminder, and involved e-mailing a reminder to non-respondents a week after the initial contact. The e-mail included the same web links and attachments as the first e-mail that was sent as part of the initial contact. The third contact

[81] Appendix 6-15 includes the full list of the administration-related guidelines followed in administrating the questionnaire. The guidelines included in Table 1 and Table 2 in Appendix 6-15 pertain to administrating the questionnaire to the initial sample, although only those included in the latter table are relevant to administrating the questionnaire to the modified sample. Additional guidelines for using multiple modes of contact - i.e., visits, phone calls and e-mails - and questionnaire that are related to administrating the questionnaire to only the modified sample, but not provided in Table 2 in Appendix 6-15 include: (1) using contacts by modes other than the questionnaire mode; and (2) offering, simultaneously, different questionnaire modes after removing the barriers to responding of each mode.

[82] Identifying the right person to answer the questionnaire helped further to enhance the validity of the responses obtained. To the author's knowledge, except for Hoque (2000), no contingency study on optimal CSD has identified the right person to answer the questionnaire through making visits or phone calls to the business-units before sending the questionnaire.

[83] All of the respondents were emailed, including those who preferred to receive the paper questionnaire during the visit. Appendices 6-16 and 6-17 contain English and Arabic copies of these e-mails, respectively.

[84] The King Faisal University's letter was written in Arabic only (see Appendix 6-18), as it proved impossible for the researcher to obtain an English copy of it.

was the second reminder, and involved making a phone call to non-respondents two weeks after the second contact, i.e., the first reminder. The fourth contact was the third reminder, and involved e-mailing a reminder that included the same web links and attachments as the first and second e-mails to non-respondents ten days after the third contact, i.e., the second reminder.[85] Appendix 6-19 includes a table showing the details of the administration of the mixed-mode questionnaire to the modified sample.

As shown in Table 6-8, the procedure followed to administer the questionnaire to the modified sample resulted in distributing 368 questionnaires and acquiring a total number of responses of 233, with a total response rate of 63.3%.

Table 6-8: Information about the total number of distributed questionnaires and responses

Number of distributed questionnaires	**368**
Number of responses:	
Online questionnaire	125
Paper questionnaire	108
Total responses	**233**
Total response rate	**63.3%**

After receiving all of the questionnaires and entering the data into Excel and the Statistical Package for the Social Sciences (SPSS), many missing and inconsistent questionnaire answers to various questions – e.g., Q3, Q4, Q5, Q6, Q7 and Q10 - were found. Therefore, phone interviews/e-mails with a large number of respondents were conducted/sent to encourage them to provide the missing answers and obtain further clarification about the inconsistent questionnaire answers with the objective of modifying them. These efforts resulted in completing and modifying the answers of a large number of respondents and,

[85] As provided in Table 6-6 and Appendix 6-15, a week, 2 weeks and 10 days are the recommended time intervals between the four contacts. Given that the respondents received the questionnaire on different dates (see Table 6-7), the researcher kept a schedule of the dates on which each group of respondents received the questionnaire, which helped to time the reminder contacts according to the recommended time intervals, i.e., a week, 2 weeks, 10 days, for each group of respondents.

accordingly, contributed towards increasing the validity of the answers provided. However, as shown in Table 6-9, 29 questionnaires were excluded due to the existence of either missing answers or inconsistent answers, resulting in decreasing the total number of responses to 204 usable responses, and the total response rate to a 55.4% usable response rate.[86] This response rate is higher than that of the majority of contingency studies on optimal CSD, particularly those that operationalised CSD with respect to the level of CSC (30.1%, Drury and Tayles, 2005; 19.6%, Al-Omiri and Drury, 2007; 41.6%, Brierley, 2007; 6.3%, Schoute, 2009; 32%, Al-Omiri and Drury, 2013), which may be attributed to the usage of the mixed-mode questionnaire by this research. Having provided information about different facets - e.g., design and pre-testing - of the data collection method adopted during the model-testing stage, i.e., questionnaire, the next section will evaluate non-response bias.

Table 6-9: Information about the unusable/usable responses and the response rate

Total number of responses	**233**
Number of unusable responses due to missing answers	21
Number of unusable responses due to inconsistent questionnaire answers	8
Total number of unusable responses	**29**
Number of usable responses	**204**
Usable response rate	**55.4%**

6.3.2.2 Non-response bias assessment

Checking for non-response bias is a crucial step when responses to a questionnaire have not been obtained from part of the selected sample. Non-response is the result of not obtaining responses from some of the members of the selected sample (Dillman, 1991; De Vaus, 2002; Bryman and Bell, 2011), which can occur for different reasons, such as the selected members

[86] Further details about the treatment of the issues relating to missing data and inconsistent questionnaire answers will be provided in Sections 7.2.1 and 7.2.2, respectively.

being ineligible to respond or uncontactable, are refusing to participate, or being unable to be located (Moser and Kalton, 1971; Couper, 2000; De Vaus, 2002; Saunders et al., 2009). There is a high possibility that non-respondents differ from the rest of the population with regard to different characteristics (Moser and Kalton, 1971; De Vaus, 2002), which makes respondents non-representative of the population and, consequently, might cause biased findings (Saunders et al., 2009; Dillman et al., 2014). Given this, checking whether non-response bias exists is vital to ensure that the findings can be generalised to the entire population (Armstrong and Overton, 1977; Van der Stede, Young and Chen, 2005; Nazari, Kline and Herremans, 2006; Collis and Hussey, 2014).

In this research, non-response bias was assessed by comparing early respondents with late ones with regard to certain characteristics (Moser and Kalton, 1971; Armstrong and Overton, 1977; Sax, Gilmartin and Bryant, 2003; Van der Stede et al., 2005; Groves, 2006). Two tests were used to examine whether early (n = 120) and late respondents (n = 80) differ in relation to many characteristics.[87] First, the independent samples t-test was conducted when the examined characteristics were measured on interval or ratio scales. These characteristics represent all of the constructs that were included in the research model. The results of the independent samples t-test revealed no significant difference between early and late respondents for all constructs, except for two constructs; namely, TMS and TMKA (the results of the independent samples t-test are presented in Appendix 6-20). Therefore, caution is required when interpreting the results related to these two constructs.[88]

[87] Respondents who returned the questionnaire before any reminder (n = 1) and after the first reminder (n = 119) were considered early respondents (total = 120), whereas those who returned it after the second (n = 57) and third reminder (n = 23) were considered late respondents (total = 80). It should be noted that the non-response bias tests excluded four cases that were multivariate outliers, which were also precluded from all of the data analysis reported in this thesis. More details about the treatment of outliers will be provided in Section 7.2.3.
[88] In addition to the independent-samples t-test, the non-parametric alternative Mann-Whitney test was performed. The results of this are similar to those of the independent-samples t-test, except for the construct TMKA, where a significant difference between early and late respondents was not found. The results of the Mann-Whitney test are provided in Appendix 6-20.

Second, the Chi-square test for independence was carried out when the examined characteristics are measured on a nominal scale. The results of the Chi-square test for independence found no significant difference between early and late respondents in relation to: (1) the overhead assignment method used, i.e., direct costing, absorption (plant-wide) costing, absorption costing and ABC; (2) whether the business-unit uses ABC or not; (3) whether the business-unit is a wholly Saudi-owned business-unit or not; and (4) the production type, i.e., mass, batch, job-order and mix.[89] The results of the Chi-square test for independence are provided in Appendix 6-20. Having assessed non-response bias, the next section will provide an overview of the statistical analysis techniques employed during the model-testing stage of the utilised survey strategy.

6.3.2.3 Overview of the statistical analysis techniques

In this research, four main statistical analysis techniques were used. The first was confirmatory factor analysis (CFA), which aims to assess whether the actual factors' structures for groups of indicators/variables conform to those hypothesised by the researcher based on theoretical or prior empirical studies (Floyd and Widaman, 1995; Henson and Roberts, 2006; Hair, Black, Babin and Anderson, 2010; Williams, Onsman and Brown, 2010). CFA was utilised to assess the quality of the reflective constructs included in the research model (further details about CFA will be provided in Section 7.3.1.1).

The second and third statistical analysis techniques are PRA and RSM. The combined usage of PRA with RSM was introduced and advocated by Professor Jeffery Edwards and colleagues in response to the problems associated with various difference-score models - e.g., algebraic, absolute, squared, empirical-Euclidian distance and residual analysis - used to test congruence/fit/matching hypotheses (e.g., Edwards and Parry, 1993; Edwards, 1994; 1996;

[89] The "mix" category of production type represents business-units for which the production mode is characterised by more than one production type, e.g., mass and batch.

2002; 2007). The joint usage of both techniques allows researchers to examine more precisely how the fit/misfit between two predictor constructs - e.g., CSC and contingency factor - influences an outcome construct (Shanock, Baran, Gentry, Pattison and Heggestad, 2010; Burkert et al., 2014). Thus, the combined usage of PRA and RSM has been promoted to test for contingency theory hypotheses related to the matching sub-form of fit (Donaldson, 2006; Burkert et al., 2014). The joint usage of PRA and RSM was employed to test Hypotheses 1 to 7 related to the matching sub-form of fit (further details about PRA and RSM will be provided in Section 8.2).

The fourth statistical analysis technique is residual analysis, which makes it possible to test the joint influence of multiple contingency factors on optimal MCS, in this research, CSD, by examining the impact of the misfit between multiple contingency factors, taken together, and the optimal MCS on an outcome construct, such as financial performance (Nicolaou, 2000; 2002; Said et al., 2003; Pizzini, 2006; King et al., 2010; Gani and Jermias, 2012; Burkert et al., 2014). It involves two steps. In the first, MCS is regressed on the contingency factors and, in the second, the outcome is regressed on the misfit represented by the residuals of the regression performed in the first step (Dewar and Werbel, 1979; Duncan and Moores, 1989; Ittner and Larcker, 2001; Ittner, Larcker and Randall, 2003; Van der Stede, Chow and Lin, 2006; Chen and Jermias, 2014). The residual analysis technique was used to test Hypothesis 8 related to the system form of fit (further details about the residual analysis technique will be provided in Section 9.2).

6.4 Conclusion

This chapter sought to demonstrate the research methodology and methods adopted to conduct this research. This chapter contributed to realising the three main contributions of this research and, hence, attaining the research aim (see Section 1.5). Likewise, it contributed towards realising the four minor contributions of this research (see Section 1.5). Therefore, it assisted in successfully addressing the main limitation of contingency research on optimal CSD and, accordingly, acquiring the research aim (see Section 1.5).

This chapter explained how the selected survey strategy was considered the most suitable research strategy for realising most of the main contributions of this research and, therefore, attaining the research aim. In addition, it discussed the objective ontological and epistemological assumptions underpinning the adopted survey strategy. Furthermore, this chapter provided information about the research population, sampling frame and sample. Moreover, it detailed the application of the utilised survey strategy, which included two stages, namely, the exploratory and model-testing stages, that, in conjunction, facilitated the achievement of the research aim. The exploratory stage involved the collection and analysis of qualitative data, which assisted in realising the third main contribution of this research - i.e., the results of testing the matching sub-form of fit and the system form of fit's hypotheses - as well as the third and fourth minor contributions of this research, i.e., the measurements of CSC and PC. The model-testing stage encompassed the collection of quantitative data from a large number of cases and the analysis of this data using appropriate statistical analysis techniques, which contributed towards realising the second and third main contributions of this research, i.e., the statistical analysis techniques exploited to test for the matching sub-form of fit and the results of testing the matching sub-form of fit and the system form of fit's hypotheses. Having described the research methodology and methods, the next chapter will present the results of the preliminary analysis.

Chapter seven: Results: preliminary analysis

7.1 Introduction

The objective of this chapter is to provide the results of the preliminary analysis carried out prior to conducting the main data analysis to test the research hypotheses, i.e., research model, relating to the influence of the different contingency factors on the optimal level of CSC, i.e., optimal CSD. The preliminary analysis was carried out to accomplish two objectives; namely, to ensure the suitability of the data for the data analysis and to provide a detailed description of the data characteristics. Hence, this chapter assists in realising the third main contribution of this research regarding the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5). Therefore, it contributes to accomplishing the research aim of investigating the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit.

This chapter is organised as follows. Section 7.2 provides information on the first aspect of the preliminary analysis; namely, the data examination and preparation. In particular, it discusses how the data were examined and prepared regarding issues related to missing data (Section 7.2.1), inconsistent questionnaire answers (Section 7.2.2), outliers (Section 7.2.3) and normality (Section 7.2.4). Section 7.3 explains and presents the results of the second aspect of the preliminary analysis concerning the assessment of the quality of the latent or unobservable constructs, including the reflective (Section 7.3.1) and formative constructs (Section 7.3.2). These two aspects are related to the first objective of conducting the preliminary analysis, i.e., ensuring the suitability of the data for the data analysis. Section 7.4 shows the results of the third aspect of the preliminary analysis; namely, the descriptive analysis. The third aspect deals with the second objective of performing the preliminary analysis, i.e., providing a detailed description of the data characteristics. The results of the descriptive analysis include general information about the respondents, business-units and the business-units' costing systems (Section 7.4.1) and descriptive statistics related to the constructs included in the research model (Section 7.4.2). Section 7.5 concludes this chapter.

7.2 Data examination and preparation

Examining and preparing the data is an initial and essential step in the data analysis procedure to ensure the suitability of the data for the data analysis that was performed to test the research model - i.e., hypotheses - and so, subsequently, the validity and accuracy of the results (Tabachnick and Fidell, 2007; Hair et al., 2010). Data examination and preparation involves assessing and solving problems related to missing data (Section 7.2.1), inconsistent questionnaire answers (Section 7.2.2), outliers (Section 7.2.3) and normality (Section 7.2.4) (Hair et al., 2017). This section sheds light on each of the abovementioned facets of the data examination and preparation.

7.2.1 Missing data

Missing data refers to the unavailability of complete valid values for one or more of the indicators/variables used in the analysis (Hair et al., 2010). Missing data can occur for reasons related to the respondent when, for example, he/she fails to answer a question or for other reasons unrelated to the respondent, such as when some data entry errors or data collection problems occur (Hair et al., 2010; Hair et al., 2017). Dealing with missing data is crucial to avoid reducing the sample size and allowing bias to affect the results (Bennett, 2001; Hair et al., 2010). To select an appropriate remedy for the missing data problem, researchers should first assess the extent of missing data and, if this proves to be substantial, then examine the pattern of missing data (Hair et al., 2010).

Regarding the extent of missing data, researchers need first to determine the percentage of missing data for each case (Hair et al., 2010). If a case is lacking more than 15% of its data, it should be deleted (Hair et al., 2017). In addition, even when the amount of missing data does not exceed 15%, cases with a high proportion of missing data related to one construct should be removed (ibid). In this research and as mentioned in Section 6.3.2.1.4.2, 21 of the 233 received responses were excluded following efforts to encourage them to provide the missing data.[90] Of these 21 deleted cases, 13 were removed due to having more than 15% of missing data, while eight were excluded due to particular constructs' missing data, e.g., unanswered questions related to the number of cost pools/cost drivers or cost structure. After determining the percentage of missing data for each case and removing problematic cases, researchers need to calculate the overall extent, i.e., percentage, of missing data across the cases (Hair et al., 2010). If this is high, researchers need to examine the pattern of missing data but, if it is low, then researchers can select from among a wide range of missing data remedies without examining the pattern of missing data (ibid). In this research and after removing the 21 problematic cases, the overall extent of missing data across cases was not substantial (less than 1%), making it possible to choose from among a wide range of missing data remedies without examining the pattern of missing data. Nevertheless, the pattern of missing data was examined to provide further assurance that the missing data issue would not cause any bias in the results.

Examining the pattern of missing data involves testing whether the data were missing completely at random (MCAR) or not (Tabachnick and Fidell, 2007; Hair et al., 2010). If the data are MCAR, researchers can choose from among a wide range of missing data remedies (Hair et al., 2010); if not, their choice of missing data remedies is smaller (ibid). Little's MCAR test can be used to examine the randomness of missing data (Tabachnick and Fidell,

[90] For further details about the follow-up phone interviews/e-mails, see Section 6.3.2.1.4.2.

2007; Hair et al., 2010). This test examines whether any significant differences exist between the actual or observed missing data pattern and the random one. If this is the case, then the missing data are not MCAR but, if not, then the missing data are MCAR. Little's MCAR test was performed using SPSS, and the results of this test (Chi-Square = 1794.87, DF = 1738, p = 0.167, $p > 0.05$) show no significant difference between the actual or observed missing data pattern - i.e., the missing data pattern of this research - and the random one. The results mean that the missing data are MCAR, permitting the selection from among a wide range of missing data remedies (Hair et al., 2010). To impute the missing data, the expectation-maximisation method was used, this being one of the most robust imputation methods (Bennett, 2001; Schafer and Graham, 2002).[91]

7.2.2 Inconsistent questionnaire answers

Inconsistent questionnaire answers occur when a respondent provides two different answers to a question that was asked in a slightly different way, or provides an answer to a question that contradicts his/her answers to other questions. Cases with inconsistent questionnaire answers need to be removed (Hair et al., 2017). In this research and as noted in Section 6.3.2.1.4.2, eight cases of the 233 received responses were deleted after efforts were made to encourage them to clarify and modify inconsistent questionnaire answers.[92] Examples of inconsistent questionnaire answers found in this research include: (1) indicating the usage of an absorption costing system with a single cost pool and cost driver in Q4 relating to the overhead assignment method while stating that multiple cost pools and cost drivers are used in, respectively, Q5 concerning the number of cost pools and Q6 regarding the number of cost drivers; and (2) indicating the usage of an overhead assignment method that conforms to TCS in Q4 while stating that ABC is used in Q10 relating to the business-unit's experience with ABC.

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[91] The expectation-maximisation method was employed using SPSS.
[92] For further details about the follow-up phone interviews/e-mails, see Section 6.3.2.1.4.2.

7.2.3 Outliers

An outlier is a case that has an extreme high or low value for one indicator/variable, i.e., univariate outlier, or an unusual combination of values of two or more indicators, i.e., multivariate outlier, that causes a distortion in the statistics (Tabachnick and Fidell, 2007). Detecting outliers is vital to prevent distortions affecting the results and, subsequently, the drawing of erroneous conclusions, i.e., Type I or Type II errors (Tabachnick and Fidell, 2007; Hair et al., 2010; Field, 2013). Detecting outliers involves examining both univariate and multivariate outliers (Tabachnick and Fidell, 2007).

Detecting univariate outliers is concerned with examining the distribution of cases for each indicator with the objective of identifying those that fall at the outer ranges, high or low, of the distribution (Hair et al., 2010). This can be done by examining the standardised score (z score)[93] for each case on each indicator (Field, 2013). Standardised scores above +3.29 or below -3.29 indicate the presence of outliers (Tabachnick and Fidell, 2007). In this research, the standardised scores for all indicators of the multi-indicator constructs[94] and single-indicator constructs were examined using SPSS, and it was found that some indicators measured on an ordinal scale and interval and ratio scales have standardised scores above +3.29 or below -3.29. For indicators measured on an ordinal scale, two for COMP, CultureOutcome, CultureDetail, CultureControl, TMS, TMKA, CSC-DEVELOPED and USEFULNESS included outliers. These indicators were examined further to determine whether the outliers have scores that fall above or below the scale range of each indicator - i.e., 1 to 5 - and it was found that the outliers' scores lie within the scale range. Thus, it was decided to keep the outliers and take no further action. For indicators measured on the interval and ratio scales, the indicators of the single-indicator constructs of CostStructure-

[93] Standardised scores, or "z-scores", have a mean value of 0 and a standard deviation (SD) of one (Hair et al., 2010; Field, 2013).

[94] The multi-indicator constructs represent the latent or unobservable constructs, which will be explained in Section 7.3.

MANUFACTURING, SizeEmployees, CSC-CostPools and CSC-CostDrivers included outliers. To reduce the impact of outliers on the results, data transformation was utilised using SPSS (Tabachnick and Fidell, 2007; Hair et al., 2010). As suggested by Tabachnick and Fidell (2007), Hair et al. (2010) and Field (2013), several transformation methods were tried for each indicator and the one that best solved the outliers issue was chosen. Table 7-1 shows the indicators that are measured on interval and ratio scales, and identifies the methods of transformation used to remedy the outliers issue. At this point, it should be noted that the transformed scales for the indicators shown in Table 7-1 and, thus, their single-indicator constructs are used throughout the subsequent data analysis in this thesis, unless otherwise stated.

Detecting multivariate outliers is concerned with measuring the position of each case in relation to the centre of all cases on a group of indicators (Hair et al., 2010). This can be done by using the Mahalanobias D^2 measure (Tabachnick and Fidell, 2007; Hair et al., 2010), which can be evaluated for each case using the Chi-square X^2 distribution (Tabachnick and Fidell, 2007). In particular, when the probability value associated with X^2 is equal to or less than 0.005 or 0.001, the case is considered to be a multivariate outlier (Tabachnick and Fidell, 2007; Hair et al., 2010). In this research, the Mahalanobias D^2 distance and probability value associated with X^2 were calculated using SPSS, and, using the 0.001 threshold, it was found that four cases of the 204 usable responses have probability values of 0.001 or below. Therefore, it was decided to remove these cases to reduce any possible impact of outliers on the results and conduct the analysis on the remaining 200 cases.

Table 7-1: Indicators measured on interval and ratio scales and the methods of transformations used

Indicator	Description	Method of transformation
The indicator of CostStructure MANUFACTURING	The percentage of indirect manufacturing costs to total manufacturing costs	Square root transformation
The indicator of SizeEmployees	The number of employees	Log N transformation
The indicator of CSC-CostPools	The number of cost pools	Log N transformation
The indicator of CSC-CostDrivers	The number of cost drivers	Log N transformation

7.2.4 Normality

Normality is concerned with the extent to which the distribution of the data obtained accords with the normal distribution, the benchmark for statistical methods (Hair et al., 2010). Large magnitudes of data non-normality can render the results invalid (Hair et al., 2010; Hair et al., 2017). Normality can be assessed by examining the shape of the data distribution in relation to two measures; namely, skewness and kurtosis (Hair et al., 2017). The skewness measure aims to evaluate the extent to which an indicator's distribution is unbalanced or asymmetrical (Tabachnick and Fidell, 2007; Hair et al., 2010; Pallant, 2013). The distribution of the indicator's responses suffers from skewness when it is shifted to the right, negative skewness, or left, positive skewness (Tabachnick and Fidell, 2007; Field, 2013; Hair et al., 2017). The kurtosis measure seeks to evaluate the extent to which the indicator's distribution is too peaked or flat in relation to the normal distribution (Tabachnick and Fidell, 2007; Hair et al., 2010; Pallant, 2013). The distribution of the indicator's responses suffers from kurtosis when it is too peaked, positive kurtosis, or flat, negative kurtosis, compared to the normal distribution (Tabachnick and Fidell, 2007; Field, 2013; Hair et al., 2017). Skewness and kurtosis values between -1 and 1 indicate the normality of the indicator distribution (Hair et al., 2017). Otherwise, the distribution of the indicator is considered non-normal.

In this research, the skewness and kurtosis of all of the indicators were examined using SPSS. As shown in Table 7-2, apart from a few indicators that showed a modest departure from normality, most of them are normal, i.e., have skewness and kurtosis values between -1 and +1. Regarding the normality of the distribution, it has been emphasised that this should not be evaluated without considering the sample size (Tabachnick and Fidell, 2007; Hair et al., 2010; Field, 2013; Pallant, 2013). Researchers have asserted that non-normality has a negligible detrimental impact on the results when the sample size is large, e.g., 200 or more (Hair et al., 2010; Field, 2013; Pallant, 2013). Hence, it was decided to take no action, e.g., transformation, to remedy the modest non-normality issue found in some of the indicators. Having examined and prepared the data regarding problems related to missing data, inconsistent questionnaire answers, outliers and normality, i.e., the first aspect of the preliminary analysis, the next section will demonstrate and provide the results of the second aspect of the preliminary analysis; namely, the assessment of the latent constructs, including both the reflective and formative ones.

Table 7-2: Skewness and kurtosis of indicators[a, b]

Indicator	**Skewness**	**Kurtosis**
Q12_COMPa	-0.43	0.24
Q12_COMPb	-0.53	-0.18
Q12_COMPc	-0.13	0.15
The indicator of CostStructure-MANUFACTURING	0.17	0.66
The indicator of CostStructure-COMBINED	0.90	1.18
Q19_CultureOutcomeA	-0.60	0.32
Q19_CultureOutcomeB	-0.63	-0.16
Q19_CultureOutcomeC	-0.55	-0.14
Q19_CultureOutcomeD	-0.85	1.22
Q19_CultureOutcomeE	-0.62	0.15
Q19_CultureDetailF	-0.47	-0.32
Q19_CultureDetailG	-0.58	0.14
Q19_CultureDetailH	-0.62	0.08
Q20_CultureControlA	-0.17	0.05
Q20_CultureControlB	-0.55	0.78
Q20_CultureControlC	-0.41	-0.25

Table 7 2: Skewness and kurtosis of indicators (continued)[a, b]

Indicator	Skewness	Kurtosis
Q20_CultureControlD	-0.37	0.02
Q20_CultureControlE	-0.39	-0.14
Q20_CultureControlF	-0.25	-0.53
Q20_CultureControlG	-0.16	-0.67
Q20_CultureControlH	-0.27	-0.51
Q14_PCcustomisation	0.40	-1.45
Q15_PCa	0.24	-0.89
Q15_PCb	0.13	-0.84
Q15_PCc	-0.21	-0.91
Q15_PCd	-0.46	-0.77
Q15_PCe	-0.13	-0.94
Q15_PCf	0.42	-0.90
Q15_PCg	0.42	-0.36
Q15_PCh	0.25	-0.96
Q15_PCi	-0.01	-0.90
Q15_PCj	0.59	0.02
Q15_PCk	0.79	0.32
Q15_PCl	0.06	-0.91
The indicator of SizeRevenue	0.01	-1.40
The indicator of SizeEmployees	-0.01	-0.18
Q8_TMSa	-1.36	2.78
Q8_TMSb	-0.79	0.26
Q8_TMSc	-0.68	-0.09
Q9_TMKAa	-1.00	1.57
Q9_TMKAb	-0.83	0.76
Q9_TMKAc	-0.87	0.59
The indicator of CSC-CostPools	0.35	-0.22
The indicator of CSC-CostDrivers	0.58	0.76
The indicator of CSC-COMPOSITE	0.44	-0.25
Q7_CSC-DEVELOPEDa	-0.39	-1.20
Q7_CSC-DEVELOPEDb	-0.66	1.88
Q7_CSC-DEVELOPEDc	-1.03	0.82
Q7_CSC-DEVELOPEDd	-0.64	0.10
Q7_CSC-DEVELOPEDe	-0.98	2.03
Q7_CSC-DEVELOPEDf	-0.91	0.62
Q2_USEFULNESSa	-1.37	2.41
Q2_USEFULNESSb	-1.02	1.50
Q2_USEFULNESSc	-0.96	1.08
The indicator of USAGE	-0.58	0.34

a. Except for the Q7_CSC-DEVELOPED indicators, the statistics for all of the indicators are based on the 200 sample. As explained in Section 6.3.2.1.2.1, Q7, related to the CSC-DEVELOPED construct, was only applicable to 152 of the 200 cases, and so, accordingly, the statistics pertaining to its indicators are based on the 152 sample. It should be noted that, in this thesis, any further results related to CSC-DEVELOPED are for the 152 sample.
b. Sections 7.3.1.1.2 and 7.3.2.1 include the statements used on the questionnaire for the indicators of the latent constructs.

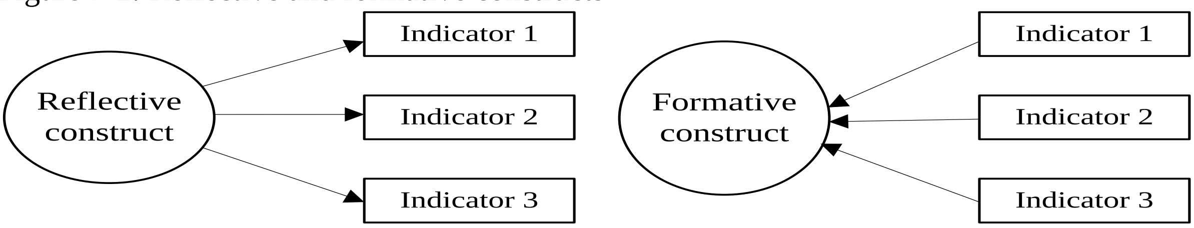
7.3 Assessing the quality of the latent constructs

This section evaluates the quality of the latent constructs included in the research model, which is important for ensuring their appropriateness to the data analysis that was conducted to test the research hypotheses - i.e., research model - and so, thereafter, the validity and accuracy of the results. Latent constructs, or unobservable constructs, are those that cannot be directly measured, e.g., satisfaction, but can be represented or measured by one or more indicator/variable that comprise the raw data and, thus, can be directly measured (Hair et al., 2010; Hair et al., 2017). There are two different approaches for measuring latent constructs, as shown in Figure 7-1 (Diamantopoulos and Winklhofer, 2001; Jarvis, MacKenzie and Podsakoff, 2003; Bisbe, Batista-Foguet and Chenhall, 2007; Petter, Straub and Rai, 2007; Henseler, Ringle and Sinkovics, 2009; Hair et al., 2010; Hair, Ringle and Sarstedt, 2011; Peng and Lai, 2012; Hair, Sarstedt, Hopkins and Kuppelwieser, 2014; Sarstedt, Ringle, Smith, Reams and Hair, 2014; Hair et al., 2017). The first is the reflective approach, where the construct is assumed to be the cause of the covariation between the indicators, i.e., the direction of the arrows runs from the construct to the indicators, as shown in Figure 7-1. The reflective approach assumes that the indicators represent the effects of a construct, which implies that a change in the evaluation of the construct causes a simultaneous change in all indicators. A group of reflective indicators of a construct is considered a sample that represents all possible indicators available within the construct's conceptual domain, i.e., the domain of the content, which the construct intends to measure. For this reason, reflective indicators should be highly correlated with each other and interchangeable, so any one of them can be discarded without changing the meaning of the construct, provided that the construct has sufficient reliability.

The second approach to measuring the latent constructs is the formative approach, where the indicators are assumed to shape the construct, i.e., the direction of the arrows runs from the indicators to the construct, as displayed in Figure 7-1. The formative approach assumes that the indicators form the construct through linear combinations, which implies that changing the construct is not necessarily associated with a simultaneous change in all indicators. Each formative indicator represents a distinct facet of the construct's conceptual domain. Therefore, formative indicators are not expected to be correlated with each other or be interchangeable, so omitting any one of them can change the nature of the construct. When the construct is characterised as formative, it is important to ensure that the indicators cover the conceptual domain of the construct.

The evaluation of the quality of the latent constructs differs between reflective and formative constructs, given that each measurement approach is based on different concepts (Diamantopoulos and Winklhofer, 2001; Bisbe et al., 2007; Hair et al., 2011; Hair et al., 2014; Hair et al., 2017). Sections 7.3.1 and 7.3.2 assess the quality of the reflective and formative constructs, respectively.[95]

Figure 7-1: Reflective and formative constructs



7.3.1 Assessing the quality of the reflective constructs

Six constructs included in the research model were characterised as reflective constructs. These constructs are COMP, CultureOutcome, CultureDetail, TMS, TMKA and

[95] Besides the latent constructs evaluated in this section, the research model includes single-indicator constructs, including CostStructure-MANUFACTURING, CostStructure-COMBINED, SizeRevenue, SizeEmployees, CSC-CostPools, CSC-CostDrivers, CSC-COMPOSITE and USAGE. The relationship between the construct and its single indicator equals 1, meaning that both have identical values (Hair et al., 2017). This suggests that the assessment criteria for reflective and formative constructs are inapplicable to single-indicator constructs (ibid). Except for USAGE, these constructs are observable - i.e., directly measured - and, thus, modelling them as single-indicator constructs is appropriate (ibid). Although USAGE is a latent construct, it was modelled as a single-indicator construct because of the weighting, multiplying and summing steps involved in its measurement (see Section 6.3.2.1.2.1).

USEFULNESS. Characterising these six constructs as reflective was based on the main differences between reflective and formative constructs, discussed in the previous section. For example, the group of indicators of each of the six constructs is considered a sample that represents all of the possible indicators available within the construct's conceptual domain, and, accordingly, the indicators of each of the six constructs are interchangeable, suggesting a reflective measurement approach. Reflective constructs are evaluated based on their internal consistency reliability and validity, i.e., the extent to which the indicators represent the construct that they are designed to measure, including convergent validity and discriminant validity (Henseler et al., 2009; Hair et al., 2011; Hair et al., 2014; Hair et al., 2017). Before explaining and presenting the results of the assessment of the quality of the reflective constructs, the next section will demonstrate the statistical analysis technique utilised to evaluate the quality of the reflective constructs, which is CFA.

7.3.1.1 Confirmatory factor analysis (CFA)

Factor analysis is a multivariate statistical technique that can be used for developing, refining and evaluating scales and measures (Floyd and Widaman, 1995; Williams et al., 2010; Pallant, 2013). The major objective of factor analysis is to determine the underlying factors' structures of groups of indicators/variables used in the analysis (Hair et al., 2010). There are two different approaches to factor analysis (Floyd and Widaman, 1995; Fabrigar, Wegener, MacCallum and Strahan, 1999; Tabachnick and Fidell, 2007; Hair et al., 2010; Williams et al., 2010; Kline, 2013).

The first approach is exploratory factor analysis (EFA), which is suitable for searching for the factor structure of a group of indicators and also as a data reduction method (Floyd and Widaman, 1995; Henson and Roberts, 2006; Hair et al., 2010; Williams et al., 2010). EFA explores the data with the objective of providing information about the required number of factors that best represent the data (Hair et al., 2010). Therefore, EFA does not require the priori determination of the number of factors that should be extracted, nor impose restrictions on the factors loadings, such that the indicators can load on their own and the other factors (Fabrigar et al., 1999; Williams et al., 2010; Kline, 2013). By determining the number of factors and the loadings of each indicator on the factor/s, EFA plays a major role in assessing the quality of the constructs, i.e., factors, in that it tests the constructs' uni-dimensionality by ensuring that the indicators of any construct loads highly only on that construct (Hair et al., 2010). Overall, EFA should be used in the early stages of research, when the researcher has little theoretical and empirical support to determine the number of factors and specify the indicators that are influenced by the factors (Hurley et al., 1997; Fabrigar et al., 1999; Kline, 2013).

The second approach is CFA, which is suitable for confirming whether the actual factors' structures for groups of indicators conform to those hypothesised by the researcher based on theoretical or prior empirical studies (Floyd and Widaman, 1995; Henson and Roberts, 2006; Hair et al., 2010; Williams et al., 2010). In other words, CFA tests how well the indicators represent a smaller number of factors (Hair et al., 2010). Thus, CFA requires researchers to determine the number of factors that should be extracted and imposes restrictions on the factors loadings, such that the indicators can load on their own factor alone (Fabrigar et al., 1999; Williams et al., 2010; Kline, 2013). The objective of CFA, i.e., assessing whether the actual factors' structures for groups of indicators complies with those hypothesised by the researcher, represents the assessment of the quality of the constructs, i.e., factors, in terms of their reliability and validity (Floyd and Widaman, 1995; Hair et al., 2010). In short, CFA should be used in advanced stages of research when a researcher has sufficient theoretical and empirical support to determine the number of factors and specify the indicators that are influenced by these (Hurley et al., 1997; Fabrigar et al., 1999; Henson and Roberts, 2006; Kline, 2013).

In this research, CFA was utilised to evaluate the quality of the reflective constructs included in the research model, for two reasons. First, except for TMKA, all of the reflective constructs' indicators were derived from prior literature, which enables the number of factors, i.e., constructs, to be determined and the indicators that are influenced by each factor to be specified. Second, the procedure for assessing the quality of the constructs is more in line with the suitable application of CFA, i.e., assessing whether the actual factors' structures for groups of indicators complies with those hypothesised by the researcher, than that of EFA, i.e., searching for the factor structure of a group of indicators and as a data reduction method.

A further important decision is to determine the estimation method for the CFA model. CFA is considered a special case of SEM (Floyd and Widaman, 1995; Hair et al., 2010; Williams et al., 2010; Kline, 2013). There are two estimation methods of SEM; namely, covariance-based SEM (CB-SEM) and partial least squares SEM (PLS-SEM) (Fornell and Bookstein, 1982; Henseler et al., 2009; Hair et al., 2011; Peng and Lai, 2012; Hair et al., 2014; Sarstedt et al., 2014; Hair et al., 2017). In this research, CFA was conducted using PLS-SEM, for two reasons. First, PLS-SEM has proven to outperform CB-SEM regarding parameter accuracy when the sample size is below 250, which is the case in this research (n = 200) (Reinartz, Haenlein and Henseler, 2009). Second, PLS-SEM is the recommended estimation method of SEM when the underlying data population is unknown, which tends to be the case in social science research (Sarstedt, Hair, Ringle, Thiele and Gudergan, 2016). To illustrate, while PLS-SEM considers the constructs as composites, i.e., the data stem from a composite population, meaning that they are a linear combination of their indicators, CB-SEM deems constructs to be common factors, i.e., the data are drawn from a common factor population, that explain the covariation between their indicators (Becker, Rai and Rigdon, 2013; Henseler et al., 2014; Rigdon, 2016; Sarstedt et al., 2016; Hair et al., 2017). Sarstedt et al. (2016) proved that CB-SEM provides severely biased parameter estimates when the data are drawn from a composite population, whereas PLS-SEM provides minimal biased parameter estimates when the data stem from a common factor population. Sarstedt et al. (2016) pointed out that there is no absolute way of determining the type of data population - i.e., composite versus common factor - and, hence, advised the use of PLS-SEM until future research proposes clear guidelines about it. The CFA was performed following the procedure described in Tenenhaus and Hanafi (2010) and using SmartPLS version 3.2.6 (Ringle, Wende and Becker, 2015). This procedure entails connecting all constructs to each other with no recursive arrows and using a factorial weighting scheme. Having described the statistical analysis technique used to evaluate the quality of the reflective constructs, i.e., CFA, the following sections will explain and present the results of the assessment of the quality of the reflective constructs with regard to the internal consistency reliability (Section 7.3.1.1.1), convergent validity (Section 7.3.1.1.2) and discriminant validity (Section 7.3.1.1.3).

7.3.1.1.1 Internal consistency reliability

The internal consistency reliability is concerned with whether a construct's indicators are internally consistent in measuring the construct, based on the strength of the interrelation between them (Hair et al., 2010). Reliable constructs should have highly interrelated indicators, which indicates that they are measuring the same thing (ibid). There are two measures for internal consistency reliability; namely, Cornbach's alpha and composite reliability (Henseler et al., 2009; Hair et al., 2011; Hair et al., 2014). Both measures range from 0 to 1, with higher values denoting higher levels of reliability (Hair et al., 2017). Values between 0.60 and 0.70 are acceptable in exploratory research, whereas values between 0.70 and 0.95 are considered satisfactory when the research has reached an advanced stage (Hair et al., 2011; Hair et al., 2017). As shown in Table 7-3, all six reflective constructs included in the research model have Cronbach's Alpha and composite reliability values that are considered satisfactory, i.e., between 0.70 and 0.95, revealing that these reflective constructs possess internal consistency.

Table 7-3: The internal consistency reliability of the reflective constructs

Construct	Cronbach's Alpha	Composite reliability
COMP	0.75	0.86
CultureOutcome	0.89	0.92
CultureDetail	0.83	0.90
TMS	0.87	0.92
TMKA	0.88	0.93
USEFULNESS	0.81	0.89

7.3.1.1.2 Convergent validity

Convergent validity examines the extent to which a construct's indicators converge or share a high proportion of variance (Hair et al., 2010). There are two measures for evaluating convergent validity; namely, indicator reliability and average variance extracted (AVE) (Hair et al., 2017). Indicator reliability is represented by the indicator loading on the construct, and high loadings on a construct indicate that the indicators converge on a common point, the construct (Hair et al., 2010; Sarstedt et al., 2014).[96] The recommendations regarding the values of indicator loading are shown in Table 7-4 (Hair et al., 2011; Hair et al., 2017). The second measure, AVE, represents the amount of variance of a construct's indicators that is explained by the construct (Hair et al., 2017). The AVE should be 0.50 or higher, indicating that the amount of variance of the indicators explained by the construct is higher than that remaining in the error of the indicators (Henseler et al., 2009; Hair et al., 2011; Hair et al., 2014; Sarstedt et al., 2014).

[96] Indicator loadings represent the relationship between the latent construct and its indicators. Specifically, the indicator loadings represent, depending on the number of indicators, the results of a number of simple regression models, where the reflective construct is the independent variable and the reflective indicator is the dependent variable (see Figure 7-1) (Cenfetelli and Bassellier, 2009).

Table 7-4: Recommendations regarding the values for the indicator loading

Indicator loading	Decision
is ≥ 0.70 (needs to be significant)	Keep the indicator.
is ≥ 0.40 but < 0.70 (needs to be significant)	1. Keep the indicator, provided that its deletion would not increase the internal consistency reliability or AVE above the recommended thresholds. 2. Delete the indicator, provided that its deletion would increase the internal consistency reliability or AVE above the recommended thresholds. However, account for the content validity consideration.
is < 0.40	Delete the indicator, but account for the content validity consideration.

As can be seen from Table 7-5, all of the indicator loadings on all six of the reflective constructs included in the research model are equal to or above the recommended value of 0.70 and significant, indicating that all of the indicators are reliable.[97] In addition, the AVE values for all six of the reflective constructs included in the research model are above the suggested value of 0.50. Both results suggest that the convergent validity has been established for all of the reflective constructs included in the research model.

7.3.1.1.3 Discriminant validity

Discriminant validity represents the extent to which a theoretical construct is distinct or different from other constructs, using empirical standards (Hair et al., 2014; Hair et al., 2017). There are three measures for evaluating discriminant validity; namely, cross-loadings, the Fornell-Larcker criterion and, the most recent and recommended one, the Heterotrait-

[97] Given that PLS-SEM does not assume the data to be normally distributed, parametric significance tests cannot be utilised, and, therefore, PLS-SEM uses a non-parametric procedure called bootstrapping to test the significance of any coefficient, e.g., indicator loading (Henseler et al., 2009; Hair et al., 2011; Lee, Petter, Fayard and Robinson, 2011; Hair et al., 2014; Sarstedt et al., 2014; Nitzl, 2016; Hair et al., 2017). Bootstrapping involves drawing a large number of samples, bootstrapping samples, from the original sample and estimating the coefficient for each. These estimates allow the construction of a bootstrapping distribution, which is assumed to approximate the sampling distribution and can be used to calculate the standard error needed when testing for the significance of any coefficient (Henseler et al., 2009; Hair et al., 2011; Hair et al., 2014; Hair et al., 2017). In this research, the significance-testing of all reported results of CFA in PLS-SEM is based on 5,000 bootstrap samples, as recommended by Hair et al. (2014), Sarstedt et al. (2014) and Hair et al. (2017).

Table 7-5: Convergent validity for reflective constructs

Indicator	Indicator loadings	AVE	Construct
Q12_COMPa: The current level of competition for the major products of your business-unit.	0.88**		
Q12_COMPb: The level of price competition for your business-unit's major products.	0.88**	0.67	**COMP**
Q12_COMPc: The level of competition for purchasing raw materials for your business-unit's major products.	0.70**		
Q19_CultureOutcomeA: Being competitive	0.73**		
Q19_CultureOutcomeB: Focus on achievements.	0.86**		
Q19_CultureOutcomeC: Having high expectations for performance.	0.85**	0.69	**CultureOutcome**
Q19_CultureOutcomeD: Focus on action.	0.87**		
Q19_CultureOutcomeE: Focus on results.	0.84**		
Q19_CultureDetailF: Paying attention to detail.	0.86**		
Q19_CultureDetailG: Being precise.	0.87**	0.75	**CultureDetail**
Q19_CultureDetailH: Being careful.	0.87**		
Q8_TMSa: Top management considers that the costing system is important to the business-unit.	0.85**		
Q8_TMSb: Top management provides support to your business-unit's costing system.	0.93**	0.79	**TMS**
Q8_TMSc: Top management has provided adequate resources to implement your business-unit's costing system.	0.89**		
Q9_TMKAa: Top management has the enough knowledge about the importance of cost information in decision-making.	0.91**		
Q9_TMKAb: Top management is aware of the undesirable consequences of making decisions based on inaccurate cost information.	0.91**	0.81	**TMKA**
Q9_TMKAc: Top management appreciates the accountants' efforts relating to providing detailed cost information when making decisions.	0.88**		
Q2_USEFULNESSa: The business-unit's costing system provides product cost information that is useful when making different decisions.	0.88**		
Q2_USEFULNESSb: I rely on product cost information generated by the business-unit's costing system to make different decisions.	0.88**	0.72	**USEFULNESS**
Q2_USEFULNESSc: I am satisfied with the accuracy of the business-unit's costing system at assigning indirect costs to products for the purpose of decision-making.	0.79**		

*** $p < 0.05$, ** $p < .01$.**

Monotrait ratio of the correlations (HTMT) (Henseler, Ringle and Sarstedt, 2015; Hair et al., 2017).

Regarding the cross-loadings measure, any indicator should have a higher loading on its construct than any of the indicator's cross-loadings on other constructs in order to establish discriminant validity (Henseler et al., 2009; Hair et al., 2010; Hair et al., 2011; Hair et al., 2014; Sarstedt et al., 2014; Hair et al., 2017). In relation to the Fornell-Larcker measure, the square root of each construct's AVE should be higher than the construct's highest correlation with any other construct in order to establish discriminant validity (Henseler et al., 2009; Hair et al., 2010; Hair et al., 2011; Hair et al., 2014; Sarstedt et al., 2014; Hair et al., 2017). The third discriminant validity measure, HTMT, is "the mean of all correlations of indicators across constructs measuring different constructs…relative to the (geometric) mean of the average correlations of indicators measuring the same construct…" (Hair et al., 2017, p. 118). HTMT values above 0.85 and, in some situations, 0.90 indicate a lack of discriminant validity (Henseler et al., 2015; Hair et al., 2017).

Using the cross-loading measure, Table 7-6 shows that all indicators have higher loadings on their assigned constructs compared to their cross-loadings on other constructs. Utilising the Fornell-Larcker measure, Table 7-7 displays that the square root of the AVE for each construct, shown in bold on the diagonal, is higher than the construct's correlations with all other constructs, shown in the same row or column. Adopting the HTMT, Table 7-8 exhibits that all HTMT values fall below the conservative threshold value of 0.85. Collectively, these results support the discriminant validity of all of the reflective constructs included in the research model.

Table 7-6: Discriminant validity (cross-loadings measure)

Indicator	COMP	CultureOutcome	CultureDetail	TMS	TMKA	USEFULNESS
Q12_COMPa	**0.88**	0.12	-0.01	0.10	0.13	0.10
Q12_COMPb	**0.88**	0.11	-0.05	0.09	0.15	0.11
Q12_COMPc	**0.70**	0.05	-0.05	0.10	0.14	0.11
Q19_CultureOutcomeA	0.19	**0.73**	0.41	0.27	0.31	0.28
Q19_CultureOutcomeB	0.11	**0.86**	0.56	0.44	0.48	0.31
Q19_CultureOutcomeC	0.05	**0.85**	0.50	0.46	0.45	0.40
Q19_CultureOutcomeD	0.05	**0.87**	0.61	0.40	0.38	0.33
Q19_CultureOutcomeE	0.10	**0.84**	0.61	0.45	0.46	0.32
Q19_CultureDetailF	0.04	0.57	**0.86**	0.43	0.45	0.32
Q19_CultureDetailG	-0.10	0.59	**0.87**	0.36	0.31	0.28
Q19_CultureDetailH	-0.08	0.54	**0.87**	0.29	0.32	0.26
Q8_TMSa	0.13	0.43	0.40	**0.85**	0.62	0.37
Q8_TMSb	0.09	0.45	0.37	**0.93**	0.64	0.44
Q8_TMSc	0.09	0.44	0.35	**0.89**	0.59	0.46
Q9_TMKAa	0.19	0.45	0.38	0.60	**0.91**	0.26
Q9_TMKAb	0.15	0.40	0.36	0.62	**0.91**	0.24
Q9_TMKAc	0.13	0.51	0.41	0.65	**0.88**	0.37
Q2_USEFULNESSa	0.11	0.36	0.29	0.37	0.34	**0.88**
Q2_USEFULNESSb	0.16	0.32	0.28	0.38	0.28	**0.88**
Q2_USEFULNESSc	0.06	0.32	0.28	0.46	0.22	**0.79**

Table 7-7: Discriminant validity (Fornell-Larcker measure)

Construct	COMP	CultureOutcome	CultureDetail	TMS	TMKA	USEFULNESS
COMP	**0.82**					
CultureOutcome	0.11	**0.83**				
CultureDetail	-0.05	0.65	**0.87**			
TMS	0.11	0.49	0.42	**0.89**		
TMKA	0.17	0.51	0.42	0.69	**0.90**	
USEFULNESS	0.13	0.40	0.33	0.48	0.33	**0.85**

Table 7-8: Discriminant validity (HTMT measure)

Construct	COMP	CultureOutcome	CultureDetail	TMS	TMKA	USEFULNESS
COMP						
CultureOutcome	0.15					
CultureDetail	0.11	0.75				
TMS	0.14	0.55	0.49			
TMKA	0.21	0.56	0.48	0.79		
USEFULNESS	0.17	0.47	0.40	0.57	0.38	

7.3.2 Assessing the quality of the formative constructs

Three of the constructs included in the research model were characterised as formative in nature; namely, CultureControl, PC and CSC-DEVELOPED. The former was adopted from prior literature, whereas the latter two were developed by the researcher. These three were characterised as formative based on the main differences between reflective and formative constructs discussed in Section 7.3. For example, each indicator for each construct represents a specific facet of that respective construct's conceptual domain, and, thus, the indicators of each of the three constructs are not interchangeable, suggesting a formative measurement approach. Formative constructs are evaluated regarding content validity and the existence of collinearity among the formative indicators (Diamantopoulos and Winklhofer, 2001; Bisbe et al., 2007; Petter et al., 2007; Hair et al., 2014; Hair et al., 2017).[98]

7.3.2.1 Content validity

As mentioned in Section 7.3, it is critical to ensure that the indicators cover all, or at least the major, facets of the conceptual domain of the formative construct because each indicator represents a particular facet of the construct's conceptual domain. This can be done through establishing content validity (Petter et al., 2007; Hair et al., 2014; Hair et al., 2017), which is considered the most important criterion for evaluating formative constructs (Bollen and Lennox, 1991; Diamantopoulos and Winklhofer, 2001; Hair et al., 2017). Establishing content validity requires the researcher to: (1) determine the conceptual domain that the indicators seek to measure; (2) identify a comprehensive list of all indicators that cover the constructs' conceptual domain by conducting an extensive literature review; and (3) obtain

[98] There are two further criteria for evaluating formative constructs; namely, the significance of the indicator weight and convergent validity (Diamantopoulos and Winklhofer, 2001; Hair et al., 2014; Sarstedt et al., 2014; Hair et al., 2017). The former cannot be applied to evaluate stand-alone formative constructs, as is the case when conducting CFA (C. M. Ringle, personal communication, e-mail, November 12, 2016). Thus, this criterion is inapplicable. The latter criterion requires the inclusion of additional questions on the questionnaire and, hence, increases its length (Hair et al., 2014; Sarstedt et al., 2014; Hair et al., 2017). To avoid the undesirable consequences associated with increasing the length of the questionnaire, e.g., low response rate (Hair et al., 2017), this research did not use the convergent validity criterion to evaluate the formative constructs.

expert opinions regarding the appropriateness of the chosen indicators (Diamantopoulos and Winklhofer, 2001; Petter et al., 2007; Hair et al., 2017).

The first formative construct, CultureControl, was adopted from Baird et al. (2004) (see Section 6.3.2.1.2.1). Hence, the content validity of CultureControl has been established through adopting the construct from prior contingency research on optimal CSD. Baird et al. (2004) was the first contingency study on optimal CSD, operationalised from the perspective of ABC adoption, to hypothesise and empirically examine the link between CultureControl and optimal CSD. To this end, it specified the construct's conceptual domain and selected a comprehensive list of indicators to cover it (see Section 5.4.1.3). Table 7-9 exhibits the indicators of CultureControl, which represent different specific facets of the construct and, subsequently, are not interchangeable, supporting the characterisation of CultureControl as formative in nature.

Table 7-9: CultureControl indicators

Q20_CultureControlA:
Employee expectations are specified in detail.
Q20_CultureControlB:
Desired results are defined explicitly.
Q20_CultureControlC:
Work rules and/or specific work polices are used widely.
Q20_CultureControlD:
Direct supervision of employee activities takes place frequently.
Q20_CultureControlE:
Frequent monitoring of employee performance takes place.
Q20_CultureControlF:
Performance measures are precise and timely.
Q20_CultureControlG:
Performance reviews are detailed, comprehensive and frequent.
Q20_CultureControlH:
There is a strong link between the penalties imposed or rewards provided and the performance measures used.

The second formative construct, PC, was developed by the researcher through, initially, conducting a literature review (see Section 4.4.3.3) and, subsequently, carrying out exploratory semi-structured interviews (see Sections 6.3.1.1, 6.3.1.2.4 and 6.3.1.3.2). Therefore, and in effect, establishing the content validity of PC involved a four-step process. First, the conceptual domain of the construct was determined to be any aspect of production that increases the complexity within the production environment and can cause distortion in product costs if less complex than required costing systems are employed (see Section 4.4.3.3). Second, an intense literature review was conducted to identify an initial list of all of the possible PC dimensions, which resulted in the identification of 11 PC dimensions (see Section 4.4.3.3). Third, exploratory semi-structured interviews were carried out to obtain expert opinions regarding the appropriateness of the identified PC dimensions, which revealed the relevance of six PC dimensions (see Sections 6.3.1.1 and 6.3.1.2.4). More specifically, this step resulted in selecting five of the 11 identified PC dimensions - product complexity, product diversity, product customisation, the frequency of introducing new products and the frequency of making changes to products and manufacturing processes - and one PC dimension, production period, that was disclosed during the interviews (see Section 6.3.1.2.4). Fourth, the PC indicators were carefully selected to encompass all six PC dimensions. Table 7-10 presents the PC indicators and the corresponding PC dimensions that the indicators were intended to cover. The indicators, clearly, represent different aspects, i.e., dimensions, of PC and, thus, are not interchangeable, thereby supporting the characterisation of PC as formative in nature.

The third formative construct, CSC-DEVELOPED, was developed by the researcher through conducting a literature review (see Sections 2.4 and 4.4.3.2.2) and, subsequently, confirmed through carrying out exploratory semi-structured interviews (see Sections 6.3.1.1, 6.3.1.2.3 and 6.3.1.3). Accordingly, and in effect, establishing the content validity of CSC-DEVELOPED involved a four-step process. First, as noted in Section 2.4, this research deals with CSD in relation to the assignment of indirect costs to products, thereby determining the

Table 7-10: PC indicators and the covered PC dimensions

PC indicators	PC dimensions
Q14_PCcustomisation: Multiple-choice question about the percentage of customised and standardised products.	Product customisation.
Q15_PCa: Most products are complex to produce because they contain large number of components. **Q15_PCb:** Most products are complex to produce because they need to pass through large number of production stages/departments.	Product complexity.
Q15_PCc: A large number of different products are produced.	Product diversity-number of products.
Q15_PCd: Most products are produced in significantly different sizes.	Product diversity-size.
Q15_PCe: There are major differences in product volumes or batch sizes.	Product diversity-volume.
Q15_PCh: Most products require different processes to design, manufacture and distribute them.	Product diversity-process 1.
Q15_PCi: For some or all products, the manufacturing process is partially manual and partially automated.	Product diversity-process 2.
Q15_PCl: Each product line requires different levels of support department costs (e.g., engineering, purchasing and marketing costs).	Product diversity-support.
Q15_PCf: The manufacturing process is not standardised because changes to the production process need to be made if some factors (e.g., the type of material or machine) have been changed. **Q15_PCk:** There are frequent changes in products and production processes.	Frequency of making changes to products and manufacturing processes.
Q15_PCg: The production processes for most products take a long time.	Production period.
Q15_PCj: There are frequent new product introductions.	Frequency of introducing new products.

conceptual domain of the CSC construct as the complexity of the costing system in relation to the assignment of indirect costs to products. Second, a thorough literature review was conducted to identify the dimensions of CSC, which resulted in identifying six CSC dimensions (see Sections 2.4 and 4.4.3.2.2). Third, exploratory semi-structured interviews were carried out to obtain expert opinions regarding the suitability of the identified CSC dimensions, which conveyed the relevance of all six identified CSC dimensions of the number and nature of cost pools and cost drivers, the type of cost drivers and the method used to assign overhead costs to cost pools. Fourth, the CSC-DEVELOPED indicators were carefully chosen to cover the six CSC dimensions. Table 7-11 shows the CSC-DEVELOPED indicators and the corresponding CSC dimensions intended to be encompassed by the indicators. The indicators, clearly, represent different facets or dimensions of CSC and, therefore, are not interchangeable, confirming the characterisation of CSC as formative in nature.[99]

Table 7-11: CSC-DEVELOPED indicators and the covered CSC dimensions

CSC-DEVELOPED indicators	CSC dimensions
Q7_CSC-DEVELOPEDa: In the first stage, non-manufacturing overhead costs are assigned to each cost centre (cost pool) by using either a direct assignment or a cause-and-effect assignment. **Q7_CSC-DEVELOPEDb:** In the first stage, manufacturing overhead costs are assigned to each cost centre (cost pool) by using either a direct assignment or a cause-and-effect assignment. **Q7_CSC-DEVELOPEDc:** In the first stage, arbitrary assignments of overhead costs to cost centres (cost pools) are avoided whenever possible.	The method of assigning overhead costs to the cost pools.
Q7_CSC-DEVELOPEDd: The number of cost centres (cost pools) is enough to ensure that each cost centre (cost pool) contains only homogeneous production processes.	1. The number of cost pools. 2.The nature of cost pools, i.e., activity-based versus department-based.
Q7_CSC-DEVELOPEDe: The number of overhead allocation bases (cost drivers) is enough to ensure that products are allocated the amount of overhead costs consumed by them.	The number of cost drivers.
Q7_CSC-DEVELOPEDf: When assigning overhead costs from cost centres (cost pools) to products, the costing system uses bases (cost drivers) that represent the actual amount of overhead costs consumed.	1. The nature of cost drivers, i.e., transaction, duration and intensity drivers. 2. The type of cost drivers, i.e., volume-based and non-volume-based.

[99] For simplicity purposes, a general statement, Q7_CSC-DEVELOPEDf, was used to cover the two CSC dimensions of the nature and type of cost drivers (see Table 7-11). It was felt, based on the exploratory semi-structured interviews with costing staff, that using more specific statements about each of the nature and type of cost drivers would increase the difficulty of this question and might possibly lead to misunderstanding.

7.3.2.2 Collinearity between the formative indicators

The second criterion for evaluating the formative constructs, the existence of collinearity among the formative indicators, is concerned with ensuring that the correlations between the formative indicators are low (Diamantopoulos and Winklhofer, 2001; Cenfetelli and Bassellier, 2009; Henseler et al., 2009; Hair et al., 2011; Hair et al., 2014; Hair et al., 2017). High correlations are not expected between formative indicators (see Section 7.3), and so their existence may indicate that redundant indicators exist and, thus, can be considered for exclusion (Diamantopoulos and Winklhofer, 2001; Petter et al., 2007). The variance inflation factor (VIF) is the standard measure of collinearity, with VIF values of five and over representing the existence of collinearity between the formative indicators (Hair et al., 2011; Hair et al., 2017). The VIF was assessed separately for each formative construct, using SPSS. The results show that the VIF values of all of the formative indicators fall below the threshold value of five. In particular, the VIF values range from 2.07 to 4.56 for CultureControl indicators, 1.23 to 2.32 for PC indicators and 1.14 to 1.57 for CSC-DEVELOPED indicators. These results suggest that the three formative constructs included in the research model do not include redundant indicators. Having described and furnished the results of the evaluation of the quality of the latent constructs, i.e., the second aspect of the preliminary analysis, the next section will display the results of the third aspect of the preliminary analysis; namely, the descriptive analysis.

7.4 Descriptive analysis

This section aims to provide a detailed description of the characteristics of the sample of business-units used in the data analysis performed to test the research model, i.e., research hypotheses. Section 7.4.1 presents general information related to the respondents, business-units and the business-units' costing systems, while Section 7.4.2 provides descriptive statistics about the constructs included in the research model, including the contingency factors, CSC and the outcome measures.[100]

7.4.1 General information related to the respondents, business-units and the business-units' costing systems

7.4.1.1 Respondents

In Q27, the respondents were asked to provide information about their role in their business-unit. Table 7-12 shows that, in most of the business-units (93%), the assignment of overhead costs is controlled by those working within the accounting and finance function. In a few of the business-units, however, this responsibility is handled by other functions, such as the general management (4%), research and development (1%) and pricing and operations (0.5%). Nonetheless, this does not affect the fact that the researcher ensured that all of the respondents have the required knowledge regarding the overhead assignment procedure and business-units, and so are the appropriate people to answer the questionnaire (see Section 6.3.2.1.4.2).

Table 7-12: Respondents' role within the business-unit

Respondents role	**N**	**%**
Finance manager	70	35
Chief accountant	38	19
Head of the costing department/section	27	13.5
Cost accountant	22	11
Accountant	21	10.5
General manager	8	4
Chief financial officer	3	1.5
Finance manager assistant	2	1
Financial analyst	2	1
Head of the research and development department	2	1
Head of management accounting section	1	0.5
Pricing and operations manager	1	0.5
Not known	3	1.5
Total	**200**	**100**

[100] SPSS was utilised throughout the descriptive analysis.

7.4.1.2 Business-units

Besides specific questions related to the contingency factors, the respondents were asked general questions related to their business-unit. In Q13, the respondents were asked to indicate whether each of three different types of production describes the type of production of their business-unit. Table 7-13 indicates that the business-units operate under different modes of production, and that the production mode of most business-units (43.5%) can be characterised by more than one production type, as shown in the "Mix" column. In addition, Table 7-13 shows that, of those business-units that are characterised by only one production type, job-order production dominates (26.5%), followed by batch (15.5%) and mass (14.5%) production. These results suggest that the production environment of most Saudi business-units (85.5%) tends to be more sophisticated, as reflected by having a mixed production mode (43.5%), whereby multiple production modes are used within the same production facility to produce different products and job-order (26.5%) and batch (15.5%) production, where the levels of product diversity and product customisation are likely to be high.

Table 7-13: Types of production of business-units

	Mass only	Batch only	Job-order only	Mix	Total
N	29	31	53	87	**200**
%	14.5	15.5	26.5	43.5	**100**

In Q22, the respondents were asked to indicate whether their business-units are wholly Saudi-owned. The results show that most of the business-units (n = 133, 66.5%) are wholly Saudi-owned. Q25 asked the respondents to define their business-unit. As presented in Table 7-14, business-units are defined in different ways, and the most widely-used definition (31.5%) is an autonomous company.

Table 7-14: Definitions of business-units

Definition	**N**	**%**
A head office of a divisionalised company	36	18
A division of a divisionalised company	56	28
A branch of a division of a divisionalised company	23	11.5
An autonomous company	63	31.5
Others	22	11
Total	**200**	**100**

In Q26, the respondents were asked to determine the manufacturing sector of their business-unit. Table 7-15 reveals that over the half of business-units (57%) operate within the five manufacturing sectors related to other non-metallic mineral products (13.5%), food products (11.5%), fabricated metal products, except for machinery and equipment (11%), chemicals and chemical products (10.5%) and rubber and plastic products (10.5%), with each sector accounting for more than 10% of the total business-units. In addition, Table 7-15 shows that 5% of the business-units work in multiple manufacturing sectors. Overall, Table 7-15 suggests that the Saudi business-units that participated in this research cover a wide range of manufacturing sectors.[101]

7.4.1.3 Business-units' costing systems

Besides specific questions related to CSC, the respondents were asked three general questions, namely, Q3, Q4 and Q10, related to their business-units' costing systems. In Q3, the respondents were asked to indicate whether their business-units include each of four different types of costs within their product costs. As shown in Table 7-16, all of the business-units (n = 200, 100%) include direct manufacturing costs within their product costs.

[101] As noted in Section 6.3.2.1.2.2, Q26 made it possible to identify business-units that operate in the oil and natural gas production and extraction sector that was excluded from this research. However, as the initial contact with the business-units of the modified sample was made by the researcher through visits and phone calls, it was possible, before handing in/e-mailing the questionnaire, to identify whether the business-units operate in this sector, i.e., are a branch of the sole company, Saudi Aramco, operating in this sector (see Section 6.2). Given this, assurance can be granted that the business-units in the "Not known" category of Table 7-15 do not belong to the oil and natural gas production and extraction sector.

Table 7-15: Business-units manufacturing sectors

Name of the manufacturing sector (International Standard Industrial Classification (ISIC) code revision.4)	N	%
Manufacture of other non-metallic mineral products (23)	27	13.5
Manufacture of food products (10)	23	11.5
Manufacture of fabricated metal products, except for machinery and equipment (25)	22	11
Manufacture of chemicals and chemical products (20)	21	10.5
Manufacture of rubber and plastic products (22)	21	10.5
Manufacture of paper and paper products (17)	12	6
Multiple sectors (N/A)	10	5
Manufacture of beverages (11)	9	4.5
Manufacture of machinery and equipment n.e.c (28)	9	4.5
Manufacture of basic metals (24)	8	4
Manufacture of electrical equipment (27)	8	4
Manufacture of furniture (31)	7	3.5
Manufacture of basic pharmaceutical products and pharmaceutical preparations (21)	5	2.5
Printing and reproduction of recorded media (18)	4	2
Other manufacturing (32)	4	2
Manufacture of wood and products made of wood and cork, except for furniture (16)	2	1
Manufacture of textiles (13)	1	0.5
Manufacture of leather and related products (15)	1	0.5
Manufacture of motor vehicles, trailers and semi-trailers (29)	1	0.5
Not known (N/A)	5	2.5
Total	**200**	**100**

In addition, Table 7-16 reveals that most of the business-units include variable indirect manufacturing costs (n = 187, 93.5%), fixed indirect manufacturing costs (n = 174, 87%) and non-manufacturing costs (n = 145, 72.5%) within their product costs. The percentage of business-units that include non-manufacturing costs within their product costs (72.5%) is comparable to that found in other CSD studies conducted in other countries, such as the UK (77%, Drury and Tayles, 1994) and New Zealand (72%, Lamminmaki and Drury, 2001). The high percentages of business-units that include both indirect manufacturing costs and non-manufacturing costs indicate that Saudi business-units are aware of the importance of accounting for these costs when calculating product costs for decision-making purposes.

Table 7-16: Types of costs included in product costs

	Direct manufacturing costs N (%)	Variable indirect manufacturing costs N (%)	Fixed indirect manufacturing costs N (%)	Non-manufacturing costs N (%)
Included in product costs	200 (100)	187 (93.5)	174 (87)	145 (72.5)
Not included in product costs	-	13 (6.5)	26 (13)	55 (27.5)
Total (%)	**100**	**100**	**100**	**100**

In Q4, the respondents were asked how their business-unit assigns the overhead costs to products. Table 7-17 summarises the results. The absorption (multiple-rate) method represents an overhead assignment method that uses multiple department and machine-based cost pools and volume-based cost drivers, and is the most widely-used overhead assignment method by business-units (n = 117, 58.5%).

The absorption (plant-wide) method represents an overhead assignment method that uses a single cost pool and cost driver, and is the second most widely-utilised method by business-units (n = 37, 18.5%). The percentage of business-units using the absorption (plant-wide) method (18.5%) is higher than that reported in some CSD studies conducted in Saudi Arabia (2.3%, Al-Omiri and Drury, 2013) and other countries, including Finland (5%, Lukka and Granlund, 1996), Greece (0%, Ballas and Venieris, 1996), Sweden (0%, Ask, Ax and Jönsson, 1996) and the UK (3.2%, Drury and Tayles, 2005; 2.8%, Al-Omiri and Drury, 2007).[102] However, it is lower than that reported by other studies, such as Lamminmaki and Drury (2001) in New Zealand (50%). A possible explanation of the high percentage of

[102] At this stage of the descriptive analysis, it should be noted that some studies did not explicitly provide the percentage of the business-units using the various overhead assignment methods, the percentage of business-units using costing systems with different CSC levels and the mean values of the constructs representing the contingency factors and the outcomes (e.g., Drury and Tayles, 2000; 2005; Al-Omiri and Drury, 2007; 2013). In such situations and when possible, these percentages and mean values were calculated by the researcher based on the information provided in these studies.

business-units using this overhead assignment method (18.5%) compared to most of the CSD studies is that, although Saudi business-units seem to be aware of the importance of accounting for indirect manufacturing costs and non-manufacturing costs when calculating product costs for decision-making purposes (Table 7-16), many do not have sufficient resources to use costing systems with multiple cost pools and cost drivers to assign indirect costs to products.

The absorption (other methods) method reflects the "other methods" choice in Q4. All of the respondents who selected this choice stated that they use separate cost drivers for support cost pools, production and non-production-related, to allocate their costs to products. This indicates that these respondents assign overhead costs to separate production and support cost pools without reassigning the costs of the support cost pools to the production ones. This method of overhead assignment can be considered a refinement to the TCS (Shank and Govindarajan, 1988; Drury and Tayles, 1994), and is the third most widely-exploited method by business-units (n = 21, 10.5%).[103] The percentage of business-units using this method (10.5%) corresponds to that found by Lamminmaki and Drury (2001) in New Zealand (9%), but is lower than that found by Drury and Tayles (1994) in the UK (21%).

Combining the three percentages of business-units that use absorption (multiple-rate) (58.5%), absorption (plant-wide) (18.5%) and absorption (other methods) (10.5%) yields a total percentage of 87.5% for business-units that use TCS (see Sections 2.2 and 2.3). The dominance of TCS accords with the findings of other contingency studies on optimal CSD (e.g., 35.2%, Al-Omiri and Drury, 2007; 40.6%, Al-Omiri and Drury, 2013).[104] However, the percentage of business-units using TCS (87.5%) is higher than that found by other

[103] For a discussion of this method of assigning overhead costs to products, see Section 2.3.
[104] The percentages reported above for Al-Omiri and Drury (2007) and Al-Omiri and Drury (2013) are related to the whole sample. The percentages for the manufacturing industry sample are 52% for Al-Omiri and Drury (2007) and 40.3% for Al-Omiri and Drury (2013).

contingency studies on optimal CSD, reflecting an increased interest among Saudi business-units in overhead assignment methods representing TCS compared to the other methods discussed below.

The ABC overhead assignment method is the fourth most widely-employed method by the business-units (n = 14, 7%). The percentage of business-units using this method (7%) is lower than that found by other contingency studies on optimal CSD conducted in Saudi Arabia (14.5%, Al-Mulhem, 2002; 33.5%, Khalid, 2005; 28.6%, Al-Omiri and Drury, 2013), Australia (12.5%, Nguyen and Brooks, 1997; 11.6%, Booth and Giacobbe, 1998), the Czech Republic (22%, Pokorná, 2015), Ireland (12%, Clarke et al., 1999), Jordan (16.4%, Nassar et al., 2009), Morocco (12.9%, Elhamma and Moalla, 2015), New Zealand (41%, Hoque, 2000; 20.3%, Cotton et al., 2003) and the UK (17.5%, Innes et al., 2000; 15%, Drury and Tayles, 2005; 26.1%, Al-Omiri and Drury, 2007), yet congruent with the percentages reported by many contingency studies on optimal CSD (e.g., 10.5%, Schoute, 2011; 7%, Ahamadzadeh et al., 2011; 3.5%, Brierley, 2011). A possible explanation for the low percentage regarding the usage of the ABC method (7%) compared to most CSD studies, especially those conducted in Saudi Arabia, is that some studies might have failed to provide a detailed explanation of the ABC overhead assignment method, i.e., costing system, when asking about ABC usage, which in turn may have caused some unknowledgeable respondents incorrectly to claim that their business-unit used ABC (e.g., Malmi, 1996; Dugdale and Jones, 1997; Innes and Mitchell, 1997; Abernethy et al., 2001). Providing a detailed illustration of the ABC method, as was done in this research in choice (4) of Q4, may have assisted in removing any ambiguity about the meaning of ABC and, thus, reducing the magnitude of erroneous claims, i.e., overestimates, regarding its usage.

The direct costing method of overhead assignment is the least widely-used method by business-units (n = 11, 5.5%). The percentage of business-units using this method is consistent with that found by Ballas and Venieris (1996) in Greece (4.3%), but lower than that reported by other contingency studies on optimal CSD conducted in Saudi Arabia (16.5%, Al-Omiri and Drury, 2013) and the UK (22.7%, Al-Omiri and Drury, 2007).[105] The lower percentage of the usage of the direct costing method in this research (5.5%) compared to Al-Omiri and Drury (2007) (22.7%) and Al-Omiri and Drury (2013) (16.5%) may be attributed the level of awareness of the importance of assigning overhead costs to products in order to generate relevant cost information for decision-making among business-units worldwide, which might have been increasing over the years.

Overall, the results presented in Table 7-17 indicate that the overhead assignment methods that rely on multiple cost pools and cost drivers to assign indirect costs to products - i.e., absorption (multiple-rate), absorption (other methods) and ABC - are used more by Saudi business-units (76%) compared to the other methods of direct costing (5.5%), which does not assign indirect costs, and absorption (plant-wide) (18.5%) that uses a single cost pool and cost driver to assign indirect costs to products.

Table 7-17: Methods used to assign overhead costs to products

	Direct costing	**Absorption (plant-wide)**	**Absorption (multiple-rate)**	**Absorption (other methods)**	**ABC**	**Total**
N	11	37	117	21	14	**200**
%	5.5	18.5	58.5	10.5	7	**100**

In Q10, the respondents were asked to determine their business-unit's experience with ABC. Table 7-18 presents the results. The results show that most of the business-units (n = 101, 50.5%) never considered using ABC, and also that 17 (8.5 %) business-units are unlikely to use ABC in future, in that one (0.5%) business-unit had implemented it and subsequently decided to abandon it, and 16 (8%) had investigated its use and decided to reject it, with 11 of

[105] The percentages reported above for Al-Omiri and Drury (2013) and Al-Omiri and Drury (2007) are related to the whole sample. The percentages for the manufacturing industry sample are 18.8% for Al-Omiri and Drury (2013) and 21% for Al-Omiri and Drury (2007).

the 16 business-units establishing a system of activity or cost driver analysis. In addition, the results reveal that 19 (9.5%) of the business-units use ABC, and also 63 (31.5%) of the business-units are likely to use ABC in the foreseeable future, in that 34 (17%) business-units are intending to use ABC, 17 (8.5%) are investigating its use and 12 (6%) are intending to investigate its use. The 19 ABC users reported in Table 7-18 include 5 (2.5%) more business-units than the 14 listed in Table 7-17. Four of these five business-units were among those that use absorption (multiple-rate), and stated that ABC is used partially in their business-unit, e.g., in manufacturing. The remaining business-unit was among those that use absorption (other methods), and it stated that ABC is at the initial stage of implementation and needs further enhancement. Given this, the initial percentage (7%) of ABC adoption reported in Table 7-17 is more realistic and reflects the full usage of the system, compared to that (9.5%) provided in Table 7-18. Taken together, the results show that, although most Saudi business-units (59%) have either never considered using ABC (50.5%) or do not expect to use it in future (8.5%), a considerable percentage of business-units (41%) either use ABC (7%), demonstrate some usage of ABC (2.5%) or may use it in the future (31.5%).

Overall, the results correspond to those of some CSD studies but not others. For example, while the percentage of business-units that have never considered using ABC (50.5%) is consistent with the findings of some CSD studies (44%, Drury and Tayles, 1994; 46.9%, Innes et al., 2000; 41%, Lamminmaki and Drury, 2001; 52.3%, Al-Khadash and Mahmoud, 2010; 60%, Pokorná, 2015; 59.6%, Jusoh and Miryazdi, 2016), it is different from the results reported by other studies (28.2%, Brierley, 2011; 28.9%, Krumwiede, 1998a). Another example is that, whilst the percentage of business-units that may use ABC in the foreseeable future (31.5%) is comparable with the results of some CSD studies (36.9%, Al-Khadash and Mahmoud, 2010; 28.6%, Brierley, 2011), it is unlike that reported by other studies (7.7%, Khalid, 2005; 12.9%, Al-Omiri, 2012).

Table 7-18: Business-units' experience with ABC

Experience with ABC	**N**	**%**
Currently using ABC	19	9.5
Intending to use ABC	34	17
Currently investigating using ABC	17	8.5
Intending to investigate using ABC	12	6
Implemented ABC and subsequently decided to abandon it	1	0.5
Investigated using ABC and decided to reject it	5	2.5
Investigated using ABC and decided to reject it. However, the company established a system of activity analysis or cost driver analysis	11	5.5
Never considered using ABC	101	50.5
Total	**200**	**100**

7.4.2 Descriptive statistics regarding the constructs included in the research model

7.4.2.1 Contingency factors

The research model (see Section 6.3.1.3.1.1) includes seven contingency factors; namely, competition, cost structure, organisational culture, PC, business-unit size, TMS and TMKA. Table 7-19 provides the descriptive statistics regarding the construct of competition (COMP). The mean value of COMP (3.86) is above the scale midpoint (3) and relatively high, indicating that Saudi business-units face higher levels of competition. In addition, all of the indicators are above the scale midpoint (3), with Q12_COMPc, competition for purchasing raw materials for the major products, having the lowest mean value of 3.49, suggesting that Saudi business-units do not significantly encounter this type of competition compared to the overall, Q12_COMPa, and price, Q12_COMPb, types of competition. The high mean value of COMP (3.86) conforms to those reported on a five-point scale by Brierley (2007) (4.34), Schoute (2009) (3.40) and Jusoh and Miryazdi (2016) (3.12), all of which exceed the scale midpoint (3). In addition, it agrees with those reported on a seven-point scale for three separate COMP items by Drury and Tayles (2000) (4.43, 5.87 and 6.02), all of which exceed the scale midpoint (4).

Table 7-19: Descriptive statistics for COMP

Construct/indicator	Mean	SD	Minimum	Maximum
COMP	**3.86**	**0.68**	**1**	**5**
Q12_COMPa	3.98	0.77	1	5
Q12_COMPb	4.11	0.82	1	5
Q12_COMPc	3.49	0.93	1	5

Table 7-20 presents descriptive statistics about the elements - e.g., direct manufacturing costs - and constructs of cost structure - i.e., CostStructure-MANUFACTURING and CostStructure-COMBINED - that are made up by these elements. Table 7-20 shows that the percentage of direct manufacturing costs has the highest mean value of 65.86, followed by indirect manufacturing costs (18.67) and non-manufacturing costs (15.41). The dominance of direct manufacturing costs accords with the findings of other contingency studies on optimal CSD. For example, Drury and Tayles (2000), Al-Omiri and Drury (2007) and Al-Omiri and Drury (2013) found that, for manufacturing companies, direct manufacturing costs represent, respectively, 64%, 66.2% and 67.5% of the total costs. An interesting observation is that both indirect manufacturing costs and non-manufacturing costs have minimum values of zero. The respondents with such low values were asked about this in the follow up phone-interview/e-mail, and they confirmed that their business-unit has a very low percentage of either type of costs compared to the other types of costs.

The mean values of CostStructure-MANUFACTURING and CostStructure-COMBINED constructs are 23 and 34.07, respectively, which still convey the dominance of direct manufacturing costs. These percentages agree with those found by several contingency studies on optimal CSD. In relation to CostStructure-MANUFACTURING, Brierley (2007) and Nguyen and Brooks (1997) reported that the mean values of this are 21.48 and 31.52 for manufacturing business-units and companies, respectively. Regarding CostStructure-COMBINED, Al-Mulhem (2002) and Jusoh and Miryazdi (2016) found, respectively, that around 95% and 86.70% of the respondents, manufacturing business-units and companies, respectively, have a maximum percentage of overhead to total costs of 30%. Comparably, Drury and Tayles (2000), Al-Omiri and Drury (2007) and Al-Omiri and Drury (2013) reported that, for manufacturing business-units, indirect costs represent, respectively, 29.4%, 25.1% and 22.65% of the total costs.

Table 7-20: Descriptive statistics for cost structure elements and constructs

Elements of Cost structure					
Elements of cost structure	**Mean**	**Median**	**SD**	**Minimum**	**Maximum**
Cost structure (Direct manufacturing costs)	65.86	70	16.08	8.00	95.00
Cost structure (Indirect manufacturing costs)	18.67	18.50	10.19	0.00	61.00
Cost structure (Non-manufacturing costs)	15.41	12	11.45	0.00	67.00
Cost structure constructs					
Cost structure measure/construct	**Mean**	**Median**	**SD**	**Minimum**	**Maximum**
CostStructure-MANUFACTURING[a]	23.00	21	14.00	0.00	88.00
CostStructure-COMBINED	34.07	30	16.10	5.00	92.00

a. The descriptive statistics pertain to the original CostStructure-MANUFACTURING measure rather than the transformed one.

Table 7-21 shows the descriptive statistics for the constructs of organisational culture, i.e., CultureOutcome, CultureDetail and CultureControl. The mean values for all of the constructs exceed the scale midpoint (3) and are relatively high, with CultureControl having the lowest mean value (3.45). At the indicator level, all of the indicators have mean values above the scale midpoint (3) with, corresponding to what was found for the constructs, CultureControl indicators having the lowest mean values. This indicates that the cultural dimensions of outcome orientation and attention to detail characterise the organisational cultures of Saudi business-units more than the tight versus loose control one. The high mean values of CultureOutcome and CultureDetail (4 and 3.92, respectively) comply with those reported on a five-point scale by Baird et al. (2007) (4.11 and 3.89) and Zhang et al. (2015) (3.97 and 4.01), which all exceed the scale midpoint (3). Similarly, the high mean value of

CultureControl (3.45) is comparable with that reported on a seven-point reversed scale by Baird et al. (2004) (3.3), which is above the scale midpoint (4).

Table 7-21: Descriptive statistics for the constructs of organisational culture

Construct/indicator	Mean	SD	Minimum	Maximum
CultureOutcome	**4.00**	**0.69**	**1.60**	**5.00**
Q19_CulOutcomeA	4.06	0.79	1.00	5.00
Q19_CulOutcomeB	3.99	0.87	2.00	5.00
Q19_CulOutcomeC	3.91	0.89	1.00	5.00
Q19_CulOutcomeD	3.94	0.84	1.00	5.00
Q19_CulOutcomeE	4.09	0.77	2.00	5.00
CultureDetail	**3.92**	**0.75**	**1.67**	**5.00**
Q19_CulDetailF	3.86	0.90	1.00	5.00
Q19_CulDetailG	3.96	0.84	1.00	5.00
Q19_CulDetailH	3.96	0.86	1.00	5.00
CultureControl	**3.45**	**0.76**	**1.38**	**5.00**
Q20_CulControlA	3.11	0.90	1.00	5.00
Q20_CulControlB	3.64	0.80	1.00	5.00
Q20_CulControlC	3.70	0.92	1.00	5.00
Q20_CulControlD	3.68	0.81	1.00	5.00
Q20_CulControlE	3.56	0.87	1.00	5.00
Q20_CulControlF	3.40	0.99	1.00	5.00
Q20_CulControlG	3.32	1.00	1.00	5.00
Q20_CulControlH	3.20	1.06	1.00	5.00

Table 7-22 displays the descriptive statistics for the PC construct. The mean value of PC (2.72) is below the scale midpoint (3). This conveys that the production environment of Saudi business-units tends to be less complex, albeit they were found to have production types - i.e., mix, job-order and batch - that indicate higher levels of sophistication in the production environment (see Table 7-13). Examining the indicators, i.e., PC dimensions and sub-dimensions, however, shows that three indicators related to the product diversity PC dimension have mean values above the scale midpoint (3), suggesting their high impact in forming the PC of Saudi business-units. These indicators are Q15_PCd (size diversity, mean = 3.33), Q15_PCc (number of products, mean = 3.18) and Q15_PCe (volume diversity, mean = 3.14). The indicators related to the frequency of making changes to products and the production process (Q15_PCk, mean = 2.16 and Q15_PCf, mean = 2.44), production period (Q15_PCg, mean = 2.39) and the frequency of introducing new products (Q15_PCj, mean = 2.41) PC dimensions obtained the lowest mean values, signalling their minimal contribution to the PC of Saudi business-units.

The findings related to the levels of the various PC dimensions and sub-dimensions are congruent with those reported by several contingency studies on optimal CSD. For example, the low mean value of product customisation (Q14_PCcustomisation, 2.71) conforms to that reported on a seven-point scale by Drury and Tayles (2000) (3.18), which is below the scale midpoint (4). Similarly, Bjørnenak (1997) and Brierley (2007) reported, respectively, on a five-point scale, product customisation mean values that are either somewhat below (2.9) or slightly above (3.1) the scale midpoint (3). In the same vein, Schoute (2011) reported a mean value of 65 for the percentage of customisation in production, which slightly exceeds the scale midpoint (50%). Another example, the relatively high mean value of volume diversity (Q15_PCe, 3.14) complies with that reported on a seven-point scale by Drury and Tayles (2000) (5.80), which exceeds the scale midpoint (4). A further example, the low mean value of support diversity (Q15_PCl, 2.76) agrees with that reported on a seven-point scale by Drury and Tayles (2000) (3.96), which is slightly below the scale midpoint (4).

The descriptive information relating to the constructs of business-unit size is shown in Table 7-23 – SizeRevenue - and Table 7-24, SizeEmployees. Before providing this information, it is important to note that there is no convention regarding the definition of small and medium-sized business-units in Saudi Arabia. In addition, contingency studies on optimal CSD conducted in Saudi Arabia have defined small and medium-sized business-units differently

Table 7-22: Descriptive statistics for PC

Construct/indicator	Mean	SD	Minimum	Maximum
PC	**2.72**	**0.70**	**1.15**	**5.00**
Q14_PCcustomisation	2.71	1.60	1.00	5.00
Q15_PCa	2.62	1.22	1.00	5.00
Q15_PCb	2.75	1.19	1.00	5.00
Q15_PCc	3.18	1.26	1.00	5.00
Q15_PCd	3.33	1.22	1.00	5.00
Q15_PCe	3.14	1.17	1.00	5.00
Q15_PCf	2.44	1.21	1.00	5.00
Q15_PCg	2.39	1.05	1.00	5.00
Q15_PCh	2.72	1.30	1.00	5.00
Q15_PCi	2.80	1.20	1.00	5.00
Q15_PCj	2.41	1.02	1.00	5.00
Q15_PCk	2.16	0.99	1.00	5.00
Q15_PCl	2.76	1.16	1.00	5.00

(Al-Mulhem, 2002; Khalid, 2005; Al-Omiri and Drury, 2013).[106] For this reason, the definition of the European Union, which defines small and medium-sized business-units as those with a sales revenue of 50 million euro or less - approximately 200 million Saudi riyal (SR) - and a number of employees of less than 250, is used to characterise business-units in relation to their size.[107] In addition, the usage of the European Union's definition or other similar definitions by other contingency studies on optimal CSD also justifies this choice (e.g., Baird et al., 2004; Drury and Tayles, 2005; Al-Omiri and Drury, 2007; Schoute, 2009).

Table 7-23 provides information about SizeRevenue. Examining the distribution of SizeRevenue shows that the business-units represent different business-unit sizes, and that the majority (61.5%) of them are small or medium-sized, as indicated by having a sales revenue of 200 million SR or less (see the first six of the nine amounts included in Table 7-23). The percentage of small and medium-sized business-units per SizeRevenue (61.5%) is congruent

[106] Al-Mulhem (2002) defined small and medium-sized business-units as those with a sales revenue not exceeding 100 million Saudi riyal, whereas Al-Omiri and Drury (2013) set this figure as not exceeding 300 million Saudi riyal. Khalid (2005) did not explain how the study defined large business-units when examining the influence of business-unit size on ABC adoption.

[107] At the time of administrating the questionnaire, April to June 2015, the average exchange rate was 1 euro to 4.21 SR, and 1 English Pound to SR 5.80 SR.

with that reported by Al-Omiri and Drury (2013) in Saudi Arabia (51%). Comparing the results of other levels of SizeRevenue with those of other contingency studies on optimal CSD reveals that the size of the business-units that participated in this research corresponds to that reported in some studies but is lower than that reported in other studies. For example, while the percentage of business-units with a sales revenue exceeding 100 million SR (56.5%) and 300 million SR (29.5%), respectively, conforms to that reported by Al-Mulhem (2002) (61.3%) and Clarke et al. (1999) (27%), the percentage of business-units with a sales revenue exceeding 300 million SR (29.5%) is lower than that reported in other studies (79%, Drury and Tayles, 2005; 86%, Al-Omiri and Drury, 2007).[108]

For SizeEmployees, Table 7-24 shows that this ranges from 20 to 4500, with mean and median values of 476.7 and 300, respectively. These values are comparable to the mean of approximately 420 reported by Bjørnenak (1997) and Brierley's (2007) report of a mean of approximately 372 and a median of 350. Examining the distribution of SizeEmployees reveals that business-units represent different business-unit sizes, and that 42.5% of the business-units are small or medium-sized, as defined by having fewer than 250 employees. The percentage of small and medium-sized business-units per SizeEmployees agrees with the 33.7% reported by Maiga and Jacobs (2007). Jointly, the descriptive statistics for SizeRevenue and SizeEmployees show that both small and medium-sized business-units and large business-units are represented approximately equally in the sample for this research.

Table 7-25 presents the descriptive statistics for the TMS and TMKA constructs. The mean values of TMS and TMKA are 4.10 and 4.12, respectively, which exceed the scale midpoint (3) and are high, suggesting that Saudi business-units have top managements that provide a high amount of support for the costing system and are knowledgeable and aware of the importance of cost information in decision-making. At the indicator level, all indicators have

[108] 300 million SR equals approximately 50 million English pounds.

Table 7-23: Information about SizeRevenue

The amount of sales revenue	N	%
Less than 10 million SR	18	9
10 to 30 million SR	25	12.5
More than 30 to 75 million SR	25	12.5
More than 75 to 100 million SR	19	9.5
More than 100 to 150 million SR	22	11
More than 150 to 200 million SR	14	7
More than 200 to 300 million SR	18	9
More than 300 to 500 million SR	16	8
More than 500 million SR	43	21.5
Total	**200**	**100**

Table 7-24: Descriptive statistics for SizeEmployees[a]

Mean	476.66	
Median	300	
SD	623.33	
Minimum	20	
Maximum	4500	
Level of the number of employees	**N**	**%**
less than 100	35	17.5
100 to less than 250	50	25
250 to less than 500	57	28.5
500 to less than 1000	34	17
1000 and more	24	12
Total	**200**	**100**

a. The descriptive statistics pertain to the original rather than the transformed SizeEmployees measure.

mean values of nearly 4 or above. The high mean value of TMS (4.10) complies with that reported on a five-point scale by McGowan and Klammer (1997) (3.5) and also those reported on a seven-point scale by Shields (1995) (4.93) and Baird et al. (2007) (4.59), all of which exceed the scales' midpoint (3 and 4, respectively). Likewise, the high mean value of TMKA (4.12) is similar to those reported on a five-point scale by Al-Khadash and Feridun (2006) (4.48) and Al-Khadash and Mahmoud (2010) (3.82 to 4.26 for 12 TMKA items), all of which exceed the scale midpoint (3).

Table 7-25: Descriptive statistics for TMS and TMKA

Construct/indicator	Mean	SD	Minimum	Maximum
TMS	**4.10**	**0.77**	**1.33**	**5.00**
Q8_TMSa	4.41	0.72	1.00	5.00
Q8_TMSb	4.02	0.89	1.00	5.00
Q8_TMSc	3.87	0.99	1.00	5.00
TMKA	**4.12**	**0.74**	**1.00**	**5.00**
Q9_TMKAa	4.24	0.75	1.00	5.00
Q9_TMKAb	4.13	0.80	1.00	5.00
Q9_TMKAc	3.99	0.92	1.00	5.00

7.4.2.2 Costing system complexity (CSC)

As mentioned in Section 6.3.2.1.2.1, CSC was measured by four constructs, i.e., measures; namely, CSC-CostPools, CSC-CostDrivers, CSC-COMPOSITE and CSC-DEVELOPED. Regarding CSC-CostPools, Table 7-26 indicates that it ranges from 0, direct costing, to 305, with mean and median values of 18.2 and 7, respectively. For CSC-CostDrivers, Table 7-26 also shows that it ranges from 0, direct costing, to 10, with mean and median values of 2.14 and 2, respectively. As shown in Table 7-27, the statistics pertaining to CSC-CostPools and CSC-CostDrivers are congruent with those reported by Brierley (2007), but tend to be lower than those reported by other contingency studies on ABC adoption, given that the latter studies reported on CSC-CostPools and CSC-CostDrivers for ABC users who typically have high numbers of cost pools and cost drivers.

A closer look at CSC, in terms of CSC-CostPools and CSC-CostDrivers, can be obtained by examining Table 7-28. This table provides information about the total number/percentage of business-units included in nine different levels of each of the number of cost pools and cost drivers (see the total row and column in Table 7-28) and a cross tabulation of the number of cost pools by the number of cost drivers. Table 7-28 indicates that 63% of business-units have ten or fewer cost pools and that 75.5% of the business-units have two or fewer cost drivers. In addition, it shows that only 17.5% of the business-units have more than ten cost pools and two cost drivers (see the highlighted cells in Table 7-28). To allow meaningful comparison with other contingency studies on CSC that excluded direct costing users, these percentages should be calculated by precluding direct costing users, whereby the percentages of business-units that use ten or fewer cost pools, two or fewer cost drivers and more than ten cost pools and two cost drivers are 60.8%, 74% and 18.5%, respectively. Compared with other contingency studies on CSC, Table 7-29 reveals that the proportions of business-units with ten or fewer cost pools and those with two or fewer cost drivers, i.e., business-units with lower CSC, are higher. In addition, Table 7-29 provides that the proportion of business-units that have more than ten cost pools and two cost drivers, i.e., business-units with higher CSC, is lower than those reported in other contingency studies on CSC. These findings correspond with those provided in Section 7.4.1.3, in that the percentage of business-units using ABC, a complex costing system, is lower in this research than in other contingency studies on CSC.[109]

On the 16-point scale CSC-COMPOSITE construct, business-units with more than ten cost pools and two cost drivers should have at least a score of eight (see the superscript numbers in the highlighted cells in Table 7-28). Table 7-30 shows that 28.5% of the business-units have a score of eight or above, which is higher than the percentage of business-units with more than ten cost pools and two cost drivers (17.5%).[110] The additional 11% represents business-units that have either a high number of cost pools and a low number of cost drivers, or vice versa (see the bolded cells in Table 7-28). Given that Drury and Tayles (2005) excluded direct costing users, the percentage of business-units that scored 8 or above (28.5%) should be computed after excluding direct costing users, to allow a meaningful comparison with Drury and Tayles' (2005) results. Precluding direct costing users, the percentage of

[109] The percentage of ABC usage found in this research is 7%, whereas it is 15%, 26.1% and 28.6% in Drury and Tayles (2005), Al-Omiri and Drury (2007) and Al-Omiri and Drury (2013), respectively.
[110] 17.5% is the percentage of business-units that have more than ten cost pools and two cost drivers, including direct costing business-units.

business-units that scored 8 or above is 30.2%, which is lower than that reported by Drury and Tayles (2005) (46.5%). This confirms the finding reported earlier that the proportion of business-units with higher CSC, as roughly indicated by having more than ten cost pools and two cost drivers, is lower in this research than in other contingency studies on CSC.

With respect to CSC-DEVELOPED, Table 7-31 conveys the descriptive statistics for the 152 respondents who answered Q7 related to this construct. The mean value of CSC-DEVELOPED (3.79) is above the scale midpoint (3) and relatively high, indicating that Saudi business-units that use multiple cost pools and cost drivers tend to employ more complex costing systems in terms of all six CSC dimensions covered by the construct (see Sections 2.4 and 7.3.2.1). Examining the descriptive statistics of the individual indicators, Table 7-31 provides that all of the indicators have mean values above the scale midpoint (3). The highest mean value (4.19) is for CSC-DEVELOPEDb related to the assignment of manufacturing overhead costs to cost pools, which suggests that the costing systems of Saudi business-units are most complex in relation to the CSC dimension related to the method used for assigning overhead costs to cost pools. However, this fact is only notable for manufacturing overhead costs, given that CSC-DEVELOPEDa pertaining to the assignment of non-manufacturing overhead costs to cost pools obtained the lowest mean value (3.16).

Table 7-26: Information about the number of cost pools and drivers[a]

	CSC-CostPools	**CSC-CostDrivers**
Mean	18.20	2.14
Median	7	2
SD	36.29	1.90
Minimum	0	0
Maximum	305	10

a. The descriptive statistics pertain to the original rather than the transformed CSC-CostPools and CSC-CostDrivers.

Table 7-27: Comparison of the mean and median number of cost pools and drivers across CSD studies

	This research	(Brierley, 2007)	(Bjørnenak, 1997)	(Innes and Mitchell, 1995)	(Innes et al., 2000)	(Cotton et al., 2003)	(Pokorná, 2015)
CSC-CostPools mean	18.20	9.10	38.34	N/A	N/A	N/A	N/A
CSC-CostPools median	7	10	N/A	10	22	6	N/A
CSC-CostDrivers mean	2.14	1.64	1.79	N/A	N/A	N/A	18
CSC-CostDrivers median	2	2	N/A	10	14	5	5

Table 7-28: Cross tabulation of the number of cost pools by the number of cost drivers[a, b, c]

	Number of cost drivers									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7-10**	**>10**	
Number Of cost pools	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	**Total N (%)**
0	11 (5.5)[0]									11 (5.5)
1		37 (18.5)[2]								37 (18.5)
2-3		5 (2.5)[3]	6 (3)[4]	1 (0.5)[5]						12 (6)
4-5		8 (4)[4]	11 (5.5)[5]	2 (1)[6]	1 (0.5)[7]	**1 (0.5)[8]**				23 (11.5)
6-10		19 (9.5)[5]	15 (7.5)[6]	7 (3.5)[7]		**1 (0.5)[9]**	**1 (0.5)[10]**			43 (21.5)
11-20		9 (4.5)[6]	8 (4)[7]	5 (2.5)[8]	2 (1)[9]	4 (2)[10]	1 (0.5)[11]	1 (0.5)[12]		30 (15)
21-30		3 (1.5)[7]	**7 (3.5)[8]**	3 (1.5)[9]	1 (0.5)[10]		2 (1)[12]	1 (0.5)[13]		17 (8.5)
31-50		**2 (1)[8]**	**3 (1.5)[9]**	1 (0.5)[10]	1 (0.5)[11]	1 (0.5)[12]	1 (0.5)[13]	3 (1.5)[14]		12 (6)
> 50		**2 (1)[9]**	**5 (2.5)[10]**	2 (1)[11]	1 (0.5)[12]	2 (1)[13]	2 (1)[14]	1 (0.5)[15]		15 (7.5)
Total N (%)	11 (5.5)	85 (42.5)	55 (27.5)	21 (10.5)	6 (3)	9 (4.5)	7 (3.5)	6 (3)	0 (0)	200 (100)

a. The superscript numbers refer to the ordinal rankings on a 16-point scale of 0 - the one point representing direct costing users - and 2-16, the 15 points representing business-units that use all of the remaining overhead assignment methods, for CSC-COMPOSITE (see Section 6.3.2.1.2.1).

b. Of the 14 ABC users, ten are in the highlighted cells representing higher levels of CSC in terms of the number of cost pools and cost drivers.

c. Of the five business-units that indicated some usage of ABC, three are in the highlighted cells representing higher levels of CSC in terms of the number of cost pools and cost drivers.

Table 7-29: Comparison of the level of CSC across CSC studies

The number of cost pools and/or cost drivers	This research[a]	**(Drury and Tayles, 2005)**	**(Al-Omiri and Drury, 2007)**	**(Al-Omiri and Drury, 2013)**
Ten or fewer cost pools	60.8%	35.3%	32.1%	30.6%
Two or fewer cost drivers	74%	59%	36.6%	34.7%
More than ten cost pools and two cost drivers	18.5%	33.5%	53.6%	57.6%

a. This column shows the percentages after excluding direct costing business-units because the other CSC studies shown in the table did not include direct costing business-units.

Table 7-30: Information about the composite measure

CSC-COMPOSITE score	**N**	**%**
0	11	5.5
2	37	18.5
3	5	2.5
4	14	7
5	31	15.5
6	26	13
7	19	9.5
8	**15**	**7.5**
9	**11**	**5.5**
10	**12**	**6**
11	**4**	**2**
12	**5**	**2.5**
13	**4**	**2**
14	**5**	**2.5**
15	**1**	**0.5**
16	**0**	**0**
Total	**200**	**100**

7.4.2.3 Costing system outcomes

The research model includes two outcome measures, namely, USEFULNESS and USAGE, to represent the optimality of the level of CSC. Table 7-32 shows the descriptive statistics for the USEFULNESS and USAGE constructs. The mean value of USEFULNESS is 4.09,

Table 7-31: Descriptive statistics for CSC-DEVELOPED

Construct/indicator	Mean	SD	Minimum	Maximum
CSC-DEVELOPED	**3.79**	**0.54**	**2.5**	**5**
Q7_CSC-DEVELOPEDa	3.16	1.35	1	5
Q7_CSC-DEVELOPEDb	4.19	0.62	2	5
Q7_CSC-DEVELOPEDc	3.95	0.96	1	5
Q7_CSC-DEVELOPEDd	3.82	0.83	2	5
Q7_CSC-DEVELOPEDe	3.89	0.73	1	5
Q7_CSC-DEVELOPEDf	3.74	0.89	1	5

which exceeds the scale midpoint (3) and is high. This indicates that the respondents perceive the costing systems employed by the Saudi business-units to be highly useful and accurate. Examining the indicators of USEFULNESS reveals that the items related to usefulness - Q2_ USEFULNESSa and Q2_ USEFULNESSb - obtained higher mean values compared to that related to accuracy, Q2_ USEFULNESSc, suggesting that more improvements in the CSD of Saudi business-units are needed in order to enhance the accuracy of the overhead assignment procedure. The high mean value of USEFULNESS (4.09) agrees with that pertaining to either USEFULNESS, satisfaction or evaluation of overall success, as reported on a five-point scale by Foster and Swenson (1997) (3.17), McGowan and Klammer (1997) (3.83), Nassar et al. (2009) (4.15 to 4.30),[111] Schoute (2009) (3.37) and Zhang et al. (2015) (3.86) and on a seven-point one by Shields (1995) (4.35), all of which exceed the scale's midpoints (3 and 4, respectively).

For USAGE, the mean value is 3.80, which is above the scale midpoint (3) and relatively high, indicating the intense usage by Saudi business-units of cost information in decision-making. The high mean value of USAGE (3.80) agrees with those reported on a five-point

[111] Nassar et al. (2009) measured respondents' satisfaction with the benefits, calculation methods and cost reduction that arose following ABC implementation. The mean values for these three aspects of satisfaction were 4.25, 4.15 and 4.30, respectively.

scale by Nassar et al. (2009) (3.76 and 4.14)[112] and Schoute (2009) (3.71), all of which exceed the scale midpoint (3).

Table 7-32: Descriptive statistics for USEFULNESS and USAGE

Construct/indicator	Mean	SD	Minimum	Maximum
USEFULNESS	**4.09**	**0.70**	**1.00**	**5.00**
Q2_ USEFULNESSa	4.34	0.78	1.00	5.00
Q2_ USEFULNESSb	4.15	0.79	1.00	5.00
Q2_ USEFULNESSc	3.77	0.92	1.00	5.00
USAGE	**3.80**	**0.76**	**1.50**	**5.00**

7.5 Conclusion

The objective of this chapter was to provide the results of the preliminary analysis performed prior to carrying out the data analysis to test the research hypotheses, i.e., research model, concerning the impact of different contingency factors on the optimal level of CSC, i.e., optimal CSD. Two objectives lay behind conducting the preliminary analysis; namely, to ensure the appropriateness of the data for the data analysis and to provide a detailed description of the data characteristics. Given this, this chapter contributed to realising the third main contribution of this research and, thus, the research aim (see Section 1.5).

This chapter covered three different aspects of the preliminary analysis. The first aspect was concerned with examining and preparing the data regarding problems relating to missing data, inconsistent questionnaire answers, outliers and normality, while the second aspect dealt with the assessment of the quality of the latent constructs, including the reflective and formative ones. These two aspects are related to the first objective of performing the preliminary analysis, i.e., ensuring the suitability of the data for the data analysis. The third aspect involved a descriptive analysis of the respondents, business-units, business-units' costing systems and the constructs included in the research model. The third aspect was

[112] Nassar et al. (2009) asked the respondents about the extent of cost information usage in pricing decisions and overall decision-making. The mean values for these USAGE measures were 3.76 and 4.14, respectively.

concerned with the second objective of carrying out the preliminary analysis, i.e., providing a detailed description of the data characteristics. Having provided the results of the preliminary analysis, the next chapter will present the results of testing the hypotheses regarding the matching sub-form of fit.

Chapter eight: The developed and employed procedure for testing for the matching sub-form of fit and the results of testing the hypotheses related to the matching sub-form of fit

8.1 Introduction

This chapter aims to: (1) develop and employ a procedure that encompasses the recommended joint usage of PRA and RSM to test for the matching sub-form of fit; and (2) provide the results of testing the first seven hypotheses shown in Table 8-1. These hypotheses are related to the influence of the contingency factors on the optimal level of CSC, i.e., optimal CSD, from the perspective of the matching sub-form of fit. These hypotheses are concerned with the impact of each of the seven contingency factors, individually, on the optimal level of CSC from the viewpoint of the matching sub-form of fit (see Sections 3.3.2, 3.3.2.1, 5.3 and 5.4). This impact entails two elements; namely, the direction of the association between the contingency factor and the optimal level of CSC - i.e., positive or negative - and the magnitude and sign of the effect of the misfit, including both over- and under-fit, between the contingency factor and the optimal level of CSC on the outcomes (see Section 3.3.2.1). Given the above, this chapter contributes to realising the three main contributions of this research relating to, respectively, the application of contingency theory with respect to the adopted forms of fit, the statistical analysis techniques employed to test for the matching sub-form of fit and the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5). Thus, it assists in achieving the research aim of investigating the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. In addition, this chapter contributes to realising the second minor contribution of this research concerning accounting for the effect of organisational factors relating to the organisation's management and employees (see Section 1.5). Hence, it assists in successfully considering the main limitation of contingency research on optimal CSD and, therefore, accomplishing the research aim (see Section 1.5).

This chapter is organised as follows. Section 8.2 explains PRA and RSM that were utilised to test the seven matching sub-form of fit's hypotheses. This explanation includes the developed and employed procedure encompassing the recommended joint usage of PRA and RSM to test the matching sub-form of fit's hypotheses; namely, the two-stage procedure involving the recommended combined usage of PRA and RSM. Section 8.3 evaluates the assumptions of PRA and RSM and provides information about the additional data preparation performed prior to the commencement of the analysis. Section 8.4 presents the results of testing the seven hypotheses of the matching sub-form of fit, while Section 8.5 includes a summary of these. Section 8.6 concludes this chapter.

Table 8-1: Matching sub-form of fit hypotheses

Contingency factor	Hypothesis
Competition	**Hypothesis 1:** *From the perspective of the matching sub-form of fit, competition is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between competition and the optimal level of CSC and a negative impact of the misfit between competition and the optimal level of CSC on the two outcomes.*
Cost structure	**Hypothesis 2:** *From the perspective of the matching sub-form of fit, the level of overhead costs is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between the level of overhead costs and the optimal level of CSC and a negative impact of the misfit between the level of overhead costs and the optimal level of CSC on the two outcomes.*
Organisational culture	**Hypothesis 3a:** *From the perspective of the matching sub-form of fit, an outcome orientation culture is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between an outcome orientation culture and the optimal level of CSC and a negative impact of the misfit between an outcome orientation culture and the optimal level of CSC on the two outcomes.* **Hypothesis 3b:** *From the perspective of the matching sub-form of fit, an attention to detail culture is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between an attention to detail culture and the optimal level of CSC and a negative impact of the misfit between an attention to detail culture and the optimal level of CSC on the two outcomes.* **Hypothesis 3c:** *From the perspective of the matching sub-form of fit, a tight control culture is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between a tight control culture and the optimal level of CSC and a negative impact of the misfit between a tight control culture and the optimal level of CSC on the two outcomes.*

Table 8-1: Matching sub-form of fit hypotheses (continued)

Contingency factor	Hypothesis
Production complexity (PC)	**Hypothesis 4:** *From the perspective of the matching sub-form of fit, PC is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between PC and the optimal level of CSC and a negative impact of the misfit between PC and the optimal level of CSC on the two outcomes.*
Business-unit size	**Hypothesis 5:** *From the perspective of the matching sub-form of fit, business-unit size is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between business-unit size and the optimal level of CSC and a negative impact of the misfit between business-unit size and the optimal level of CSC on the two outcomes.*
Top management support (TMS)	**Hypothesis 6:** *From the perspective of the matching sub-form of fit, TMS is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes, namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between TMS and the optimal level of CSC and a negative impact of the misfit between TMS and the optimal level of CSC on the two outcomes.*
Top management knowledge and awareness of the importance of cost information in decision-making (TMKA)	**Hypothesis 7:** *From the perspective of the matching sub-form of fit, TMKA is expected to have a positive influence on the optimal level of CSC that yields the highest levels of two outcomes; namely, USEFULNESS and USAGE. This positive influence entails two elements; namely, a positive association between TMKA and the optimal level of CSC and a negative impact of the misfit between TMKA and the optimal level of CSC on the two outcomes.*

8.2 Polynomial regression analysis (PRA) and response surface methodology (RSM)

8.2.1 Overview

To test the congruence/fit/matching hypotheses, researchers have relied on various difference-score models, such as algebraic, absolute, squared, empirical-Euclidian distance and residual analysis (see Section 3.3.2.1).[113] The various difference-score models utilised to test the congruence/fit/matching hypotheses, however, are associated with many problems that can reduce the validity of their results (Edwards, 1994; 2002; Meilich, 2006; Burkert et al., 2014). The theoretical version of the difference-score models - e.g., algebraic, absolute and squared difference-score models - and the empirical one - e.g., empirical-Euclidian distance and residual analysis - suffer from common issues, such as: (1) low reliability; (2) high ambiguity caused by combining distinct constructs into a single score; (3) confounding the effects of the component/predictor constructs - i.e., CSC and contingency - on the outcome construct; (4) forcing untested constraints on the effects of the component constructs on the outcome construct; (5) reducing a three-dimensional relationship into a two-dimensional one; and (6) imposing the untested assumption that the outcome, e.g., financial performance, is equal along all fit points (Edwards, 1994; 1996; 2002; Chenhall and Chapman, 2006; Meilich, 2006; Cafri, van den Berg and Brannick, 2010; Phillips, 2013; Burkert et al., 2014). Specific problems associated with the theoretical version of the difference-score models include, but are not limited to, imposing the unexamined assumption that fit is achieved when the component constructs share the same score, i.e., CSC = contingency (Burkert et al., 2014). Particular problems related to the empirical version of the difference-score models encompass, but are not limited to, (1) the impossibility of identifying whether there is a fit line and, assuming that it exists, whether the predicted optimal level of

[113] The empirical-Euclidian distance and residual analysis difference-score models are conceptually similar to the absolute and squared difference-score models, respectively.

the intended component construct, i.e., CSC, or the predicted fit line is located below, on or above the true fit line; and (2) the dependence on moderate associations between the component constructs - i.e., CSC and contingency - to determine the fit line (Meilich, 2006; Burkert et al., 2014).

As a response to the issues associated with the various difference-score models used to test the congruence/fit/matching hypotheses, PRA together with RSM was introduced and promoted by Professor Jeffery Edwards and colleagues (e.g., Edwards and Parry, 1993; Edwards, 1994; 1996; 2002; 2007). The combined usage of PRA and RSM overcomes the problems normally associated with the various difference-score models. For the common issues shared by the theoretical and empirical versions of the difference-score models, the joint usage of PRA and RSM replaces the difference-score with the component constructs making up the difference-score, which mitigates the associated problems of low reliability, high ambiguity and confounding the effects of the component constructs on the outcome construct (Edwards, 1994; 2002; Burkert et al., 2014). In addition, it treats the untested constraints as hypotheses that are tested empirically, considers the relationship between the fit/misfit between the two component constructs and the outcome construct as a three-dimensional relationship and does not assume that the outcome, e.g., financial performance, is the same along all fit points (Edwards, 1994; 2002; Meilich, 2006; Burkert et al., 2014). Regarding the specific issues associated with the theoretical version of the difference-score models, the combined usage of PRA and RSM does not assume that fit is achieved when the component constructs share the same score, i.e., contingency = CSC (Burkert et al., 2014). With respect to the particular problems of the empirical version of the difference-score models, the joint usage of PRA and RSM locates more precisely the fit line, where it exists, refrains from predetermining the fit line and, accordingly, does not require that the component constructs - i.e., CSC and contingency - be associated (Meilich, 2006; Burkert et al., 2014).

A further advantage of the combined usage of PRA and RSM is its ability to test for the predictions of the matching and moderation sub-forms of fit of the interaction form of fit, allowing the accurate determination of the correct sub-form of fit that describes the relationship between the contingency factor and optimal CSD (Donaldson, 2006; Burkert et al., 2014). This is attributed to the fact that the various difference-score models used to test for the matching sub-form of fit and the MRA utilised to test for the moderation sub-forms of fit are considered special cases of PRA (Meilich, 2006).

Given the superiority of the joint usage of PRA and RSM, contingency theory researchers have advocated its use when testing for the matching sub-form of fit's hypotheses (Donaldson, 2006; Burkert et al., 2014). Therefore, this research employed PRA together with RSM when testing the matching sub-form of fit hypotheses. Nonetheless, to the author's knowledge, the combined usage of PRA and RSM to test hypotheses related to the matching sub-form of fit, i.e., in contingency theory research, has not been described, in detail, by contingency theory researchers (Donaldson, 2006; Burkert et al., 2014). This necessitates the development of a procedure that encompasses the recommended joint usage of PRA and RSM to test for the matching sub-form of fit, which is the underlying task of this section. Before developing this procedure in Section 8.2.5, crucial aspects of PRA and RSM are provided. These include a through demonstration of the fundamentals of PRA and RSM (Section 8.2.2), the assumptions of PRA and RSM (Section 8.2.3) and the approaches of applying PRA and RSM (Section 8.2.4). After developing this procedure, a description of a related statistical analysis technique, namely, MRA, is provided (Section 8.2.6), along with information about the software and sources employed to conduct the analysis (Section 8.2.7).

8.2.2 Demonstration of fundamentals of PRA and RSM

The usage of PRA in combination with RSM permits a more accurate examination of the effect of the fit/misfit between two predictor constructs - e.g., CSC and contingency - on an outcome construct, i.e., testing hypotheses related to the matching sub-form of fit (Shanock et al., 2010; Burkert et al., 2014). The usage of PRA makes it possible to obtain regression coefficients, which, through employing RSM, can be plotted on a three-dimensional surface or graph that facilitates the interpretation of the regression coefficients (Edwards and Parry, 1993; Edwards, 2002; Shanock et al., 2010).

PRA involves regressing the outcome construct, e.g., USEFULNESS, on two predictor constructs, e.g., CSC and contingency, the quadratic term of the first predictor construct, $(CSC)^2$, the interaction term of the two predictor constructs, (CSC)(contingency), and the quadratic term of the second predictor construct, $(contingency)^2$ (Edwards and Parry, 1993; Edwards, 2002; Shanock et al., 2010). The PRA equation is shown in Equation 1:[114]

$$\boldsymbol{Outcome = b_0 + b_1 CSC + b_2 contingency + b_3 (CSC)^2 + b_4 (CSC)(contingency) + b_5 (contingency)^2 + e}$$

RSM is a technique that facilitates the interpretation of three-dimensional surfaces that represent the relationship between the fit/misfit between two predictor constructs and an outcome construct (Edwards, 2002; 2007; Phillips, 2013). It mainly involves the analysis of three different features of the surface that represents the results of the polynomial regression models (Edwards and Parry, 1993; Edwards, 1996; 2002; 2007).[115] The first feature is the

[114] Equation 1 represents the quadratic polynomial regression model related to the squared difference-score model of the theoretical version of the difference-score models. The focus of this section is on the quadratic polynomial regression model because the fit/misfit relationship implied by the matching sub-form of fit corresponds to the squared difference-score model (Meilich, 2006; Burkert et al., 2014). Hence, this section does not illustrate the other polynomial regression models, such as the linear and piecewise ones, that are associated with the algebraic and absolute difference-score models, respectively (Edwards, 2007; Phillips, 2013). As provided in footnote 113, Empirical-Euclidian distance and residual analysis difference-score models are conceptually similar to the absolute and squared difference-score models, respectively.

[115] The three features are the main concern when analysing surfaces that correspond to Equation 1, which represents the quadratic polynomial regression model. However, this is not the case when analysing surfaces that correspond to other polynomial regression models, e.g., linear ones.

location of the stationary point, which represents the point at which the slope of the surface is zero in all directions. The second feature is the location of the principal axes - i.e., the first and second principal axes - of the surface. The first and second principal axes provide information about the orientation of the surface. The first and second principal axes intersect at the stationary point and are perpendicular to each other. The principal axes form three different types of surface; namely, concave, i.e., dome-shaped, as shown in Figure 8-1, convex, i.e., bowl-shaped, as presented in Figure 8-2 and saddle-shaped, as displayed in Figure 8-3 (Edwards, 2002; 2007). Table 8-2 shows the differences between these three types of surface and the location of the principal axes in each type (Edwards and Parry, 1993; Edwards, 2002).[116]

The third feature is the shape of the surface along relevant lines in the CSC-contingency surfaces. These lines are related to the fit and misfit lines. Non-contingency studies that adopt PRA and RSM are usually concerned with analysing the shape of the surface along the lines of numerical-fit - i.e., CSC = contingency line - and numerical-misfit, i.e., CSC = -contingency line. However, in most situations, the numerical-fit/misfit lines have no meaning in contingency studies where the MCS construct, in this research, CSC, and contingency construct tend to differ in terms of content and scale (Burkert et al., 2014). Therefore, researchers might be interested in analysing the shape of the surface along other lines that they consider more representative of the fit/misfit lines. Examples of these lines include the principal axes or any other lines of theoretical interest (Edwards and Parry, 1993; Edwards, 2007).

The analysis of the shape along the fit/misfit lines, e.g., numerical-fit/misfit lines, principal axes, or any other lines, involves examining their slope and curvature (e.g., Kalliath,

[116] The matching sub-form of fit assumes a concave or a saddle-shaped surface because, with both types of surfaces, one of the principal axes has a negative curvature, representing the detrimental effect of the misfit on the outcome construct.

Bluedorn and Strube, 1999; Edwards, 2002; 2007; Atwater, Waldman, Ostroff, Robie and Johnson, 2005; Kreiner, 2006; Brown, Venkatesh, Kuruzovich and Massey, 2008; Shanock et al., 2010; Yang, Kang, Oh and Kim, 2013; Phillips, 2013; Koppensteiner and Stephan, 2014). For the fit line, finding a positive/negative slope means that the outcome is higher when the fit between the two predictor constructs - i.e., CSC and contingency - is at higher/lower values of the predictor constructs compared to lower/higher values of both constructs. In addition, finding a positive/negative curvature along the fit line means that the outcome is higher/lower when the fit between the predictor constructs is at either high or low values compared to moderate ones. For the misfit lines, i.e., lines perpendicular to the fit line, finding a positive/negative slope means that the outcome is higher/lower in situations of over-fit, i.e., when the level of CSC is higher than that required by the level of the contingency factor, compared to under-fit, i.e., when the level of CSC is lower than that required by the level of the contingency factor. Further, finding a negative/positive curvature along the misfit lines means that the outcome decreases/increases more as the deviation, i.e., misfit, from the fit line increases. Using PRA and RSM requires meeting some assumptions, which will be illustrated in the next section.

Table 8-2: Types of surfaces and the location of the principal axes

	Concave	**Convex**	**Saddle-shaped**
Features	Two downward, i.e., negative, curvatures.	Two upward, i.e., positive, curvatures.	One upward, i.e., positive, curvature and one downward, i.e., negative, curvature.
First principal axis	Represented by the line along which the downward curvature is minimised, i.e., has the lower negative value.	Represented by the line along which the upward curvature is maximised, i.e., has the higher positive value.	Represented by the line along which the upward curvature is maximised.
Second principal axis	Represented by the line along which the downward curvature is maximised, i.e., has the higher negative value.	Represented by the line along which the upward curvature is minimised, i.e., has the lower positive value.	Represented by the line along which the downward curvature is maximised.

Figure 8-1: Concave surface

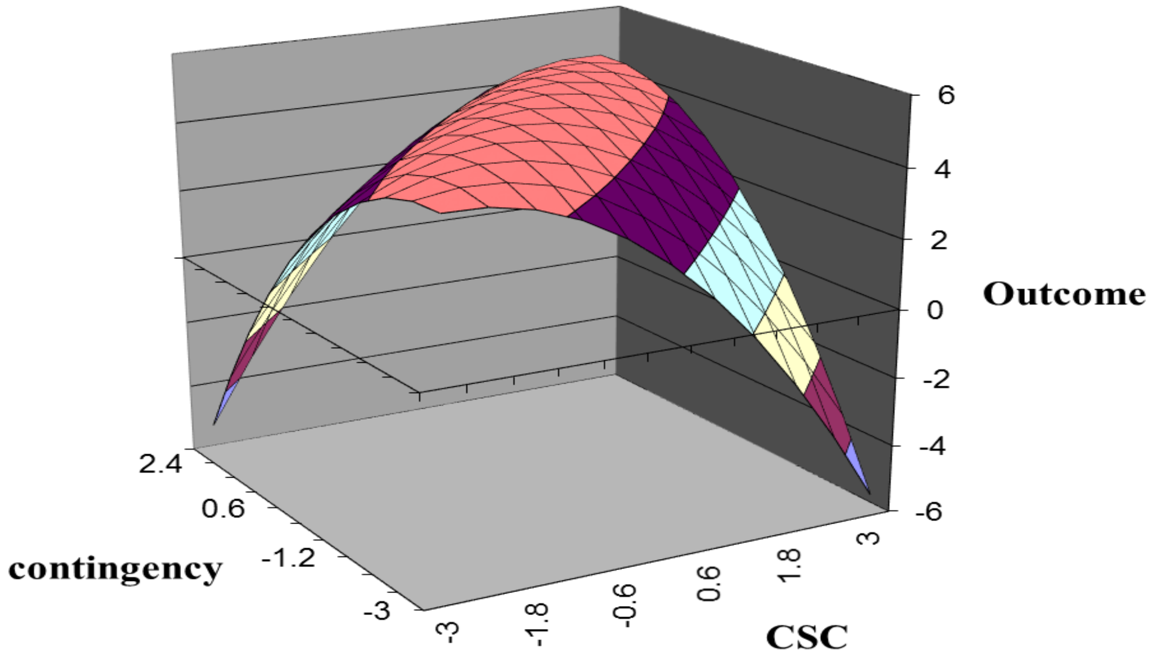


Figure 8-2: Convex surface

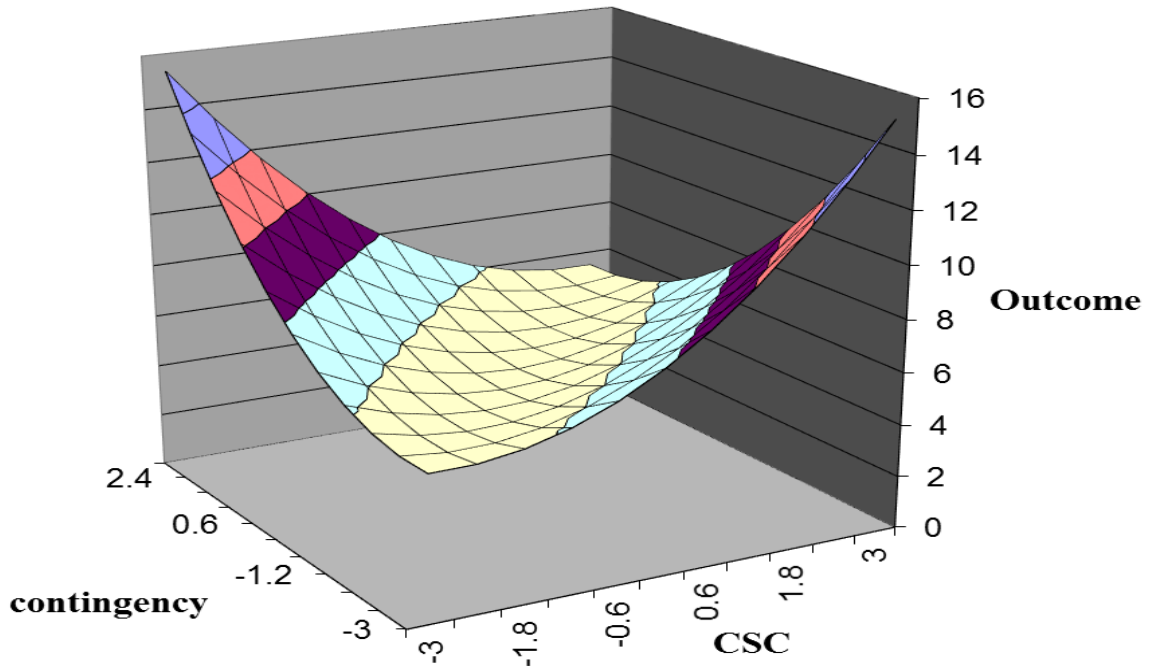
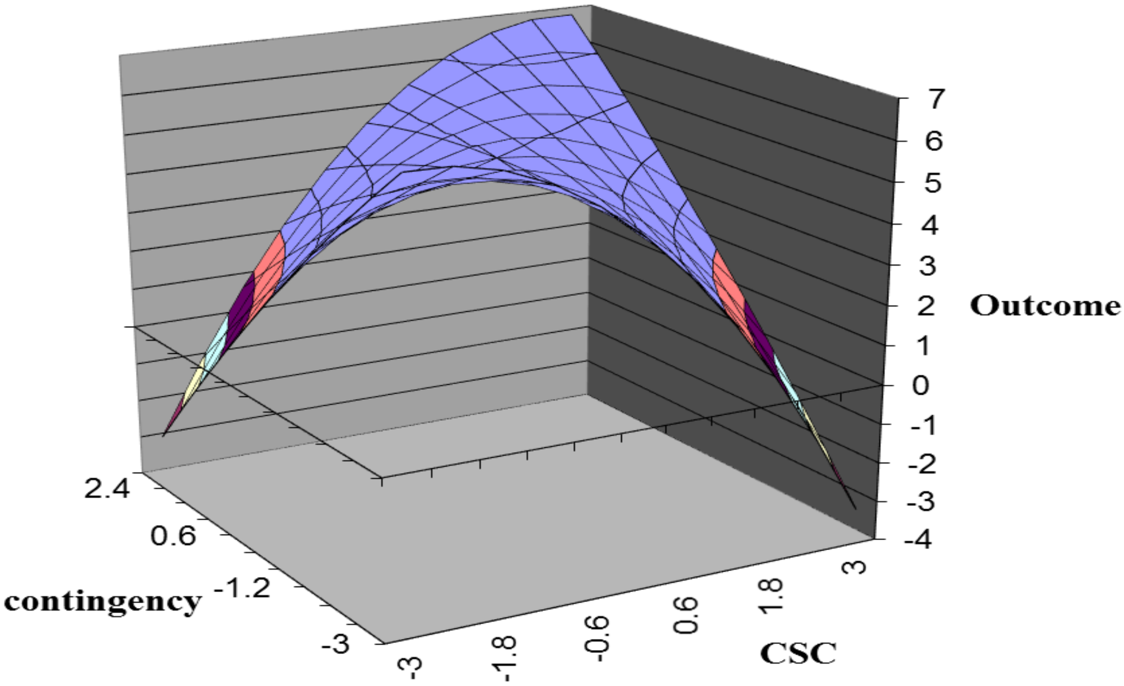


Figure 8-3: Saddle-shaped surface



8.2.3 PRA and RSM assumptions

The usage of PRA with RSM demands meeting certain assumptions (Edwards and Parry, 1993; Edwards, 1994; 2002). First, the predictor constructs - i.e., CSC and contingency - need to be commensurate, which means that they represent different aspects or perspectives of the same conceptual domain, e.g., expected and received pay or supervisors and subordinates' reports of performance. Using commensurate predictor constructs is important for ensuring that the predictor constructs are conceptually related and in order to interpret more meaningfully the results in terms of congruence/fit/matching. Second, the predictor constructs need to be measured using a similar numerical scale. This is critical for determining the level of conformance between the two constructs and to compare the coefficient estimates. Nonetheless, if the two predictor constructs are not measured on the same numerical scale, the scale of one construct or both constructs can be changed (Harris, Anseel and Lievens, 2008; Shanock et al., 2010; Kazén and Kuhl, 2011; Koppensteiner and Stephan, 2014; Zenker, Gollan and Quaquebeke, 2014). Third, all of the constructs need to be measured on interval or ratio scales, and the two predictor constructs are assumed to contain no measurement errors. Fourth, rigorous procedures to detect outliers and influential cases must be performed before running the regression models. PRA along with RSM can be applied in two different approaches, which will be explained in the next section.

8.2.4 Approaches to applying PRA and RSM

PRA along with RSM can be applied using either a confirmatory or exploratory approach (Edwards, 1994; 2002; Phillips, 2013; Phillips, Diefenbach, Kronish, Negron and Horowitz, 2014). The former is used when a fit/misfit relationship that corresponds to a particular difference-score model of the theoretical version of the difference-score models - i.e., absolute, algebraic or squared - has been hypothesised (Phillips, 2013). The confirmatory approach starts with selecting a conceptual model of the fit that corresponds to any difference-score model of the theoretical version of the difference-score models and determining the appropriate polynomial regression model to test that model. The polynomial regression models represent unconstrained versions of the difference-score models.[117] Then, the researcher needs to evaluate the difference-score model. The objective in using PRA in a confirmatory approach is to confirm whether the constraints imposed by the selected difference-score model are valid and supported (Phillips, 2013; Phillips et al., 2014). If so, the results would be interpreted as implied by the selected difference-score model. If not, the exploratory approach should be used. There are four conditions for supporting any difference-score model (Edwards, 1994; 1996; 2002; Kalliath et al., 1999; Antonioni and Park, 2001; Phillips, 2013; Phillips et al., 2014), which are summarised as follows in the context of the squared difference-score one that corresponds to the fit/misfit relationship implied by the matching sub-form of fit:

[117] In contrast to the various difference-score models, the polynomial regression models do not impose untested constraints, i.e., conditions, on the relationships between the predictor constructs - i.e., CSC and contingency - and the outcome construct, e.g., USAGE. For further details about the constraints imposed by the difference-score models and how they are relaxed using the polynomial regression models, see Edwards (1994; 2002).

1. The quadratic polynomial regression model must explain a significant variance in the outcome, i.e., significant R^2.
2. The coefficients of the quadratic polynomial regression model have the expected sign and magnitude that follow the pattern indicated by the squared difference-score model, i.e., the coefficients on CSC and contingency are not significant, the coefficients on $(CSC)^2$ and $(contingency)^2$ are significant, equal and negative and the coefficient on (CSC)(contingency) is twice that of the coefficient on either $(CSC)^2$ or $(contingency)^2$, significant and has the opposite sign, i.e., positive.
3. The squared difference-score model's constraints are satisfied. In order to achieve this, R^2 should not differ significantly between the quadratic polynomial regression model and the squared difference-score one.
4. The variance explained of the models that have one order higher constructs, i.e., cubic, should not be significant.[118]

The exploratory approach is used when the researcher has not created a specific hypothesis regarding the relationship between the fit/misfit between two predictors and the outcome (Edwards, 1994; 2002), or when the results of the confirmatory approach do not support the corresponding difference-score model (Kalliath et al., 1999; Phillips, 2013). It involves estimating higher-order models in a progressive manner until the incremental variance, i.e., difference in R^2, becomes insignificant (Edwards, 1994; 2002; Phillips et al., 2014). In other words, it starts with a linear model that includes only the predictor constructs - i.e., CSC and contingency - and then adds, in a set, higher-order terms - e.g., quadratic and cubic - of the higher-order models - e.g., quadratic and cubic - up to a point where the difference in R^2

[118] The equation of the cubic model is: $\boldsymbol{Outcome = b_0 + b_1 CSC + b_2 contingency + b_3 (CSC)^2 + b_4 (CSC)(contingency) + b_5 (contingency)^2 + b_6 (CSC)^3 + b_7 (CSC)^2 (contingency) + b_8 (CSC)(contingency)^2 + b_9 (contingency)^3}$ (Edwards, 1994).

between them becomes insignificant.[119] The best-fitting model is the highest-order model that explains a significant incremental variance from the preceding model. Having explained the fundamentals of PRA and RSM, the assumptions of PRA and RSM and the approaches of applying PRA and RSM, the next section will develop a procedure involving the recommended combined usage of PRA and RSM to test the matching sub-form of fit's hypotheses; namely, the two-stage procedure encompassing the recommended joint usage of PRA and RSM.

8.2.5 The developed and employed two-stage procedure involving the recommended combined usage of PRA and RSM

The application of PRA and RSM is a straightforward process when the predictor constructs - i.e., CSC and contingency - are commensurate, i.e., when they represent different aspects or perspectives of the same conceptual domain. This is attributed to the fact that the lines of numerical-fit/misfit are the lines of interest to researchers when using commensurate predictor constructs. These lines can be located, analysed and interpreted easily without problems, a procedure which is well-documented (e.g., Edwards, 2002; Shanock et al., 2010; Phillips, 2013).

However, the application of PRA and RSM in contingency theory is unclear, given the fact that, in most cases, the predictor constructs used are not commensurate (Burkert et al., 2014). Although some researchers have advocated the use of PRA and RSM (Donaldson, 2006; Meilich, 2006; Burkert et al., 2014), they only provided general overviews, without offering any detailed guidelines regarding how to apply these techniques to test the matching sub-form of fit's hypotheses. For this reason, the researcher had to consult literature related to both PRA/RSM and contingency theory to develop a two-stage procedure that encompasses the recommended joint usage of PRA and RSM in the contingency theory context (e.g.,

[119] The equation of the linear model is: $\boldsymbol{Outcome = b_0 + b_1 CSC + b_2 contingency}$, while Equation 1 and that presented in footnote 118 represent the quadratic and cubic models, respectively (Edwards, 1994).

Edwards and Parry, 1993; Edwards, 1994; 2002; 2007; Kalliath et al., 1999; Kreiner, 2006; Meilich, 2006; Brown et al., 2008; Edwards and Cable, 2009; Shanock et al., 2010; Kazén and Kuhl, 2011; Patel, 2011; Phillips, 2013; Yang et al., 2013; Burkert et al., 2014; Phillips et al., 2014; Zenker et al., 2014). In this two-stage procedure, a fit line according to the matching sub-form of fit (Matching-Fit-Line) and the principal axes are the lines of interest rather than the numerical-fit/misfit lines. Nevertheless, the numerical-fit/misfit lines are referred to and analysed when appropriate. The Matching-Fit-Line represents the values of CSC at which the outcome is maximised given the level of the contingency factor (Meilich, 2006), while the principal axes are lines that provide information about the orientation of the surface (Edwards, 2002; 2007).[120] The two-stage procedure is displayed in Figure 8-4 and illustrated in the following paragraphs.

As described by many researchers (e.g., Edwards, 1994; 2002), the first stage is to apply PRA along with RSM using the confirmatory approach given that matching sub-form of fit's hypotheses that correspond to the squared difference-score model exist. When applying the confirmatory approach, the quadratic polynomial regression model, i.e., Equation 1, is used, since it is the most appropriate model for testing the constraints imposed by the squared difference-score model. If the conditions of the confirmatory approach are met (see Section 8.2.4), then the coefficients obtained from PRA are plotted and interpreted using RSM. Otherwise, the second stage is applied.

As demonstrated by many researchers (Kalliath et al., 1999; Phillips, 2013; Phillips et al., 2014), when the confirmatory approach fails to support the corresponding difference-score model, the second stage is to apply PRA along with RSM using the exploratory approach. This approach, as mentioned in Section 8.2.4, involves estimating the higher-order models -

[120] The equation of the Matching-Fit-Line is: $\boldsymbol{CSC = (-b_1/2b_3) + (-b_4/2b_3)(contingency)}$ (Meilich, 2006). The coefficients used in this equation, e.g., b_3, are those of Equation 1.

e.g., linear, quadratic and cubic - in a progressive manner until the incremental variance, i.e., difference in R^2, becomes insignificant (Edwards, 1994; 2002; Phillips et al., 2014). The second stage includes two steps.

The first step is to test whether there is a significant R^2 difference between the linear and quadratic models.[121] If so, the second step is applied (Edwards, 1994; 2002); if not, this means that the matching/fit hypothesis, i.e., the matching sub-form of fit hypothesis, implied by the quadratic model is not supported, and that there are two possible outcomes. The first is finding that the interaction term, i.e., (CSC)(contingency), is the only significant higher-order term in the quadratic model, i.e., Equation 1. This indicates that the moderation model, i.e., moderation sub-form of fit, is supported, and, thus, the quadratic terms - i.e., $(CSC)^2$ and $(contingency)^2$ - included in the quadratic model, i.e., Equation 1, are removed to conduct MRA (Meilich, 2006; Burkert et al., 2014; Dawson, 2014).[122] The second outcome is finding that the interaction term is not the only significant higher-order term, which suggests that the linear model is supported (e.g., Brown et al., 2008; Phillips et al., 2014). The results of the first outcome, i.e., the moderation model or moderation sub-form of fit, are presented, whereas those for the second outcome, i.e., the linear model, are discarded. Finding support for the moderation model, i.e., the moderation sub-form of fit, indicates that the contingency factor influences the optimal level of CSC, although in a different way from its impact based on the matching sub-form of fit (see Sections 3.3.2.1, 3.3.2.2 and 4.4.2). Finding support for the linear model, however, simply means that each of CSC and the contingency factor has a linear relationship with the outcome construct, suggesting that the contingency factor has no effect on the optimal level of CSC.

[121] The equation of the linear model is presented in footnote 119, while Equation 1 represents the quadratic model.
[122] MRA is considered to be a constrained case of PRA (Meilich, 2006), and is demonstrated in Section 8.2.6.

When a significant R^2 difference exists between the linear and quadratic models, the second step is to test whether there is a significant R^2 difference between the quadratic and cubic models.[123] If so, this means that the matching/fit hypothesis implied by the quadratic model is not supported and that the cubic model is applied, plotted and interpreted (Edwards, 1994; 2002). If not, this suggests that the quadratic model is supported, which is required to proceed with testing the matching/fit hypothesis. Nevertheless, there are three possible outcomes for this (Meilich, 2006; Burkert et al., 2014).

The first is finding that the interaction term, i.e., (CSC)(contingency), is the only significant higher-order term in the quadratic model, i.e., Equation 1. This indicates that the moderation rather than the matching sub-form of fit is supported - i.e., the matching/fit hypothesis is not supported - and, therefore, the quadratic terms - i.e., $(CSC)^2$ and $(contingency)^2$ - included in the quadratic model, i.e., Equation 1, are deleted to run MRA (Meilich, 2006; Burkert et al., 2014; Dawson, 2014).

The second outcome is finding, in the quadratic model, i.e., Equation 1, either: (1) that the interaction term - i.e., (CSC)(contingency) - and the quadratic one related to CSC, i.e., $(CSC)^2$, are both significant; or (2) all higher-order terms - i.e., interaction and quadratic terms - are significant. This provides initial statistical support for the matching/fit hypothesis. More specifically, it allows the Matching-Fit-Line to be drawn on the surface and further analysis to be conducted on the surface to examine the matching/fit hypothesis (Meilich, 2006; Edwards, 2009; Burkert et al., 2014).[124] Concluding whether or not the matching/fit hypothesis is completely supported depends on the results of the surface analysis. The surface is analysed in relation to two aspects.

[123] The equation of the cubic model is presented in footnote 118, while Equation 1 represents the quadratic model.
[124] The equation of the Matching-Fit-Line is presented in footnote 120.

First, the type of the surface - i.e., concave, convex and saddle-shaped - is analysed through examining the surface visually and the curvatures of the principal axes that represent the orientation of the surface (Edwards, 2002). Analysing the type of the surface provides initial support regarding whether the surface conforms to those implied by the matching sub-form of fit, which are the concave and saddle-shaped surfaces (see footnote 116, Figure 8-1, Figure 8-3 and Table 8-2). Second, the two elements that represent the influence of the contingency factor on the optimal level of CSC from the perspective of the matching sub-form of fit, i.e., the matching/fit hypothesis, are analysed. These two elements include the direction of the association between the contingency factor and the optimal level of CSC - i.e., positive or negative - and the magnitude and sign of the impact of the misfit, including both over- and under-fit, between the contingency factor and the optimal level of CSC on the outcomes (see Section 3.3.2.1). The direction of the association between the contingency factor and the optimal level of CSC is analysed visually by inspecting the direction of the Matching-Fit-Line. The magnitude and sign of the impact of the misfit on the outcome is analysed through examining the curvatures of the lines that are perpendicular to the Matching-Fit-Line, i.e., misfit lines.[125] To find support for the matching/fit hypothesis, the direction of the association between the contingency factor and optimal level of CSC needs to be positive, and the misfit between the contingency factor and the optimal level of CSC needs to have a significant negative impact on the outcome.

[125] Besides the abovementioned aspects, additional analysis of the surface can be conducted to investigate whether the first or second extensions of the classical matching sub-form of fit apply (see Section 3.3.2.1). For the first extension, which suggests higher levels of outcome when the fit is between higher values of the contingency factor and CSC compared to lower ones, i.e., hetero-outcome, the level of outcome at each fit point along the Matching-Fit-Line can be examined (Burkert et al., 2014). For the second extension, which suggests a more detrimental effect of under- compared to over-fit on the outcome, the slopes of the misfit lines can be examined (Shanock et al., 2010).

The third outcome is finding a pattern of results that do not follow those of the first two outcomes.[126] In this case, it is impossible, on the surface, to draw the Matching-Fit-Line, suggesting that the matching/fit hypothesis is not supported (Meilich, 2006). Although the quadratic model lacks either the joint significance of the interaction term and the quadratic one related to CSC or the significance of all higher-order terms that is required to find initial statistical support for the matching/fit hypothesis, the surface that corresponds to the quadratic model can be analysed to investigate the extent of any effect that the contingency factor may have on the optimal level of CSC from the perspective of a weak form of the matching sub-form of fit, i.e., weak support for the matching/fit hypothesis. The surface is analysed in the same way as the surfaces produced in the second outcome. The only difference is that the first principal axis rather than the Matching-Fit-Line is considered the fit line, given that the former line represents the line along which the outcome is maximised in concave and saddle-shaped surfaces and the fact that, as mentioned earlier, the latter line cannot be drawn on the surface of the third outcome.[127] As outlined in the developed two-stage procedure involving the recommended combined usage of PRA and RSM, in some situations, the quadratic polynomial regression models should be presented and tested as moderation models, using the constrained case of PRA; namely, MRA. Accordingly, the next section will explain MRA.

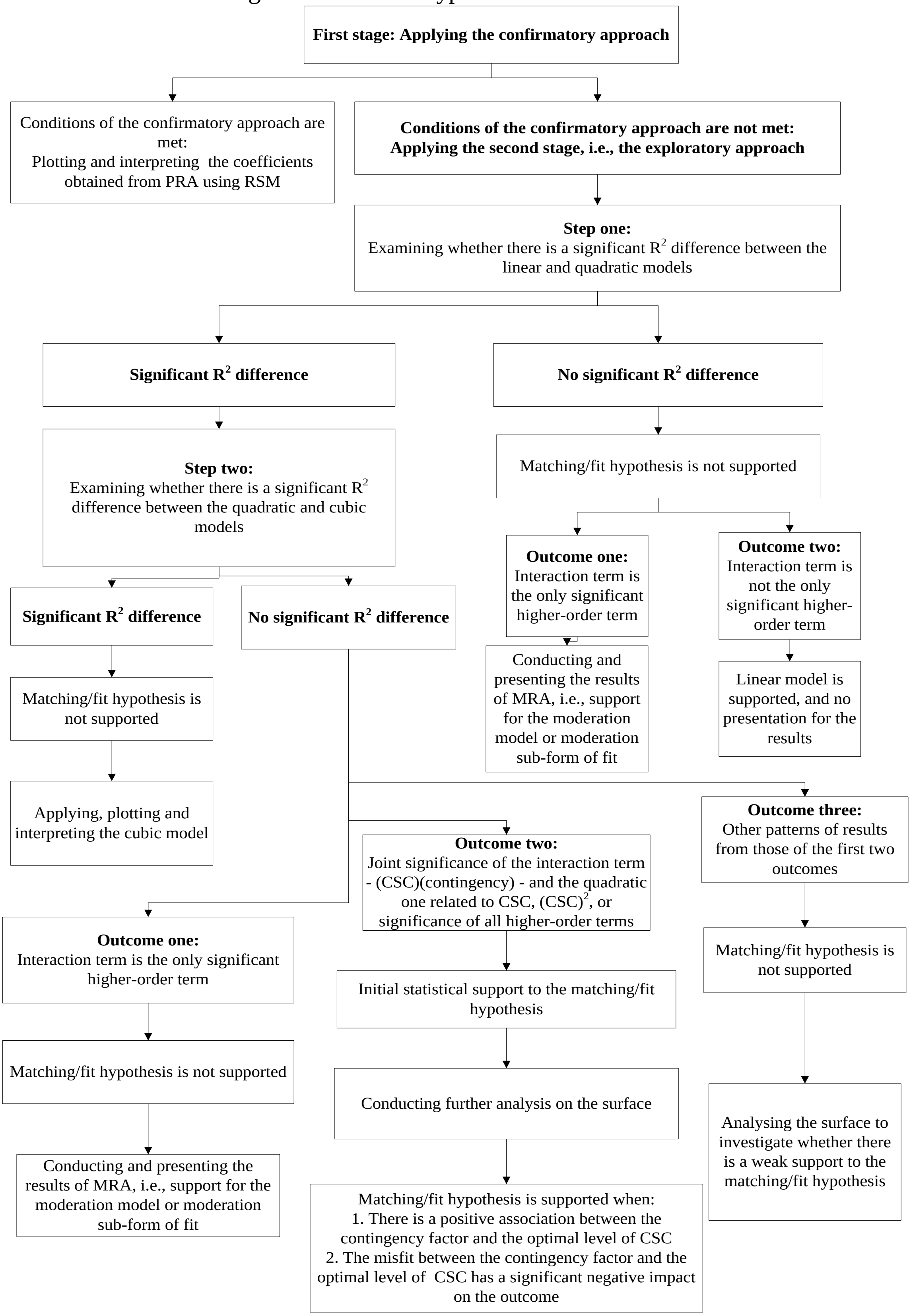
8.2.6 Moderated regression analysis (MRA)

MRA is concerned with testing whether one construct, called a "moderator", moderates, i.e., changes, the strength and/or form of the relationship between two constructs (Hayes, 2013;

[126] For example, finding the quadratic term related to CSC, $(CSC)^2$, to be the only significant higher-order term in the quadratic model.

[127] Even though the outcome is maximised along the Matching-Fit-Line and first principal axis, prior literature has not explained how these two lines differ from each other. However, Edwards and Parry (1993) implied that the first principal axis is the line of interest to contingency theory researchers. When conducting the analysis for this research, it was found that the Matching-Fit-Line and the first principal axis almost coincide and become almost identical. Thus, the first principal axis was deemed the fit line of the surfaces of third outcome.

Figure 8-4: The two-stage procedure involving the recommended joint usage of PRA and RSM to test the matching sub-form of fit hypotheses



Dawson, 2014). In contingency research, the contingency factor is assumed to be the moderator construct that changes the relationship between the MCS construct - in this research, CSC - and the outcome construct (Hartmann and Moers, 1999; Chenhall and Chapman, 2006; Burkert et al., 2014). MRA involves regressing the outcome construct, e.g., USEFULNESS, on two independent constructs - e.g., CSC and contingency - and their interaction, i.e., (CSC)(contingency) (Hartmann and Moers, 1999; Edwards, 2009; Hayes, Glynn and Huge, 2012; Hayes, 2013; Burkert et al., 2014; Dawson, 2014). Thus, the equation of MRA is similar to Equation 1 related to the quadratic polynomial regression model, but excludes the quadratic terms, i.e., $(CSC)^2$ and $(contingency)^2$. Hence, MRA is considered as a constrained case of PRA (Meilich, 2006). The MRA equation is shown in Equation 2:

$$\textbf{\textit{Outcome}} = b_0 + b_1\,CSC + b_2\,contingency + b_3(CSC)(contingency) + e.$$

To find statistical support for the moderation influence of the moderator construct, i.e., contingency, on the relationship between the predictor, i.e., CSC, and the outcome constructs, the interaction term in Equation 2 needs to be significant (Hartmann and Moers, 1999; Hayes, 2013; Burkert et al., 2014; Dawson, 2014). To obtain further details about the nature and facilitate the interpretation of the moderation effect, additional analysis needs to be performed (Hayes, 2013; Burkert et al., 2014). This includes examining, i.e., conducting simple-slope tests, and plotting the relationship between the independent construct and the outcome one at different values of the moderator construct (Hayes, 2013; Burkert et al., 2014; Dawson, 2014). These values of the moderator construct should be meaningful and based on theory (Dawson, 2014). In situations when no such values exist for the moderator construct, researchers typically rely on the three arbitrary common values of one SD below the mean as a low value, the mean as a moderate value and one SD above the mean as a high value when examining and plotting the relationship between the independent construct and the outcome one (Hayes, 2013; Dawson, 2014). To reduce the degree of arbitrariness of the moderator construct values, researchers can use the percentile values - e.g., 10th, 25th, 50th, 75th and 90th - to examine and plot the relationship between the independent construct and the outcome one (Hayes, 2013). The 10th, 25th, 50th, 75th and 90th percentile values represent, respectively, very low, low, moderate, high and very high values. In this research, the percentile values - i.e., 10th, 25th, 50th, 75th and 90th - of the moderator construct were used. Further to validate the results of the simple-slope tests obtained at the percentile values, the Johnson-Neyman technique was utilised (Bauer and Curran, 2005; Spiller, Fitzsimons, Lynch and McClelland, 2013; Burkert et al., 2014), which evaluates the region of significance of the relationship between the independent construct - i.e., CSC - and the outcome one across the whole range of values of the moderator construct, i.e., contingency (Hayes, 2013; Spiller et al., 2013; Dawson, 2014). Conducting PRA along with RSM as well as MRA requires the use of different software and sources, about which the next section will provide information.

8.2.7 Analysis software and sources

The PRA analysis was performed using SPSS software version 22 and the SPSS syntaxes and Excel sheets provided on Professor Jeffery Edwards' website, http://public.kenan-flagler.unc.edu/faculty/edwardsj/index.htm. The surfaces of RSM were drawn using MYSTAT software version 12 – a student version of SYSTAT - and Excel sheets provided on the same website. MRA was conducted using SPSS software version 22 and Professor Andrew F. Hayes' macro through SPSS, http://afhayes.com/spss-sas-and-mplus-macros-and-code.html. The moderation effects' plots were created using SPSS. Having illustrated PRA and RSM, including the developed and utilised two-stage procedure involving the recommended combined usage of PRA and RSM in contingency theory research, the next section will examine the assumptions of PRA and RSM and discuss how the data were further prepared for analysis.

8.3 Checking the assumptions of PRA and RSM and the further preparation of the data for analysis

As demonstrated in Section 8.2.3, the combined usage of PRA and RSM demands that four assumptions are met. Regarding the first two, i.e., using commensurate predictor constructs and measuring them using a similar numerical scale, Burkert et al. (2014) pointed out that, although in contingency theory research the predictor constructs - i.e., CSC and contingency - usually have different conceptual domains - i.e., non-commensurate - and are measured on different scales, the influence of the fit/misfit between two constructs on the outcome construct can be interpreted by examining the coefficients obtained from PRA. In addition, the first two assumptions are only relevant when the lines of numerical-fit/misfit are meaningful and represent the lines of interest. However, as noted in Section 8.2.1, this tends not to be the case in contingency theory research, so contingency researchers might be more interested in analysing other lines, such as the principal axes or lines of theoretical interest, e.g., the Matching-Fit-Line.

Regarding the third assumption, i.e., all constructs are measured on interval or ratio scales and the two predictor constructs are assumed to be free from measurement errors, all of the predictors and outcome constructs are measured using either interval or ratio scales.[128] In relation to the measurement errors of the predictor constructs, the quality of all of the reflective and formative predictor constructs was evaluated (see Section 7.3). More specifically, the reflective constructs were assessed regarding their internal consistency, convergent validity and discriminant validity using CFA (see Section 7.3.1), while the formative ones were apprised in relation to content validity and collinearity issues (see Section 7.3.2). Given that all of the predictor constructs, including both reflective and

[128] Although, in this research, most of the constructs' indicators are measured on a five-point Likert scale, i.e., an ordinal scale, Hair et al. (2017) noted that, when the categories, i.e., answer choices, are equidistant, then a Likert-scale behaves more like an interval scale. Equidistant categories can be achieved when using a middle category that represents a neutral category (Hair et al., 2017), which was done with all five-point Likert scales.

formative, displayed a high level of quality and passed all of the quality criteria, the predictor constructs can be assumed to be free from measurement errors.

With respect to the fourth assumption, i.e., checking for outliers and influential cases, the problem of outliers, including univariate and multivariate ones, was examined and solved in Section 7.2.3. More specifically, many univariate outliers and four multivariate ones were found in the dataset, to resolve which issue, it was decided to transform some of the constructs that have univariate outliers and remove all of the multivariate outliers. Yet, the problem of outliers and influential cases needs to be further examined and, if required, solved every time a regression model that involves higher-order terms, e.g., quadratic terms, is performed (Cohen, Cohen, West and Aiken, 2003). Given that the application of PRA and RSM to test hypotheses about the matching sub-form of fit involves running many quadratic and moderation regression models (see Section 8.2.5 and Figure 8-4), further checking for outliers and influential cases becomes necessary.

As recommended by Cohen et al. (2003) and others (e.g., Edwards, 2002), when conducting regression analysis that involves higher-order terms, the data were screened for outliers and influential cases using many diagnostic statistics, each providing different information regarding the effects of outliers and influential cases on the regression model. These diagnostic statistics include centred leverage, i.e., leverage, studentized deleted residuals, i.e., discrepancy, Cook's distance and DFBETAS, i.e., influence.[129] Checking for outliers and influential cases was performed prior to conducting the analysis, i.e., the two-stage procedure involving the recommended combined usage of PRA and RSM, with each of the quadratic polynomial regression models. Cases with values that lay outside the recommended values or

[129] Leverage is a measure of the distance between a case's observed values for the independent variables from the mean values of the independent variables, while discrepancy measures the difference between the predicted and observed values on the outcome variable. Influence is the product of leverage and discrepancy, and measures the amount of change that would occur to the characteristics of the regression equation, Cook's distance, and its coefficients, DFBETAS, if a case were to be removed from the data set.

range of values of at least two of the used diagnostic statistics were removed from the analysis (Cohen et al., 2003; Tabachnick and Fidell, 2007; Field, 2013).[130] This rigorous procedure resulted in excluding no more than three cases for each quadratic model.

In addition to examining and preparing the data regarding the issues of missing data, inconsistent questionnaire answers, outliers and normality (see Section 7.2), and checking the assumptions of PRA and RSM, further preparation was also applied to the data, which involved three steps. First, the constructs' mean scores, i.e., summated scores, were used to measure the latent constructs. As pointed out in Section 8.2.3, using PRA along with RSM entails assuming that the predictor constructs have no measurement errors. Hence, measuring the constructs using the mean scores is suitable here, and is the only available method for forming the constructs when conducting PRA and RSM (Burkert et al., 2014). Using the constructs' mean scores should have no substantial impact on the validity of the results, given that all of the constructs, including both the reflective and formative ones, have met the various quality criteria, as noted earlier and discussed in detail in Section 7.3. Second, the scores for all predictor/independent constructs - i.e., CSC and contingency - were normalised, with 0 as the lowest value and 1 as the highest. Predictor constructs have different minimum and maximum values, and, thus, normalising the scores was deemed beneficial to facilitate the presentation of the predictor constructs on the surfaces. Third, the normalised score was scale-centred by subtracting its mid-point, i.e., 0.50, thereby producing scores that range from -0.50 to 0.50. Scale-centring was conducted because it means that the coefficients of the first-order terms - i.e., CSC and contingency - can always be interpreted (Edwards, 2002).[131]

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[130] The followed recommendations regarding the values/range of values for the diagnostic statistics are: ≤ 0.075 for centred leverage, between -3.29 and +3.29 for studentized deleted residuals, ≤ 1 for Cook's distance and between -1 and +1 for DFBETAS (Cohen et al., 2003; Tabachnick and Fidell, 2007; Field, 2013). The recommended value for the centred leverage was calculated using the following procedure: (3 * 5 (the number of independent variables in the quadratic model))/200 (the sample size).

[131] If the predictor constructs are kept in their raw form when running regression models that contain higher-order terms, the effect of either construct would represent its influence on the outcome construct when the other

However, it should be noted that, when the quadratic model proved to be better represented by the moderation model, e.g., the first outcome of the second step of stage two, the standardised rather than the scale-centred normalised scores for the predictor constructs were used, as standardising is more common in moderation analysis (e.g., Hayes, 2013; Dawson, 2014).[132] Having assessed the assumptions of PRA and RSM and explained the further data preparation conducted prior to starting the analysis, the next section will present the results of testing the hypotheses about the matching sub-form of fit.

8.4 Results

Given that: (1) there are seven examined contingency factors in the research model, with cost structure and business-unit size being measured using two measures, and that there are three separate dimensions of organisational culture, i.e., a total of 11 measures of the seven contingency factors; (2) there are four CSC measures; and (3) there are two outcome measures, the analysis involved running a total of 88 quadratic polynomial regression models, 11 measures of the seven contingency factors x 4 CSC measures x 2 outcome measures. The results of the hypotheses of the matching sub-form of fit are presented following the developed and employed two-stage procedure involving the recommended combined usage of PRA and RSM to test the matching sub-form of fit (see Section 8.2.5 and Figure 8-4). Given that the influence of each contingency factor on the optimal level of CSC is tested at least eight times, i.e., eight quadratic polynomial regression models as a result of: 4 CSC measures x 2 outcome measures, it is essential to note that a conclusion about this influence

predictor construct is equal to 0 (Hartmann and Moers, 1999; Edwards, 2009; Hayes et al., 2012; Hayes, 2013). If 0 is not a value within the scale range of the predictor constructs, then the impact of these constructs on the outcome construct becomes meaningless (ibid). Scale-centring changes this, so that the effect of either predictor construct on the outcome represents its effect when the other predictor construct is at the scale mid-point (Edwards, 2002; Hayes et al., 2012). Thus, scale-centring means that the effects of the predictor constructs can always be interpreted, unlike when they only have a meaningful 0 value (Hayes, 2013). Although, in this thesis, the first-order terms - i.e., CSC and contingency - will not be interpreted, given that they are unrelated to testing the matching/fit hypothesis, they were scale-centred to make them interpretable to the reader.

[132] Like scale-centring, standardising means that the effects of the predictor constructs can always be interpreted, unlike when they only have a meaningful 0 value (Hayes, 2013).

cannot be drawn unless the two-stage procedure is fully employed. This is because, for a single contingency factor, the eight quadratic polynomial regression models using the different combinations of the four CSC measures and the two outcome ones might provide different results during various stages of the two-stage procedure.

For the first stage, i.e., applying PRA along with RSM using the confirmatory approach, the four conditions required to support the squared difference-score model provided in Section 8.2.4 were tested consecutively.[133] The results of all of the quadratic polynomial regression models (n = 88) failed to provide support for the squared difference-score model. Of the 88 quadratic polynomial regression models, six failed to meet the first condition that requires explaining a significant variance in the outcome, i.e., significant R^2, as indicated by finding a nonsignificant F-ratio for each quadratic model ($p > 0.05$) (Hair et al., 2010; Field, 2013). The remaining 82 quadratic models failed to meet the second condition of having coefficients that follow the pattern indicated by the squared difference-score model, i.e., the coefficients on CSC and contingency are insignificant, the coefficients on $(CSC)^2$ and $(contingency)^2$ are significant, equal and negative and the coefficient on (CSC)(contingency) is twice that on either $(CSC)^2$ or $(contingency)^2$, significant and has the opposite sign, i.e., positive. A summary of the results of the first stage is provided in Appendix 8-1.

Given that the confirmatory approach of applying PRA along with RSM did not support the squared difference-score model in all of the 88 quadratic polynomial regression models, the second stage of the two-stage procedure, i.e., applying PRA along with RSM using the exploratory approach, was performed (see Section 8.2.5 and Figure 8-4). The results of the first step of the second stage, i.e., testing whether a significant R^2 difference exists between the linear and quadratic models, showed that the incremental variance, i.e., R^2 difference,

[133] As mentioned in Section 8.2.4, the squared difference-score model corresponds to the fit/misfit relationship implied by the matching sub-form of fit (Edwards, 2002; Meilich, 2006; Burkert et al., 2014).

explained by the quadratic model over the linear model was not significant in 72 of the 88 quadratic polynomial regression models, as indicated by the finding of nonsignificant values for the F change between the quadratic and the linear models ($p > 0.05$) (Field, 2013). Appendix 8-2 provides the results related to these 72 quadratic polynomial regression models. A significant R^2 difference ($p < 0.05$) was only observed in 16 of the quadratic polynomial regression models, as shown in Table 8-3. According to the outcomes of finding insignificant and significant R^2 differences, the results of the 72 models with insignificant R^2 differences and those of the 16 models with significant ones will be presented in Sections 8.4.1 and 8.4.2, respectively.

Table 8-3: Quadratic polynomial regression models with significant R^2 differences between the linear and quadratic models

Contingency factor	**CSC measure**	**Outcome measure**	**R^2 Change**	**F Change**	**Sig. F Change**
COMP	CSC-CostPools	USEFULNESS	0.05	3.74	0.012
COMP	CSC-CostDrivers	USEFULNESS	0.04	2.82	0.040
COMP	CSC-COMPOSITE	USEFULNESS	0.05	3.88	0.010
CostStructure-COMBINED	CSC-CostDrivers	USAGE	0.04	3.08	0.029
CostStructure-COMBINED	CSC-COMPOSITE	USEFULNESS	0.04	3.15	0.026
CultureOutcome	CSC-CostPools	USEFULNESS	0.03	2.69	0.047
CultureOutcome	CSC-COMPOSITE	USEFULNESS	0.04	2.91	0.036
CultureDetail	CSC-COMPOSITE	USEFULNESS	0.04	2.91	0.036
CultureControl	CSC-CostPools	USEFULNESS	0.05	4.28	0.006
CultureControl	CSC-COMPOSITE	USEFULNESS	0.06	4.91	0.003
PC	CSC-CostPools	USAGE	0.05	3.49	0.017
SizeRevenue	CSC-CostPools	USEFULNESS	0.05	3.76	0.012
SizeRevenue	CSC-COMPOSITE	USEFULNESS	0.05	3.95	0.009
TMKA	CSC-CostPools	USEFULNESS	0.05	3.86	0.010
TMKA	CSC-CostDrivers	USEFULNESS	0.05	3.61	0.014
TMKA	CSC-COMPOSITE	USEFULNESS	0.05	3.93	0.009

8.4.1 Models with insignificant R^2 differences

The results of the first step of the second stage revealed that the R^2 difference was not significant in 72 of the quadratic polynomial regression models (see Appendix 8-2), indicating that the matching/fit hypothesis, i.e., matching sub-form of fit, implied by the quadratic model is not supported. As illustrated in Section 8.2.5 and shown in Figure 8-4, there are two possible outcomes when the R^2 difference is not significant. If the interaction term, i.e., (CSC)(contingency), is the only significant higher-order term in the quadratic model, i.e., Equation 1, the moderation model is supported, and, hence, the quadratic terms - i.e., $(CSC)^2$ and $(contingency)^2$ - included in the quadratic model are removed to run MRA, i.e., first outcome. Otherwise, the linear model is supported, i.e., second outcome.

As described in Section 8.2.5, the results of the first outcome alone are presented. The interaction term, i.e., (CSC)(contingency), was found to be the only significant higher-order term in five of the 72 quadratic models. Table 8-4 provides information about the five quadratic models, and shows that they are related to three contingency factors; namely, cost structure, PC and TMKA. The quadratic terms - i.e., $(CSC)^2$ and $(contingency)^2$ - included in these five quadratic models were then removed from each one in order to run five moderation models using MRA. The results of these five moderation models will be presented for each of the three contingency factors of cost structure (CostStructure-MANUFACTURING and CostStructure-COMBINED) (Section 8.4.1.1), PC (Section 8.4.1.2) and TMKA (Section 8.4.1.3).

Table 8-4: Quadratic models in which the interaction term was found to be the only significant higher-order term in the first step of the second stage

Contingency factor	**CSC measure**	**Outcome measure**
CostStructure-MANUFACTURING	CSC-DEVELOPED	USEFULNESS
CostStructure-COMBINED	CSC-CostDrivers	USEFULNESS
CostStructure-COMBINED	CSC-DEVELOPED	USEFULNESS
PC	CSC-COMPOSITE	USAGE
TMKA	CSC-CostPools	USAGE

8.4.1.1 Cost structure (CostStructure-MANUFACTURING and CostStructure-COMBINED)

Table 8-4 shows that, among the five quadratic models in which the interaction term was found to be the only significant higher-order term, three quadratic models are related to cost structure. Each involves either of the two different measures of cost structure, i.e., CostStructure-MANUFACTURING or CostStructure-COMBINED, as the contingency factor, either CSC-CostDrivers or CSC-DEVELOPED as the CSC measure and USEFULNESS as the outcome measure. Although some differences exist between the results of the moderation versions, i.e., models, of the three quadratic models related to cost structure, this section furnishes the results of the moderation model that best represents the dominant trend of the three moderation effects of cost structure found in Section 8.4.1 (see Table 8-4) and the sole one found in Section 8.4.2.1.1.[134] This moderation model is the one that pertains to the quadratic model involving the CostStructure-MANUFACTURING cost structure measure as the contingency factor, CSC-DEVELOPED as the CSC measure and USEFULNESS as the outcome measure (see Table 8-4). The results of the other two moderation models relating to the other two quadratic models of cost structure, as shown in Table 8-4, are provided in Appendix 8-3.[135]

Table 8-5 displays the results of the moderation version of the quadratic model involving CostStructure-MANUFACTURING as the contingency factor, CSC-DEVELOPED as the CSC measure and USEFULNESS as the outcome measure. As presented in Table 8-5 (Panel A), the moderation model is significant (F-value = 7.73, $p < 0.01$, adjusted $R^2 = 0.12$), and the interaction term, (CSC-DEVELOPED)(CostStructure-MANUFACTURING), has a significant positive effect on USEFULNESS (b3 = 0.12, $p < .05$), thereby supporting the

[134] The moderation effect of cost structure reported in Section 8.4.2.1.1 is related to a quadratic polynomial regression model of cost structure, where the R^2 difference between the linear and quadratic model is significant.

[135] Due to the slight differences between the results of the four moderation effects of cost structure found in this research, three in Section 8.4.1 and one in Section 8.4.2.1.1, the results of the two moderation models provided in Appendix 8-3 are described in the text in Appendix 8-3.

moderation role of CostStructure-MANUFACTURING on the relationship between CSC-DEVELOPED and USEFULNESS.[136] To obtain further details about the nature and simplify the interpretation of the moderation effect of CostStructure-MANUFACTURING, the relationship between CSC-DEVELOPED and USEFULNESS was examined - i.e., simple-slope tests - and plotted at the 10th, 25th, 50th, 75th and 90th percentile values of CostStructure-MANUFACTURING. As provided in Table 8-5 (Panel B), the results of the simple-slope tests reveal that the relationship between CSC-DEVELOPED and USEFULNESS is positive and insignificant at the 10th percentile/very low (effect = 0.05, $p > 0.05$) and 25th percentile/low (effect = 0.11, $p > 0.05$) values of CostStructure-MANUFACTURING and positive and significant at the 50th/moderate (effect = 0.21, $p < 0.01$), 75th/high (effect = 0.28, $p < 0.01$) and 90th/very high (effect = 0.33, $p < 0.01$) values of CostStructure-MANUFACTURING. This finding is visualised in Figure 8-5, which shows the weaker positive relationship between CSC-DEVELOPED and USEFULNESS at very low and low levels of CostStructure-MANUFACTURING compared to the positive one between the two constructs at moderate, high and very high levels of CostStructure-MANUFACTURING.

Nevertheless, the trend of the relationship reported above was not completely confirmed by the findings produced by using the Johnson-Neyman technique, which agreed completely with those of the simple-slope tests regarding the fact that the relationship between CSC-DEVELOPED and USEFULNESS is positive for all examined values of CostStructure-MANUFACTURING - e.g., low and high - and significant at moderate, high and very high values of CostStructure-MANUFACTURING. However, given the technique's ability to examine the region of significance of the relationship between CSC-DEVELOPED and

[136] The adjusted R^2 is reported as an indicator of the regression model's predictive power, because it adjusts R^2, also an indicator of the regression model's predictive power, based on the number of independent variables relative to the sample size (Hair et al., 2010; Hair et al., 2017).

USEFULNESS across the complete range of values of CostStructure-MANUFACTURING, its findings showed that, although insignificant, the relationship between CSC-DEVELOPED and USEFULNESS is negative at extreme low values, i.e., below the 10th percentile value, of CostStructure-MANUFACTURING.

Substantially, the results provide that CostStructure-Manufacturing has an influence on the optimal level of CSC-DEVELOPED from the perspective of the moderation sub-form of fit. Even though the results of the simple-slope tests (Table 8-5, Panel B) and Figure 8-5 indicate that the moderation effect of CostStructure-MANUFACTURING is monotonic, in that the relationship between CSC-DEVELOPED and USEFULNESS is positive for all levels of CostStructure-MANUFACTURING, the findings produced by using the Johnson-Neyman technique reveal that it is actually non-monotonic, in that this relationship is positive across all levels of CostStructure-MANUFACTURING, apart from the very low ones, where the relationship between the two constructs becomes negative.

8.4.1.2 PC

Table 8-4 shows that, among the five quadratic models in which the interaction term was found to be the only significant higher-order term, one quadratic model involves PC as the contingency factor, CSC-COMPOSITE as the CSC measure and USAGE as the outcome measure. Table 8-6 summarises the results of the moderation version of this quadratic model. As shown in Table 8-6 (Panel A), the moderation model is significant (F-value = 3.88, p = 0.01, adjusted R^2 = 0.04), and the interaction term, (CSC-COMPOSITE)(PC), has a significant negative effect on USAGE (b3 = -0.12, $p < .05$), thereby supporting the moderation role of PC on the relationship between CSC-COMPOSITE and USAGE. As provided in Table 8-6 (Panel B), the results of the simple-slope tests convey that the relationship between CSC-COMPOSITE and USAGE is positive and significant at the 10th percentile/very low (effect = 0.28, $p < 0.01$), 25th percentile/low (effect = 0.20, $p < 0.01$) and

Table 8-5: The results of the moderation effect of CostStructure-MANUFACTURING on the relationship between CSC-DEVELOPED and USEFULNESS

Moderation model: USEFULNESS= $b_0 + b_1$ CSC-DEVELOPED + b_2 CostStructure-MANUFACTURING + b_3 (CSC-DEVELOPED)(CostStructure-MANUFACTURING)

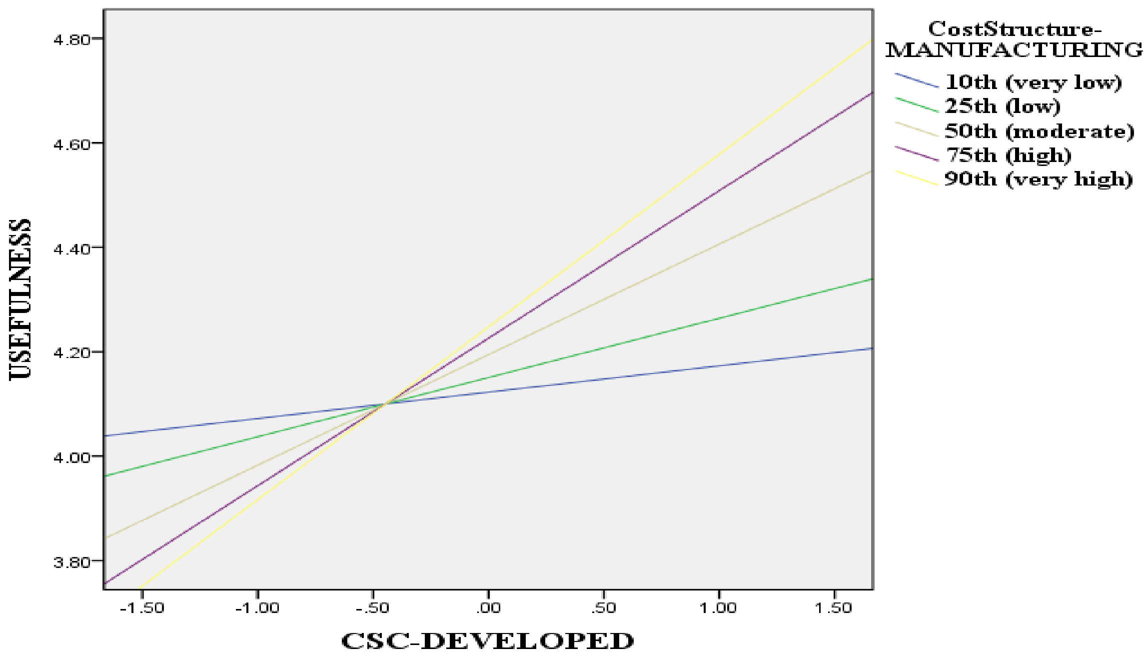
Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.19	0.05		88.32	0.000	
CSC-DEVELOPED (b_1)	0.20	0.05	0.33	4.25	0.000	1.00
CostStructure-MANUFACTURING (b_2)	0.05	0.05	0.08	1.05	0.295	1.06
(CSC-DEVELOPED)(CostStructure-MANUFACTURING) (b_3)	0.12	0.06	0.17	2.11	**0.037**	1.06
F-value	7.73					
Sig.	**0.000**					
Adjusted R^2	0.12					

Panel B:

CostStructure-MANUFACTURING value	**Effect**	**SE**	**t-value**	**Sig**
10th percentile (-1.31)	0.05	0.09	0.58	0.565
25th percentile (-0.77)	0.11	0.06	1.76	0.080
50th percentile (0.08)	0.21	0.05	4.43	**0.000**
75th percentile (0.69)	0.28	0.06	4.69	**0.000**
90th percentile (1.11)	0.33	0.08	4.32	**0.000**

Figure 8-5: The moderation effect of CostStructure-MANUFACTURING on the relationship between CSC-DEVELOPED and USEFULNESS



50th percentile/moderate (effect = 0.12, $p < 0.05$) values of PC, positive and insignificant at the 75th percentile/high value of PC (effect = 0.04, $p > 0.05$) and negative and insignificant at the 90th percentile/very high values of PC (effect = -0.05, $p > 0.05$).[137] This finding is visualised in Figure 8-6, which displays the strong positive relationship between CSC-COMPOSITE and USAGE at very low, low and moderate levels of PC, the weak positive one between the two constructs at high levels of PC and the weak negative relationship between the two constructs at very high levels of PC.

In aggregate, the results show that PC has an influence on the optimal level of CSC-COMPOSITE from the perspective of the moderation sub-form of fit. More specifically, the results of the simple-slope tests (Table 8-6, Panel B) and Figure 8-6 reveal that the moderation effect of PC is non-monotonic, in that the relationship between CSC-COMPOSITE and USAGE is positive along all levels of PC except for very high ones, where the relationship between the two constructs becomes negative. In addition, although the moderation influence of PC agrees with the dominant trend of the moderation impacts of cost structure in signifying the importance of increasing CSC at moderate values of the contingency factor, the moderation effect of PC contradicts the dominant trend of the moderation influences of cost structure, in that the former signals the importance of increasing CSC at lower rather than higher values of the contingency factor.[138]

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[137] This trend of relationship was also confirmed by the findings produced by using the Johnson-Neyman technique, which evaluates the region of significance of the relationship between the independent construct - i.e., CSC - and the outcome one across the whole range of values of the moderator construct, i.e., contingency (see Section 8.2.6).

[138] As provided in Section 8.4.1.1 and below in Section 8.4.2.1.1, cost structure has four moderation effects. The dominant trend, i.e. found in three of the effects, is non-monotonic and positive, revealing a relationship between CSC and the outcome that is negative and insignificant at very low values, positive and insignificant at low values, positive and predominantly significant at moderate values and positive and significant at high and very high values of cost structure (see Section 8.4.1.1). Accordingly, the dominant trend of the moderation influences of cost structure stresses the importance of increasing CSC at moderate and higher values of the contingency factor. The exception to the dominant trend of the moderation impacts of cost structure is the moderation effect of CostStructure-COMBINED on the relationship between CSC-DEVELOPED and USEFULNESS (see Appendix 8-3). This moderation influence of cost structure is monotonic and positive, in that the relationship between CSC and the outcome is positive and insignificant at very low values and positive

Table 8-6: The results of the moderation effect of PC on the relationship between CSC-COMPOSITE and USAGE

Moderation model: USAGE= $b_0 + b_1$ CSC-COMPOSITE + b_2 PC + b_3 (CSC-COMPOSITE)(PC)

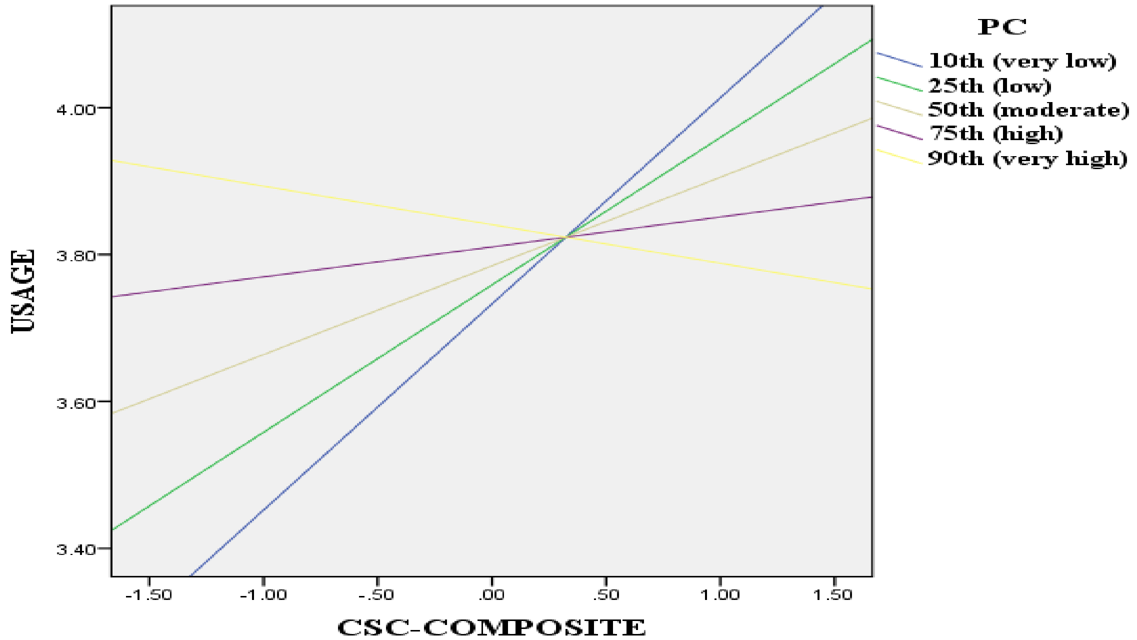
Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	3.79	0.05		70.71	0.000	
CSC-COMPOSITE (b_1)	0.12	0.06	0.15	2.13	0.035	1.06
PC (b_2)	0.04	0.06	0.05	0.71	0.477	1.08
(CSC-COMPOSITE)(PC) (b_3)	-0.12	0.06	-0.15	-2.09	**0.038**	1.08
F-value	3.88					
Sig.	**0.010**					
Adjusted R^2	0.04					

Panel B:

PC value	**Effect**	**SE**	**t-value**	**Sig.**
10th percentile (-1.36)	0.28	0.09	3.21	**0.002**
25th percentile (-0.70)	0.20	0.06	3.25	**0.001**
50th percentile (-0.04)	0.12	0.05	2.23	**0.027**
75th percentile (0.62)	0.04	0.07	0.58	0.564
90th percentile (1.39)	-0.05	0.11	-0.50	0.618

Figure 8-6: The moderation effect of PC on the relationship between CSC-COMPOSITE and USAGE



and significant at the remaining values of cost structure (see Table 2 in Appendix 8-3), providing partial support for the importance of increasing CSC at lower values of the contingency factor.

8.4.1.3 TMKA

Table 8-4 shows that, of the five quadratic models in which the interaction term was found to be the only significant higher-order term, one quadratic model involves TMKA as the contingency factor, CSC-CostPools as the CSC measure and USAGE as the outcome measure. Table 8-7 displays the results of the moderation version of this quadratic model. As presented in Table 8-7 (Panel A), the moderation model is significant (F-value = 20.11, $p < 0.01$, adjusted $R^2 = 0.23$), and the interaction term, (CSC-CostPools)(TMKA), has a significant negative effect on USAGE ($b_3 = -0.11$, $p < .05$), thereby supporting the moderation role of TMKA on the relationship between CSC-CostPools and USAGE. As provided in Table 8-7 (Panel B), the results of the simple-slope tests reveal that the relationship between CSC-CostPools and USAGE is positive and significant at the 10th percentile/very low (effect = 0.19, $p < 0.05$) and 25th percentile/low (effect = 0.13, $p < 0.05$) values of TMKA, positive and insignificant at the 50th percentile/moderate value of TMKA (effect = 0.08, $p > 0.05$) and negative and insignificant at the 75th percentile/high (effect = -0.02, $p > 0.05$) and 90th percentile/very high (effect = -0.08, $p > 0.05$) values of TMKA.[139] This finding is visualised in Figure 8-7, which exhibits the strong positive relationship between CSC-CostPools and USAGE at very low and low levels of TMKA, the weak positive one between the two constructs at moderate levels of TMKA and the weak negative one between the two constructs at high and very high levels of TMKA.

Substantially, the results provide that TMKA has an influence on the optimal CSC-CostPools from the perspective of the moderation sub-form of fit. In particular, the results of the simple-slope tests (Table 8-7, Panel B) and Figure 8-7 indicate that the moderation effect of TMKA is non-monotonic, in that at very low, low and moderate levels of TMKA, the

[139]This trend of relationship was also confirmed by the findings produced by using the Johnson-Neyman technique, which evaluates the region of significance of the relationship between the independent construct - i.e., CSC - and the outcome one across the whole range of values of the moderator construct, i.e., contingency (see Section 8.2.6).

relationship between CSC-CostPools and USAGE is positive, whereas, at high and very high levels of TMKA, the relationship between the two constructs is negative. Furthermore, the moderation effect of TMKA corresponds to that of PC in denoting the importance of increasing CSC at lower values of the contingency factor. Nonetheless, it weakly agrees with it in signalling the importance of increasing CSC at moderate values of the contingency factor.[140] Moreover, despite the weak level of conformity between the moderation impact of TMKA and the dominant trend of the moderation effects of cost structure in signifying the importance of increasing CSC at moderate values of the contingency factor, the moderation influence of TMKA conflicts with the dominant trend of the moderation impacts of cost structure, in that the former highlights the importance of increasing CSC at the lower rather than the higher values of the contingency factor.

8.4.2 Models with significant R^2 differences

As provided in Section 8.4, the results of the first step of the second stage revealed that the R^2 difference between the linear and quadratic models was significant in only 16 of the 88 quadratic polynomial regression models (see Table 8-3). In this situation, the second step of the second stage, which involves testing whether there is a significant R^2 difference between the quadratic and cubic models, is applied (see Section 8.2.5 and Figure 8-4). The results provided in Table 8-8 indicate that the cubic versions, i.e., models, of the 16 quadratic polynomial regression models fail to explain a significant incremental amount of variance, i.e., R^2 difference, over the quadratic models. These results mean that the 16 quadratic models are supported, as required in order to proceed with testing the matching hypotheses.

[140] The moderation influence of TMKA on the relationship between CSC-CostPools and USAGE provides only weak support for the importance of increasing CSC at moderate values of the contingency factor, as the positive relationship between CSC and the outcome measure at the 50th percentile value, i.e., moderate, of the contingency factor was found to be significant at the 10% significance level (see Table 8-7).

Table 8-7: The results of the moderation effect of TMKA on the relationship between CSC-CostPools and USAGE

Moderation model: USAGE= $b_0 + b_1$ CSC-CostPools + b_2 TMKA + b_3 (CSC-CostPools)(TMKA)

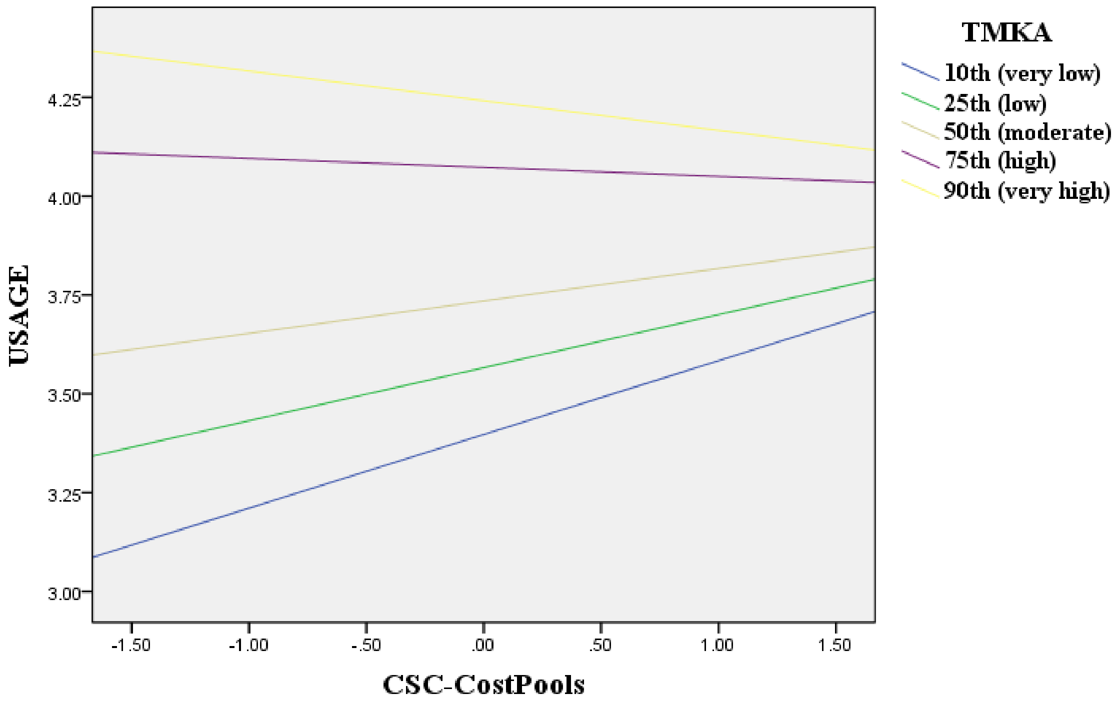
Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	3.82	0.05		78.98	0.000	
CSC-CostPools (b_1)	0.06	0.05	0.07	1.17	0.244	1.02
TMKA (b_2)	0.34	0.05	0.44	6.98	0.000	1.02
(CSC-CostPools)(TMKA) (b_3)	-0.11	0.05	-0.14	-2.21	**0.028**	1.00
F-value	20.11					
Sig.	**0.000**					
Adjusted R^2	0.23					

Panel B:

TMKA value	**Effect**	**SE**	**t-value**	**Sig.**
10th percentile (-1.24)	0.19	0.07	2.49	**0.014**
25th percentile (-0.74)	0.13	0.06	2.28	**0.024**
50th percentile (-0.24)	0.08	0.05	1.66	0.099
75th percentile (0.76)	-0.02	0.06	-0.37	0.712
90th percentile (1.25)	-0.08	0.08	-0.96	0.338

Figure 8-7: The moderation effect of TMKA on the relationship between CSC-CostPools and USAGE



However, as explained in Section 8.2.5 and provided in Figure 8-4, there are three possible outcomes of this situation. The following sections will present the results of the 16 quadratic polynomial regression models in relation to these three outcomes, which include: (1) finding, in the quadratic model, the interaction term, i.e., (CSC)(contingency), to be the only significant higher-order term (three quadratic models in Section 8.4.2.1); (2) finding, in the quadratic model, either (a) that both the interaction term and the quadratic one related to CSC, i.e., $(CSC)^2$, are significant or (b) all higher-order terms - i.e., interaction and quadratic terms - to be significant (one quadratic model in Section 8.4.2.2); and (3) all other findings besides the first two outcomes (12 quadratic models in Section 8.4.2.3).

Table 8-8: The results of testing the R^2 difference between the quadratic and cubic models

Contingency factor	CSC measure	Outcome measure	R^2 Change	F Change	Sig. F Change
COMP	CSC-CostPools	USEFULNESS	0.02	0.85	0.493
COMP	CSC-CostDrivers	USEFULNESS	0.02	0.81	0.517
COMP	CSC-COMPOSITE	USEFULNESS	0.03	1.61	0.174
CostStructure-COMBINED	CSC-CostDrivers	USAGE	0.01	0.65	0.628
CostStructure-COMBINED	CSC-COMPOSITE	USEFULNESS	0.02	1.09	0.364
CultureOutcome	CSC-CostPools	USEFULNESS	0.01	0.90	0.466
CultureOutcome	CSC-COMPOSITE	USEFULNESS	0.01	0.61	0.656
CultureDetail	CSC-COMPOSITE	USEFULNESS	0.02	0.92	0.453
CultureControl	CSC-CostPools	USEFULNESS	0.02	1.03	0.393
CultureControl	CSC-COMPOSITE	USEFULNESS	0.02	0.88	0.479
PC	CSC-CostPools	USAGE	0.01	0.66	0.623
SizeRevenue	CSC-CostPools	USEFULNESS	0.01	0.35	0.846
SizeRevenue	CSC-COMPOSITE	USEFULNESS	0.00	0.11	0.980
TMKA	CSC-CostPools	USEFULNESS	0.01	0.81	0.523
TMKA	CSC-CostDrivers	USEFULNESS	0.01	0.58	0.681
TMKA	CSC-COMPOSITE	USEFULNESS	0.01	0.80	0.530

8.4.2.1 Quadratic models with the interaction term as the only significant higher-order term

As explained in Section 8.2.5 and presented in Figure 8-4, when the interaction term is the only significant higher-order term in the quadratic model, the matching sub-form of fit, i.e., matching/fit hypothesis, is rejected, and the moderation one is supported instead. This pattern of results was found in three of the 16 supported quadratic models. Table 8-9 provides information about the three quadratic models, which are related to two contingency factors; namely, cost structure (CostStructure-COMBINED) and business-unit size (SizeRevenue). The quadratic terms - i.e., $(CSC)^2$ and $(contingency)^2$ - included in these three quadratic models were then removed from each model in order to run three moderation models using MRA. The results of these three moderation models will be presented for each of the two contingency factors of cost structure (CostStructure-COMBINED) (Section 8.4.2.1.1) and business-unit size (SizeRevenue) (Section 8.4.2.1.2).

Table 8-9: Information about the quadratic models in which the interaction term was found to be the only significant higher-order term in the second step of the second stage of the two-stage procedure

Contingency factor	**CSC measure**	**Outcome measure**
CostStructure-COMBINED	CSC-CostDrivers	USAGE
SizeRevenue	CSC-CostPools	USEFULNESS
SizeRevenue	CSC-COMPOSITE	USEFULNESS

8.4.2.1.1 Cost structure (CostStructure-COMBINED)

Table 8-9 shows that, among the three quadratic models in which the interaction term was found to be the only significant higher-order term, one of the quadratic models involves CostStructure-COMBINED as the contingency factor, CSC-CostDrivers as the CSC measure and USAGE as the outcome measure. Given that the moderation version of this quadratic model represents the dominant trend of the moderation effects of cost structure and that the dominant trend of the moderation effects was already furnished in Section 8.4.1.1, the results of the moderation version of this quadratic model are provided in Appendix 8-4.[141]

[141] Given the slight differences between the results of the four moderation effects of cost structure found in this research, here and in Sections 8.4.1 and 8.4.1.1 and Appendix 8-3, the results of the moderation model provided in Appendix 8-4 are described in the text in Appendix 8-4.

8.4.2.1.2 Business-unit size (SizeRevenue)

Table 8-9 shows that, among the three quadratic models in which the interaction term was found to be the only significant higher-order term, two quadratic models are related to SizeRevenue. The results of the moderation versions of these two quadratic models are almost identical. Hence, the results of the moderation version of one of the quadratic models are presented in this section, while those of the other one can be found in Appendix 8-5.[142] The moderation version of the quadratic model involving SizeRevenue as the contingency factor, CSC-CostPools as the CSC measure and USEFULNESS as the outcome measure is selected as an example. Table 8-10 summarises the results of this moderation model.

As shown in Table 8-10 (Panel A), the moderation model is significant (F-value = 12, $p < 0.01$, adjusted $R^2 = 0.14$), and the interaction term, (CSC-CostPools)(SizeRevenue), has a significant negative effect on USEFULNESS (b3 = -0.16, $p < .01$), thereby supporting the moderation role of SizeRevenue on the relationship between CSC-CostPools and USEFULNESS. As provided in Table 8-10 (Panel B), the results of the simple-slope tests convey that the relationship between CSC-CostPools and USEFULNESS is positive and significant at the 10th percentile/very low (effect = 0.36, $p < 0.01$), 25th percentile/low (effect = 0.30, $p < 0.01$) and 50th percentile/moderate (effect = 0.19, $p < 0.01$) values of SizeRevenue, positive and insignificant at the 75th percentile/high value of SizeRevenue (effect = 0.02, $p > 0.05$) and negative and insignificant at the 90th percentile/very high value of SizeRevenue (effect = -0.04, $p > 0.05$).[143] This finding is visualised in Figure 8-8, which displays the strong positive relationship between CSC-CostPools and USEFULNESS at very low, low and moderate levels of SizeRevenue, the weak positive one between the two

[142] Given that the results of the moderation versions, models, of the two quadratic models pertaining to business-unit size are almost identical, the results of the moderation model provided in Appendix 8-5 are not illustrated in the text in Appendix 8-5.

[143] This trend of relationship was also confirmed by the findings produced by using the Johnson-Neyman technique, which evaluates the region of significance of the relationship between the independent construct - i.e., CSC - and the outcome one across the whole range of values of the moderator construct, i.e., contingency (see Section 8.2.6).

constructs at high levels of SizeRevenue and the weak negative one between the two constructs at very high levels of SizeRevenue.

Overall, the results show that SizeRevenue has an influence on the optimal CSC-CostPools from the perspective of the moderation sub-form of fit. In particular, the results of the simple-slope tests (Table 8-10, Panel B) and Figure 8-8 indicate that the moderation effect of SizeRevenue is non-monotonic, in that the relationship between CSC-CostPools and USEFULNESS is positive across all levels of SizeRevenue, except for very high levels, where the relationship between the two constructs becomes negative. Furthermore, the moderation influence of SizeRevenue is congruent with the moderation impacts of PC (see Section 8.4.1.2) and TMKA (see Section 8.4.1.3) in denoting the importance of increasing CSC at lower values of the contingency factor.[144] In addition, even though the moderation effect of SizeRevenue corresponds with the dominant trend of the moderation influences of cost structure in emphasising the importance of increasing CSC at moderate values of the contingency factor, the moderation impact of SizeRevenue conflicts with the dominant trend of the moderation effects of cost structure, in that the former signals the importance of increasing CSC at lower rather than higher values of the contingency factor.

8.4.2.2 Quadratic models with either joint significance of the interaction term and the quadratic one related to CSC or significance of all higher-order terms

As demonstrated in Section 8.2.5 and illustrated in Figure 8-4, either the joint significance of both the interaction term - i.e., (CSC)(contingency) - and quadratic one related to CSC, i.e., $(CSC)^2$, or the significance of all higher-order terms provides initial statistical support for the matching/fit hypothesis. However, further analysis of the surface of the quadratic model is required in order to conclude whether the matching/fit hypothesis is completely supported.

[144] Moreover, the moderation effect of SizeRevenue agrees with that of PC in highlighting the importance of increasing CSC at moderate values of the contingency factor. This, however, was only weakly supported by the moderation influence of TMKA (see Section 8.4.1.3).

Table 8-10: The results of the moderation effect of SizeRevenue on the relationship between CSC-CostPools and USEFULNESS

Moderation model: USEFULNESS= $b_0 + b_1$ CSC-CostPools + b_2 SizeRevenue + b_3 (CSC-CostPools)(SizeRevenue)

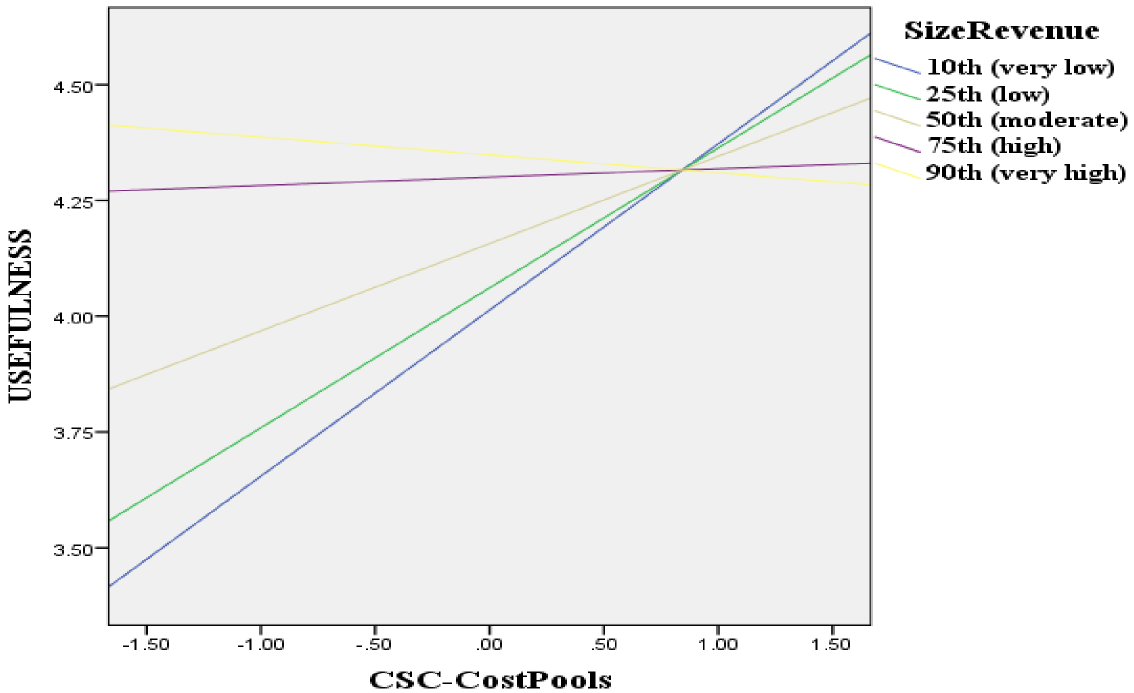
Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.17	0.05		78.46	0.000	
CSC-CostPools (b_1)	0.17	0.06	0.25	3.02	0.003	1.55
SizeRevenue (b_2)	0.13	0.06	0.19	2.41	0.017	1.42
(CSC-CostPools)(SizeRevenue) (b_3)	-0.16	0.05	-0.22	-3.19	**0.002**	1.11
F-value	12.00					
Sig.	**0.000**					
Adjusted R^2	0.14					

Panel B:

SizeRevenue value	**Effect**	**SE**	**t-value**	**Sig.**
10^{th} percentile (-1.18)	0.36	0.09	3.86	**0.000**
25^{th} percentile (-0.82)	0.30	0.08	3.81	**0.000**
50^{th} percentile (-0.10)	0.19	0.06	3.20	**0.002**
75^{th} percentile (0.98)	0.02	0.06	0.29	0.775
90^{th} percentile (1.34)	-0.04	0.07	-0.52	0.602

Figure 8-8: The moderation effect of SizeRevenue on the relationship between CSC-CostPools and USEFULNESS



Among the remaining 13 of the 16 supported quadratic models, only one had one of either of the patterns of results required for initial statistical support for the matching/fit hypothesis. More specifically, one quadratic model involving PC as the contingency factor, CSC-CostPools as the CSC measure and USAGE as the outcome measure was found to have a joint significance of both the interaction term and the quadratic one related to CSC. Table 8-11 summarises the results of this model, showing (in Panel A) that the quadratic model is significant (F-value = 3.60, $p < 0.01$, adjusted $R^2 = 0.06$), and that both the interaction term, (CSC-CostPools)(PC), and the quadratic term related to CSC, $(\text{CSC-CostPools})^2$, are significant ($b_4 = -4.59$ ($p < 0.01$), $b_3 = -1.85$ ($p < 0.05$), respectively).

Figure 8-9 displays the surface that corresponds to the coefficients of the quadratic model reported in Table 8-11 (Panel A). Before analysing this surface, it is important to explain the five lines included on the surface. The dotted line running from the near-front corner to the far-back corner of the surface is the numerical-fit line, whereas the dotted line running from the right-hand corner to the left-hand corner of the surface is the numerical-misfit line.[145] The solid line represents the first principal axis, while the heavy-dashed line represents the second one.[146] The light-dashed line is the Matching-Fit-Line.[147]

As exhibited in Figure 8-9, the surface is saddle-shaped. This is also confirmed by the positive/negative curvature of the first/second principal axis (see Table 8-11, Panel B). The saddle-shaped surface is compatible with the implication of the matching sub-form of fit (see Section 8.2.2). To determine the direction of the association between PC and the optimal

[145] Regardless of the results of the quadratic model, the lines of numerical-fit and numerical-misfit appear on any surface. In this thesis, these lines are presented in the same way as shown in Figure 8-9 for all subsequent surfaces.
[146] Depending on the results of the quadratic model, the first and second principal axes do not necessarily appear on all surfaces. Whether each or both of the principal axes appear on any subsequent surface or not, the principal axes, in this thesis, are presented in the same way as in Figure 8-9.
[147] In this thesis, the Matching-Fit-Line appears only on the surface shown in Figure 8-9, given that this is the only surface to represent a quadratic model that has either a joint significance of both the interaction term and quadratic one related to CSC or a significance of all higher-order terms.

CSC-CostPools, the Matching-Fit-Line can be analysed. Figure 8-9 reveals that the Matching-Fit-Line, light-dashed line, runs from low values of PC and high values of CSC-CostPools to high values of PC and low values of CSC-CostPools. This means that PC is negatively associated with the optimal CSC-CostPools. This negative association contrasts with the positive one implied by the matching/fit hypothesis, whereby the Matching-Fit-Line should run from low values of both the contingency factor and the optimal level of CSC to high values of both constructs (see Hypothesis 4 in Section 8.1).

To determine the magnitude and sign of the impact of the misfit between PC and the optimal CSC-CostPools on USAGE, the second principal axis, heavy-dashed line, can be analysed because it is perpendicular to the Matching-Fit-Line and represents the line along which USAGE is minimised. In addition, the line of numerical-fit, the dotted line running from the near-front corner to the far-back corner of the surface, can also be used, since, as Figure 8-9 shows, it is perpendicular to the Matching-Fit-Line. As presented in Table 8-11 (Panel B), both the second principal axis and the line of numerical-fit have a significant negative curvature (-6.64 ($p < 0.01$), -7.58 ($p < 0.01$), respectively), indicating that deviating from the Matching-Fit-Line, i.e., the misfit, including over- and under-fit, causes a reduction in USAGE. Table 8-12 provides further support for the negative impact of the misfit on USAGE. In particular, it conveys that the levels of USAGE at the Matching-Fit-Line (see the dark-highlighted cells in Table 8-12), which correspond to different levels of PC and their associated optimal CSC-CostPools, are the highest, and that deviating from the optimal CSC-CostPools causes a decline in USAGE (see the light-highlighted cells in Table 8-12).[148]

[148] The surface was not analysed regarding the first - i.e., hetero-outcome - and second, i.e., more negative impact of under-fit, extensions to the classical matching sub-form of fit because the Matching-Fit-Line, and, accordingly, the misfit lines - i.e., the second principal axis and the numerical-fit line - run in the reverse direction to that implied by the matching/fit hypothesis.

Overall, the results provided in Table 8-11, Table 8-12 and Figure 8-9 reveal that PC has a significant negative influence on the optimal CSC-CostPools from the perspective of the matching sub-form of fit. This negative influence partially agrees with the non-monotonic negative moderation effect of PC that was reported in Section 8.4.1.2. The first element of this negative influence, i.e., the negative association between PC and the optimal CSC-CostPools, indicates that the outcome is maximised at extreme opposite values of both PC and CSC, which is, to some extent, consistent with the non-monotonic negative moderation effect of PC, whereby the relationship between CSC and the outcome is positive and significant at very low and negative and insignificant at very high values of PC, i.e., the outcome is maximised when PC is very low and CSC is very high and might also be so when these levels are reversed. However, at the remaining values of PC, it disagrees with the non-monotonic negative moderation effect that the outcome is maximised at either the highest or lowest values of CSC. Instead, the first element of the negative influence of PC on the optimal CSC-CostPools, i.e., the negative association between PC and the optimal CSC-CostPools, implies that, at the remaining values of PC, there are specific values other than the highest or lowest value of CSC at which the outcome is maximised. The second element of the negative influence of PC on the optimal CSC-CostPools, i.e., the significant negative influence of the misfit, including both over- and under-fit, on USAGE, is congruent with the assumption of the non-monotonic negative moderation effect of PC that the misfit negatively influences the outcome. Nonetheless, it contradicts the assumption of the non-monotonic negative moderation effect that, based on the level of PC, the misfit is represented by either over- or under-fit, but not both.[149] The second element of the negative influence of PC on the

[149] Given that the moderation sub-form of fit assumes that the relationship between CSD and the outcome is linear, positive or negative, that changes at different levels of the contingency factor, it follows that the impact of the misfit on the outcome is also linear and, hence, represented by either an over-fit, if the linear relationship is negative, or an under-fit, if the linear relationship is positive (see Sections 3.3.2.2 and 4.4.2).

optimal CSC-CostPools, i.e., the negative influence of the misfit, including both over- and under-fit, on USAGE, assumes that the misfit is represented by both over- and under-fit.

Table 8-11: The results of the quadratic model involving PC, CSC-CostPools and USAGE

Quadratic model: USAGE= $b_0 + b_1$ CSC-CostPools + b_2 PC + b_3 (CSC-CostPools)^2 + b_4 (CSC-CostPools)(PC) + b_5 (PC)^2

Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	3.89	0.08		46.24	0.000	
CSC-CostPools (b_1)	-0.35	0.39	-0.10	-0.89	0.374	2.59
PC (b_2)	-0.49	0.47	-0.12	-1.04	0.298	2.60
(CSC-CostPools)^2 (b_3)	-1.85	0.91	-0.17	-2.04	**0.043**	1.52
(CSC-CostPools)(PC) (b_4)	-4.59	1.62	-0.32	-2.83	**0.005**	2.68
(PC)^2 (b_5)	-1.15	1.32	-0.07	-0.87	0.385	1.53
F-value	3.60					
Sig.	**0.004**					
Adjusted R^2	0.06					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	-0.84	**-7.58****
Numerical-misfit line	0.14	1.6
First principal axis	0.45	1.95
Second principal axis	-1.52	**-6.64****

*** $p < 0.05$, ** $p < 0.01$.**

8.4.2.3 Other quadratic models

The pattern of results found in the remaining 12 of the 16 supported quadratic models did not follow those reported in Sections 8.4.2.1 and 8.4.2.2. As described in Section 8.2.5 and illustrated in Figure 8-4, this means that the Matching-Fit-Line cannot be drawn, indicating a lack of support for the matching/fit hypothesis. Nevertheless, the surfaces corresponding to these quadratic models can be analysed to investigate the extent of any influence that the contingency factor might have on the optimal level of CSC from the perspective of the weak form of the matching sub-form of fit, i.e., weak support for the matching/fit hypothesis. Table 8-13 provides information about the 12 supported quadratic models that did not follow

Figure 8-9: Response surface analysis for the quadratic model involving PC, CSC-CostPools and USAGE

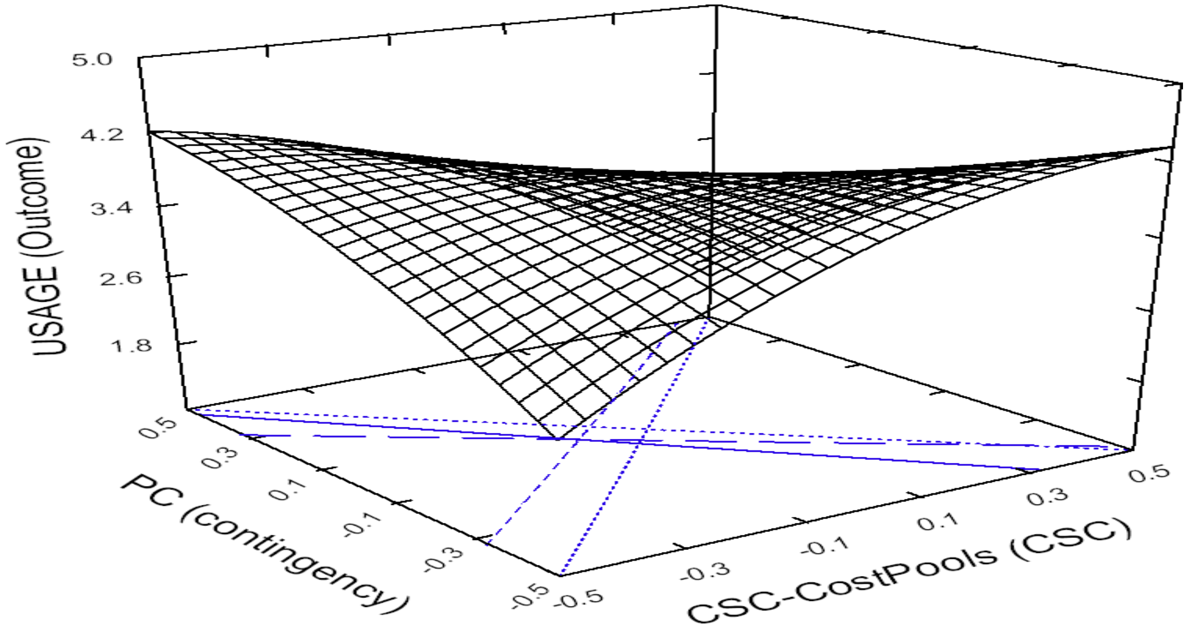


Table 8-12: Levels of USAGE on and off the Matching-Fit-Line

PC	**-0.5**	2.42	2.78	3.10	3.39	3.64	3.85	4.03	4.17	4.27	4.33	**4.36**
	-0.4	2.70	3.01	3.29	3.53	3.74	3.90	4.03	4.13	4.18	4.20	4.19
	-0.3	2.96	3.23	3.46	3.66	3.81	3.94	4.02	4.07	**4.08**	4.05	3.99
	-0.2	3.20	3.42	3.61	3.76	3.87	3.94	3.98	3.98	3.95	3.88	3.77
	-0.1	3.41	3.59	3.73	3.83	3.90	**3.93**	3.92	3.88	3.80	3.68	3.52
	0	3.61	3.74	3.83	3.89	3.91	3.89	3.84	3.75	3.62	3.46	3.26
	0.1	3.77	3.86	3.91	**3.92**	3.89	3.83	3.73	3.60	3.42	3.21	2.97
	0.2	3.92	3.96	3.96	3.93	3.86	3.75	3.60	3.42	3.20	2.95	2.65
	0.3	**4.04**	4.04	3.99	3.91	3.80	3.64	3.45	3.22	2.96	2.66	2.32
	0.4	4.14	4.09	4.00	3.88	3.71	3.51	3.28	3.00	2.69	2.34	1.96
	0.5	4.22	4.12	3.99	3.82	3.61	3.36	3.08	2.76	2.40	2.01	1.58
		-0.5	-0.4	-0.3	**-0.2**	-0.1	**0**	0.1	0.2	**0.3**	0.4	**0.5**
		CSC-CostPools										

the results reported in Sections 8.4.2.1 and 8.4.2.2. The results of these 12 quadratic models will be provided for each of the four contingency factors shown in Table 8-13, which include competition (COMP) (Section 8.4.2.3.1), cost structure (CostStructure-COMBINED) (Section 8.4.2.3.2), organisational culture (CultureOutcome, CultureDetail and CultureControl) (Section 8.4.2.3.3) and TMKA (Section 8.4.2.3.4).

Table 8-13: Information about other quadratic models

Contingency factor	CSC measure	Outcome measure
COMP	CSC-CostPools	USEFULNESS
	CSC-CostDrivers	USEFULNESS
	CSC-COMPOSITE	USEFULNESS
CostStructure-COMBINED	CSC-COMPOSITE	USEFULNESS
CultureOutcome	CSC-CostPools	USEFULNESS
	CSC-COMPOSITE	USEFULNESS
CultureDetail	CSC-COMPOSITE	USEFULNESS
CultureControl	CSC-CostPools	USEFULNESS
	CSC-COMPOSITE	USEFULNESS
TMKA	CSC-CostPools	USEFULNESS
	CSC-CostDrivers	USEFULNESS
	CSC-COMPOSITE	USEFULNESS

8.4.2.3.1 Competition (COMP)

Of the 12 quadratic models that did not follow the patterns of results reported in Sections 8.4.2.1 and 8.4.2.2, Table 8-13 shows that three quadratic models are related to COMP. The CSC measures for these three quadratic models are CSC-CostPools, CSC-CostDrivers and CSC-COMPOSITE, while the outcome measure for all three models is USEFULNESS. The results and surfaces of the three quadratic models are almost identical. Thus, the results and surface of one quadratic model are presented in this section, while those of the other two models can be found in Appendix 8-6.[150] The quadratic model that involves CSC-COMPOSITE as the CSC measure is chosen as an example. Table 8-14 displays the results of this model, where (in Panel A) the quadratic model is significant (F-value = 5.79, $p < 0.01$, adjusted $R^2 = 0.11$), and the quadratic term related to COMP, $(COMP)^2$, is the only significant higher-order term ($b_5 = 3.15$, $p < 0.01$).

Figure 8-10 shows the surface that reflects the coefficients of the quadratic model reported in Table 8-14 (Panel A). As exhibited in Figure 8-10, the surface is saddle-shaped. This is also

[150] Given that the results of the three quadratic models concerning competition are almost identical, the results of the two quadratic models provided in Appendix 8-6 are not explained in the text in Appendix 8-6.

confirmed by the positive/negative curvature of the first/second principal axis (see Table 8-14, Panel B). The saddle-shaped surface is compatible with the implication of the matching sub-form of fit. However, examining the surface in relation to the principal axes fails to provide any support even for a weak matching effect, i.e., matching sub-form of fit. The first principal axis, solid line, runs almost parallel to the COMP or contingency axis. This means that, regardless of the level of COMP, the optimal level of CSC-COMPOSITE that achieves the highest level of USEFULNESS is almost identical. In other words, COMP is not associated with the optimal level of CSC-COMPOSITE.

To determine the magnitude and sign of the impact of the misfit between COMP and the optimal CSC-COMPOSITE on USEFULNESS, the second principal axis can be analysed because it is perpendicular to the first principal axis and represents the line along which USEFULNESS is minimised. As shown in Table 8-14 (Panel B), the second principal axis has an insignificant negative curvature (-1.15, $p > 0.05$), which indicates that deviating from the first principal axis, i.e., the misfit, including both over- and under-fit, does not cause a decline in USEFULNESS.[151] In aggregate, the results provided in Table 8-14 and Figure 8-10 indicate that COMP does not influence the optimal level of CSC-COMPOSITE from the perspective of the weak form of the matching sub-form of fit.

8.4.2.3.2 Cost structure (CostStructure-COMBINED)

Of the 12 quadratic models that did not follow the patterns of results reported in Sections 8.4.2.1 and 8.4.2.2, Table 8-13 reveals that one quadratic model is related to CostStructure-COMBINED as the contingency factor, CSC-COMPOSITE as the CSC measure and USEFULNESS as the outcome measure. Table 8-15 summarises the results of this model, where (see Panel A) the quadratic model is significant (F-value = 5, $p < 0.01$, adjusted R^2 =

[151] The surface was not analysed in relation to the first - i.e., hetero-outcome - and second, i.e., more negative impact of under-fit, extensions to the classical matching sub-form of fit because COMP did not appear to exert any influence on the optimal level of CSC-COMPOSITE.

Table 8-14: The results of the quadratic model involving COMP, CSC-COMPOSITE and USEFULNESS

Quadratic model: USEFULNESS= $b_0 + b_1$ CSC-COMPOSITE + b_2 COMP + b_3 (CSC-COMPOSITE)^2 + b_4 (CSC-COMPOSITE)(COMP) + b_5 (COMP)^2

Panel A:

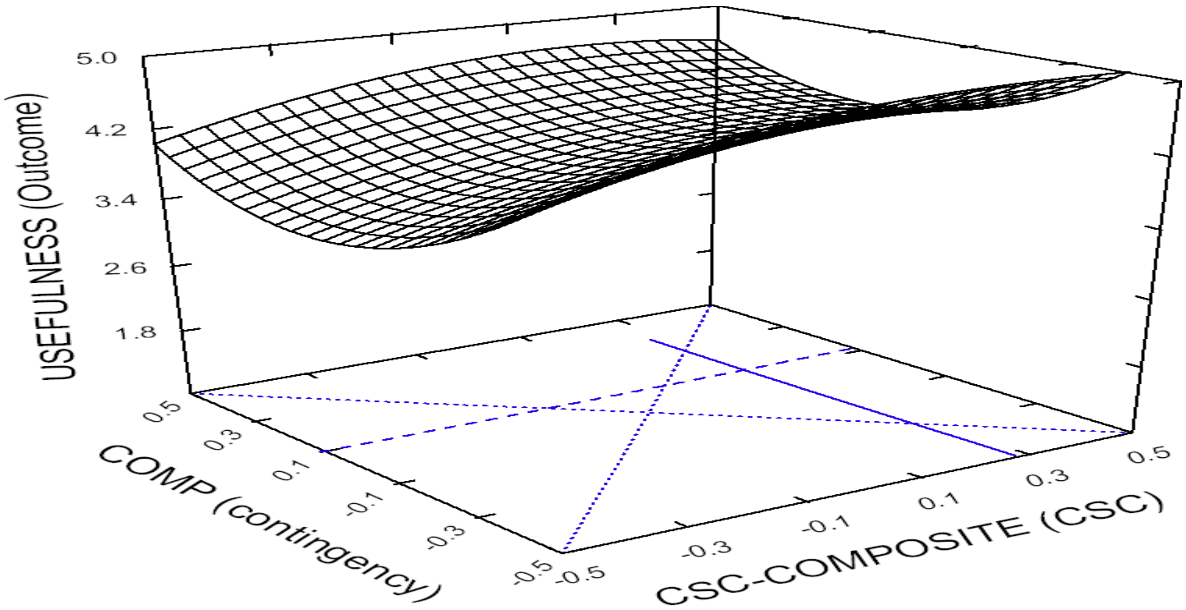
Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.15	0.10		43.22	0.000	
CSC-COMPOSITE (b_1)	0.63	0.31	0.22	2.02	0.045	2.55
COMP (b_2)	-0.68	0.54	-0.17	-1.27	0.207	4.21
(CSC-COMPOSITE)^2 (b_3)	-1.14	0.71	-0.12	-1.62	0.107	1.21
(CSC-COMPOSITE)(COMP) (b_4)	-0.15	1.21	-0.01	-0.13	0.900	2.72
(COMP)^2 (b_5)	3.15	1.08	0.36	2.92	**0.004**	3.26
F-value	5.79					
Sig.	**0.000**					
Adjusted R^2	0.11					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	-0.05	1.86
Numerical-misfit line	1.32	2.16
First principal axis	-5435.39	10091.71*
Second principal axis	0.62	-1.15

*** p < 0.05, ** p < 0.01.**

Figure 8-10: Response surface analysis for the quadratic model involving COMP, CSC-COMPOSITE and USEFULNESS



0.09), and both the interaction term - (CSC-COMPOSITE)(CostStructure-COMBINED) - and the quadratic term related to CSC, $(\text{CSC-COMPOSITE})^2$, are significant at the 10% level ($b_4 = 2.47$ ($p < 0.10$), $b_3 = -1.35$ ($p < 0.10$), respectively).

Figure 8-11 shows the surface that matches the coefficients of the quadratic model reported in Table 8-15 (Panel A). As exhibited in Figure 8-11, the surface is saddle-shaped. This is also confirmed by the positive/negative curvature of the first/second principal axis (see Table 8-15, Panel B). The saddle-shaped surface is compatible with the implication of the matching sub-form of fit. Examining the surface in relation to the principal axes provides support for a weak positive matching effect, i.e., a weak form of the matching sub-form of fit. The first principal axis, solid line, runs from low values of both CostStructure-COMBINED and CSC-COMPOSITE to high values of both constructs. This means that CostStructure-COMBINED is positively associated with the optimal level of CSC-COMPOSITE, which accords with the direction of the association implied by the matching/fit hypothesis (see Hypothesis 2 in Section 8.1).

To determine the magnitude and sign of the impact of the misfit between CostStructure-COMBINED and the optimal CSC-COMPOSITE on USEFULNESS, the second principal axis, heavy-dashed line, can be analysed because it is perpendicular to the first principal axis and represents the line along which USEFULNESS is minimised. In addition, the line of numerical-misfit, the dotted line running from the right-hand corner to the left-hand corner of the surface, can be also utilised because, as Figure 8-11 shows, it is perpendicular to the first principal axis. As presented in Table 8-15 (Panel B), both the second principal axis and the numerical-misfit line have a significant negative curvature (-2.39 ($p < 0.01$), -3.19 ($p < 0.05$), respectively), suggesting that deviating from the first principal axis, i.e., the misfit, including both over- and under-fit, reduces USEFULNESS.[152]

Substantially, the results provided in Table 8-15 and Figure 8-11 reveal that CostStructure-COMBINED has a positive influence on the optimal level of CSC-COMPOSITE from the perspective of the weak form of the matching sub-form of fit. This positive influence partially agrees with the dominant trend of the moderation effects of cost structure, which is non-monotonic and positive, as reported in Sections 8.4.1.1 and 8.4.2.1.1 (see footnote 138 above). The first element of this positive influence, i.e., the positive association between CostStructure-COMBINED and the optimal level of CSC-COMPOSITE, indicates that the outcome is maximised at extreme similar values of both CostStructure-COMBINED and CSC, which is, to some extent, consistent with the dominant non-monotonic positive moderation effects of cost structure that the relationship between CSC and the outcome is negative and insignificant at very low and positive and significant at very high values of cost structure, i.e., the outcome is maximised when the cost structure and CSC are both very high and might be so when both are very low. However, at the remaining values of CostStructure-COMBINED, it disagrees with the dominant non-monotonic positive moderation effects of cost structure that the outcome is maximised at either the highest or lowest value of CSC. Instead, the first element of the positive influence of CostStructure-COMBINED on the optimal level of CSC-COMPOSITE, i.e., the positive association between CostStructure-COMBINED and the optimal level of CSC-COMPOSITE, implies that, at the remaining values of CostStructure-COMBINED, there are specific values other than the highest or lowest value of CSC at which the outcome is maximised. The second element of the positive

[152] The surface was analysed in relation to the first - i.e., hetero-outcome - and second, i.e., more negative impact of under-fit, extensions to the classical matching sub-form of fit. The results shown in Table 8-15 (Panel B) reveal that the first extension does not apply because the first principal axis has an insignificant negative slope (-0.21, $p > 0.05$), indicating that the outcome is the same at all fit points. Likewise, the results provided in Table 8-15 (Panel B) reveal that the second extension does not apply because both the second principal axis and the numerical-misfit line have insignificant positive slopes (0.08 ($p > 0.05$), 0.62 ($p > 0.05$), respectively), suggesting that the negative effect of both over- and under-fit on the outcome is the same.

influence of CostStructure-COMBINED on the optimal level of CSC-COMPOSITE, i.e., the significant negative influence of the misfit, including both over- and under-fit, on USEFULNESS, conforms with the assumption of the dominant non-monotonic positive moderation effects of cost structure that the misfit negatively influences the outcome. Nevertheless, it contradicts the assumption of the dominant non-monotonic positive moderation effects of cost structure that, based on the level of cost structure, the misfit is represented by either over- or under-fit, but not both. The second element of the positive influence of CostStructure-COMBINED on the optimal level of CSC-COMPOSITE, i.e., the negative influence of the misfit, including both over- and under-fit, on USEFULNESS, assumes that the misfit is represented by both over- and under-fit.

8.4.2.3.3 Organisational culture (CultureOutcome, CultureDetail and CultureControl)

Of the 12 quadratic models that did not follow the patterns of results reported in Sections 8.4.2.1 and 8.4.2.2, Table 8-13 shows that, in total, five quadratic models are related to organisational culture. More specifically, two are related to CultureOutcome, one to CultureDetail and two to CultureControl. The CSC measures for these five quadratic models are either CSC-CostPools or CSC-COMPOSITE, while the outcome measure for all five models is USEFULNESS. The results and surfaces of the five quadratic models are almost identical. Therefore, the results and surface of one quadratic model are presented in this section, while those of the other four models can be found in Appendix 8-7.[153] The quadratic model that involves CultureOutcome as the contingency factor, CSC-CostPools as the CSC measure and USEFULNESS as the outcome measure is selected as an example. Table 8-16 displays the results of this model, where (see Panel A) the quadratic model is significant (F-value = 11.83, $p < 0.01$, adjusted $R^2 = 0.21$), and the quadratic term related to CSC,

[153] Given that the conclusions about the results of the five quadratic models related to organisational culture are almost identical, the results of the quadratic models provided in Appendix 8-7 are not explained in the text in Appendix 8-7.

Table 8-15:The results of the quadratic model involving CostStructure-COMBINED, CSC-COMPOSITE and USEFULNESS

Quadratic model: USEFULNESS= b_0 + b_1 CSC-COMPOSITE + b_2 CostStructure-COMBINED + b_3 (CSC-COMPOSITE)^2 + b_4 (CSC-COMPOSITE)(CostStructure-COMBINED) + b_5 (CostStructure-COMBINED)^2

Panel A:

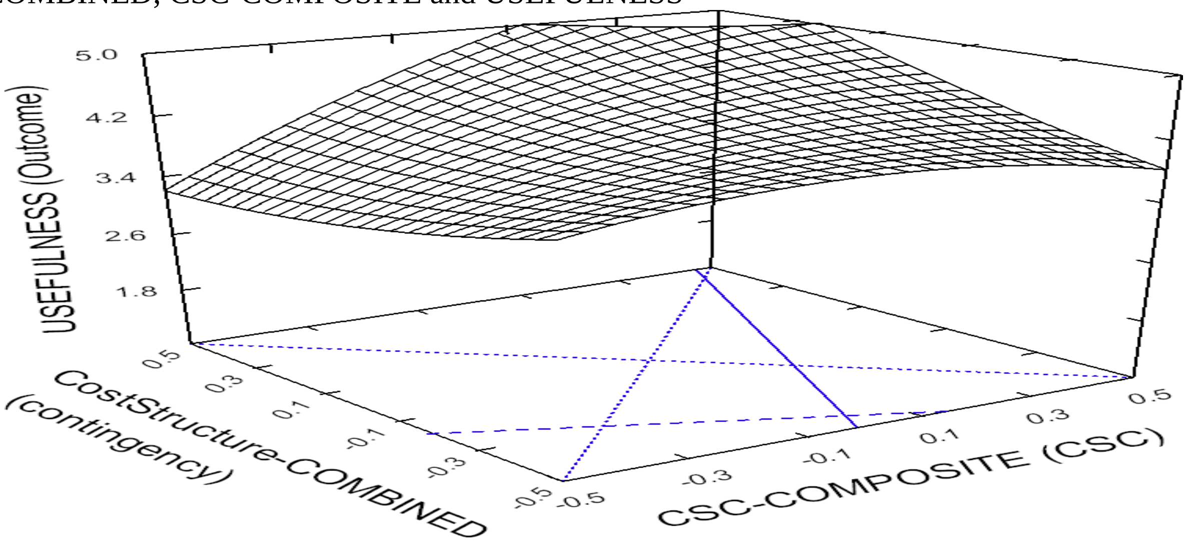
Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.32	0.09		47.06	0.000	
CSC-COMPOSITE (b_1)	1.11	0.35	0.36	3.18	0.002	2.87
CostStructure-COMBINED (b_2)	0.50	0.39	0.13	1.28	0.203	2.29
(CSC-COMPOSITE)^2 (b_3)	-1.35	0.76	-0.14	-1.78	**0.077**	1.28
(CSC-COMPOSITE)(CostStructure-COMBINED) (b_4)	2.47	1.29	0.22	1.92	**0.057**	2.74
(CostStructure-COMBINED)^2 (b_5)	0.62	0.94	0.05	0.66	0.508	1.43
F-value	5.00					
Sig.	**0.000**					
Adjusted R^2	0.09					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	1.61*	1.74
Numerical-misfit line	0.62	**-3.19***
First principal axis	-0.21	6.44
Second principal axis	0.08	**-2.39****

*** p < 0.05, ** p < 0.01.**

Figure 8-11: Response surface analysis for the quadratic model involving CostStructure-COMBINED, CSC-COMPOSITE and USEFULNESS



(CSC-CostPools)^2, is the only significant higher-order term ($b_3 = -1.67$, $p < 0.05$).

Figure 8-12 shows the surface that corresponds to the coefficients of the quadratic model reported in Table 8-16 (Panel A). As exhibited in Figure 8-12, the surface is saddle-shaped. This is also confirmed by the positive/negative curvature of the first/second principal axis (see Table 8-16, Panel B)). The saddle-shaped surface is compatible with the implication of the matching sub-form of fit. Examining the surface in relation to the principal axes provides support for a weak negative matching effect, i.e., a weak form of the matching sub-form of fit. In particular, the first principal axis, solid line, runs from low values of CultureOutcome and high values of CSC-CostPools to high values of CultureOutcome and low values of CSC-CostPools. This means that CultureOutcome is negatively associated with the optimal CSC-CostPools. This negative association contradicts the positive one implied by the matching/fit hypothesis, where the first principal axis should run from low values of both the contingency factor and CSC to high values of both constructs (see Hypotheses 3a-3c in Section 8.1).

To determine the magnitude and sign of the impact of the misfit between CultureOutcome and the optimal CSC-CostPools on USEFULNESS, the second principal axis, the heavy-dashed line, can be analysed because it is perpendicular to the first principal axis and represents the line along which USEFULNESS is minimised. As shown in Table 8-16 (Panel B), the second principal axis has a significant negative curvature (-2.03, $p < 0.01$), conveying that deviating from the first principal axis, i.e., the misfit, including both over- and under-fit, causes a decline in USEFULNESS.[154] In conjunction, the results provided in Table 8-16 and Figure 8-12 indicate that CultureOutcome has a negative influence on the optimal CSC-CostPools from the perspective of the weak form of the matching sub-form of fit.

[154] The surface was not analysed with respect to the first - i.e., hetero-outcome - and second, i.e., more negative impact of under-fit, extensions to the classical matching sub-form of fit because the fit line - i.e., the first principal axis - and, accordingly, the misfit line, i.e., the second principal axis, run in the reverse direction to that implied by the matching/fit hypothesis.

Table 8-16: The results of the quadratic model involving CultureOutcome, CSC-CostPools and USEFULNESS

Quadratic model: $USEFULNESS = b_0 + b_1\ CSC\text{-}CostPools + b_2\ CultureOutcome + b_3\ (CSC\text{-}CostPools)^2 + b_4\ (CSC\text{-}CostPools)(CultureOutcome) + b_5\ (CultureOutcome)^2$

Panel A:

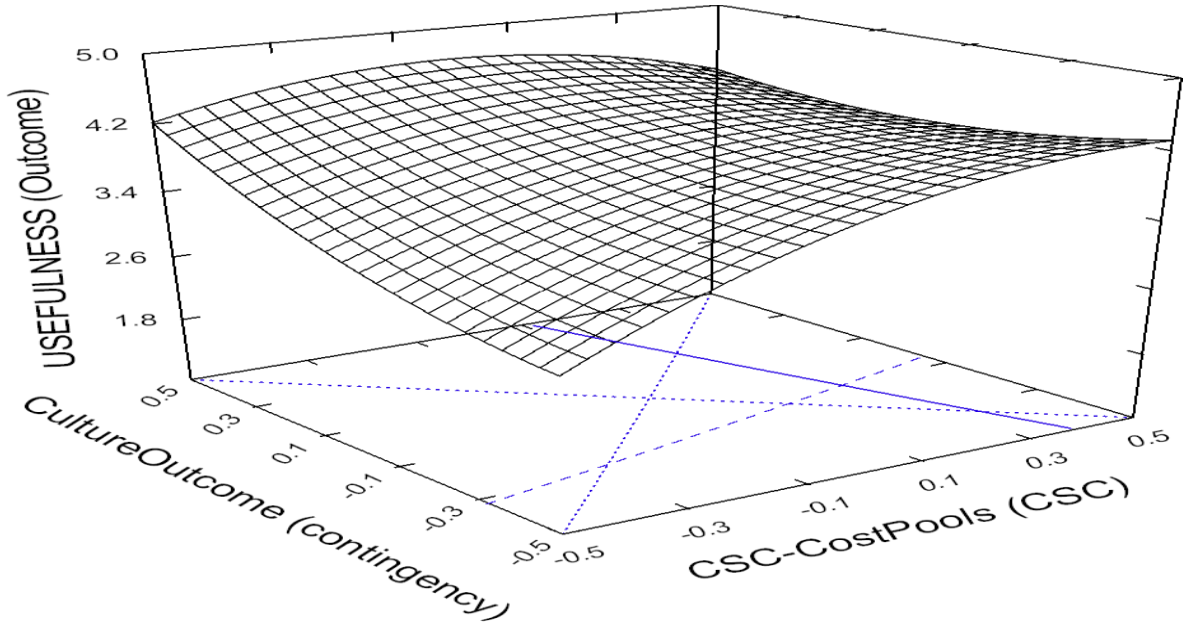
Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.04	0.09		45.44	0.000	
CSC-CostPools (b_1)	0.76	0.34	0.23	2.22	0.027	2.81
CultureOutcome (b_2)	0.66	0.39	0.19	1.69	0.094	3.25
(CSC-CostPools)^2 (b_3)	-1.67	0.74	-0.17	-2.25	**0.026**	1.45
(CSC-CostPools)(CultureOutcome) (b_4)	-1.59	1.05	-0.16	-1.51	0.134	2.70
(CultureOutcome)^2 (b_5)	0.98	0.76	0.12	1.29	0.200	2.12
F-value	11.83					
Sig.	**0.000**					
Adjusted R^2	0.21					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	1.42**	-2.28
Numerical-misfit line	0.10	0.90
First principal axis	-9.50	16.98
Second principal axis	1.14	**-2.03****

*** p < 0.05, ** p < 0.01.**

Figure 8-12: Response surface analysis for the quadratic model involving CultureOutcome, CSC-CostPools and USEFULNESS



8.4.2.3.4 TMKA

Of the 12 quadratic models that did not follow the patterns of results reported in Sections 8.4.2.1 and 8.4.2.2, Table 8-13 shows that three quadratic models are related to TMKA. The CSC measures of these three quadratic models are CSC-CostPools, CSC-CostDrivers and CSC-COMPOSITE, while the outcome measure for all three models is USEFULNESS. The results and surfaces of the three quadratic models are almost identical. Hence, the results and surface of one quadratic model are presented in this section, while those of the other two models can be found in Appendix 8-8.[155] The quadratic model that involves CSC-COMPOSITE as the CSC measure is chosen as an example. Table 8-17 summarises the results of this model, whereby (see Panel A) that the quadratic model is significant (F-value = 11.48, $p < 0.01$, adjusted $R^2 = 0.21$), and the quadratic term related to TMKA, $(TMKA)^2$, is the only significant higher-order term ($b_5 = -3.42$, $p < 0.01$).

Figure 8-13 shows the surface that reflects the coefficients of the quadratic model reported in Table 8-17 (Panel A). As exhibited in Figure 8-13, the surface is concave. This is also confirmed by the negative curvature of both the first and second principal axes (see Table 8-17, Panel B). The concave surface is compatible with the implication of the matching sub-form of fit. Examining the surface in relation to the principal axes provides support for a weak positive matching effect, i.e., a weak form of the matching sub-form of fit. The first principal axis, solid line, runs from low values of both TMKA and CSC-COMPOSITE to high values of both constructs. This means that TMKA is positively associated with the optimal level of CSC-COMPOSITE, which conforms to the direction of the association implied by the matching/fit hypothesis (see Hypothesis 7 in Section 8.1). However, as can be seen in Figure 8-13, the first principal axis only runs in an area of the surface where TMKA is at higher values, and, therefore, it is impossible from the surface to determine whether the

[155] Given that the results of the three quadratic models pertaining to TMKA are almost identical, the results of the quadratic models provided in Appendix 8-8 are not explained in the text in Appendix 8-8.

first principal axis follows similar behaviour in running from low values of both TMKA and CSC-COMPOSITE to high values of both constructs across the complete range of TMKA values.

To determine the magnitude and sign of the impact of the misfit between TMKA and the optimal CSC-COMPOSITE on USEFULNESS, the second principal axis, the heavy-dashed line, can be analysed because it is perpendicular to the first principal axis and represents the line along which USEFULNESS is minimised. As presented in Table 8-17 (Panel B), the second principal axis has a significant negative curvature (-262.82, $p < 0.01$), indicating that deviating from the first principal axis, i.e., the misfit, including both over- and under-fit, reduces USEFULNESS.[156]

Overall, the results provided in Table 8-17 and Figure 8-13 reveal that TMKA has a positive influence on the optimal level of CSC-COMPOSITE from the perspective of the weak form of the matching sub-form of fit. However, this positive influence, to a great extent, disagrees with the non-monotonic negative moderation effect of TMKA, as reported in Section 8.4.1.3. The first element of this positive influence, i.e., the positive association between TMKA and the optimal level of CSC-COMPOSITE, indicates that the outcome is maximised at extreme similar values of both TMKA and CSC, which is, to a great extent, inconsistent with the non-monotonic negative moderation effect of TMKA, whereby the relationship between CSC and the outcome is positive and significant at very low and negative and insignificant at very high values of TMKA, i.e., the outcome is maximised when TMKA is very low and CSC is very high and might be so when TMKA is very high and CSC is very low. Similarly, at the

[156] The surface was analysed in relation to the first - i.e., hetero-outcome - and second, i.e., more negative impact of under-fit, extensions to the classical matching sub-form of fit. The results shown in Table 8-17 (Panel B) reveal that the first extension does not apply because the first principal axis has an insignificant positive slope (0.55, $p > 0.05$), indicating that the outcome is the same at all fit points. Likewise, the results provided in Table 8-17 (Panel B) reveal that the second extension does not apply because the second principal axis has an insignificant positive slope (193.84, $p > 0.05$), suggesting that the negative effect of both over- and under-fit on the outcome is identical.

remaining values of TMKA, it does not conform with the non-monotonic negative moderation effect that the outcome is maximised at either the highest or lowest value of CSC. Instead, the first element of the positive influence, i.e., the positive association between TMKA and the optimal level of CSC-COMPOSITE, implies that there are specific values other than the highest or lowest value of CSC at which the outcome is maximised. Although the second element of the positive influence of TMKA on the optimal level of CSC-COMPOSITE, i.e., the negative influence of the misfit, including both over- and under-fit, on USEFULNESS, agrees with the assumption of the non-monotonic negative moderation effect that the misfit negatively influences the outcome, it contradicts its assumption that, based on the level of TMKA, the misfit is represented by either over- or under-fit, but not both. The second element of the positive influence of TMKA on the optimal level of CSC-COMPOSITE, i.e., the negative influence of the misfit, including both over- and under-fit, on USEFULNESS, assumes that the misfit is represented by both over- and under-fit. Having presented the results of testing the hypotheses related to the matching sub-form of fit, the next section will present a summary of these.

Table 8-17: The results of the quadratic model involving TMKA, CSC-COMPOSITE and USEFULNESS

Quadratic model: USEFULNESS= b_0 + b_1 CSC-COMPOSITE + b_2 TMKA + b_3 (CSC-COMPOSITE)^2 + b_4 (CSC-COMPOSITE)(TMKA) + b_5 (TMKA)^2

Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	3.69	0.12		31.86	0.000	
CSC-COMPOSITE (b_1)	0.27	0.36	0.09	0.76	0.449	3.63
TMKA (b_2)	3.10	0.64	0.80	4.88	0.000	6.64
(CSC-COMPOSITE)^2 (b_3)	-0.77	0.66	-0.08	-1.17	0.245	1.19
(CSC-COMPOSITE)(TMKA) (b_4)	0.62	1.03	0.07	0.60	0.549	3.51
(TMKA)^2 (b_5)	-3.42	1.11	-0.47	-3.08	**0.002**	5.86
F-value	11.48					
Sig.	**0.000**					
Adjusted R^2	0.21					

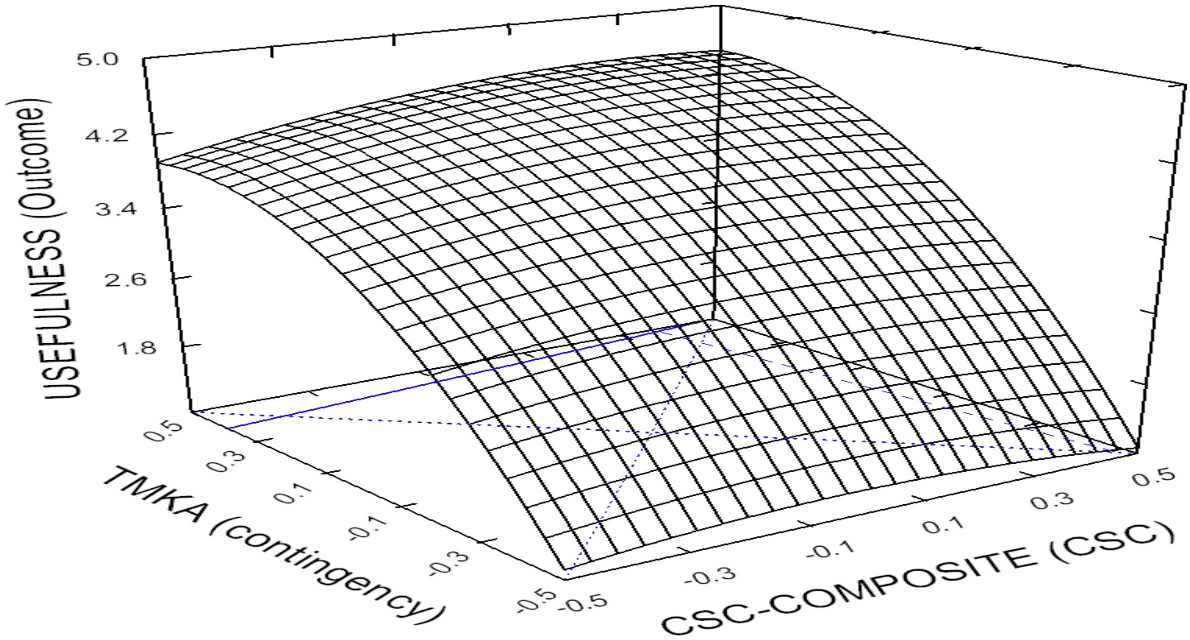
Table 8-17: The results of the quadratic model involving TMKA, CSC-COMPOSITE and USEFULNESS (continued)

Panel B:

Line	Slope	Curvature
Numerical-fit line	3.37**	-3.57*
Numerical-misfit line	-2.83**	-4.81*
First principal axis	0.55	-0.75
Second principal axis	193.84	**-262.82****

*** p < 0.05, ** p < 0.01.**

Figure 8-13: Response surface analysis for the quadratic model involving TMKA, CSC-COMPOSITE and USEFULNESS



8.5 Summary of the results of testing the hypotheses regarding the matching sub-form of fit

In the previous section, the seven hypotheses related to the influence of each of the seven contingency factors on the optimal level of CSC from the perspective of the matching sub-form of fit were tested, i.e., Hypotheses 1-7 (see Section 8.1). The results revealed that none of the hypotheses was supported. Table 8-18 provides a summary of the results, showing that only one quadratic model relating to PC, i.e., Hypothesis 4, had one of either of the patterns of results necessary for initial statistical support for the matching/fit hypothesis. However, further analysis of the surface corresponding to this quadratic model indicated that the results conflict with the hypothesis related to PC, i.e., Hypothesis 4. PC was found to have a significant negative impact on the optimal level of CSC from the perspective of the matching sub-form of fit (see Section 8.4.2.2). In addition, PC was also found to affect the optimal level of CSC from the viewpoint of the moderation sub-form of fit (see Section 8.4.1.2).

Table 8-18 shows that the quadratic models related to the other six contingency factors did not have either pattern of results required for initial statistical support for the matching/fit hypothesis. Although this suggests that none of the hypotheses related to these six contingency factors was supported, the results provided insights into the nature of their influence on the optimal level of CSC. As provided in Table 8-18, the results showed that cost structure and TMKA have an impact on the optimal level of CSC from the standpoints of the moderation and the weak form of the matching sub-forms of fit.[157] In addition, the results indicated that organisational culture, including all of its dimensions of outcome orientation, attention to detail and tight versus loose control, has an effect on the optimal level of CSC from the perspective of the weak form of the matching sub-form of fit. Furthermore, the results conveyed that business-unit size influences the optimal level of CSC from the viewpoint of the moderation sub-form of fit.[158] Lastly, the results revealed that neither competition nor TMS has an impact on the optimal level of CSC. Table 8-18 presents the details of the effect/s of each contingency factor on the optimal level of CSC.

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[157] For cost structure, both CostStructure-MANUFACTURING and CostStructure-COMBINED were found to have an influence on the optimal level of CSC from the perspective of the moderation sub-form of fit (see Sections 8.4.1.1 and 8.4.2.1.1). However, only CostStructure-COMBINED was found to have an impact on the optimal level of CSC from the viewpoint of the weak form of the matching sub-form of fit (see Section 8.4.2.3.2).

[158] The moderation effects of business-unit size were found with the SizeRevenue measure (see Section 8.4.2.1.2).

Table 8-18: Summary of the results of testing the hypotheses regarding the matching sub-form of fit

	Significant R^2 between the linear and quadratic models is NOT required		**Significant R^2 between the linear and quadratic models is required**			
	Moderation sub-form of fit		**Matching sub-form of fit**		**Weak form of the matching sub-form of fit**	
Contingency factor/Hypothesis	Was the interaction term the only significant higher-order term in the quadratic model?	Results	Was either of: (1) the joint significance of both the interaction term and the quadratic one related to CSC, i.e., $(CSC)^2$; or (2) the significance of all higher-order terms observed?	Results	Did the results follow a pattern that differs from those of the moderation and the typical form of the matching sub-forms of fit?	Results
Competition/ Hypothesis 1	No	N/A	No	N/A	Yes	Competition did not have any influence on the optimal level of CSC.
Cost structure/ Hypothesis 2	Yes	1.Three positive non-monotonic moderation effects, indicating a relationship between CSC and the outcome that is negative at very low levels of cost structure and positive at the remaining levels. 2.One positive monotonic moderation effect, revealing a relationship between CSC and the outcome that is positive at all levels of cost structure. 3.The dominant trend of the moderation effects signified the importance of increasing CSC at moderate and higher levels of cost structure.	No	N/A	Yes	Cost structure had a positive impact on the optimal level of CSC.

Table 8-18: Summary of the results of testing the hypotheses regarding the matching sub-form of fit (continued)

Contingency factor/Hypothesis	**Significant R^2 between the linear and quadratic models is NOT required**		**Significant R^2 between the linear and quadratic models is required**			
	Moderation sub-form of fit		**Matching sub-form of fit**		**Weak form of the matching sub-form of fit**	
	Was the interaction term the only significant higher-order term in the quadratic model?	Results	Was either of: (1) the joint significance of both the interaction term and the quadratic one related to CSC, i.e., $(CSC)^2$; or (2) the significance of all higher-order terms observed?	Results	Did the results follow a pattern that differs from those of the moderation and the typical form of the matching sub-forms of fit?	Results
Organisational culture/ Hypotheses 3a, 3b and 3c	No	N/A	No	N/A	Yes	Organisational culture, including all of its dimensions, had a negative effect on the optimal level of CSC.
PC/Hypothesis 4	Yes	1.One negative non-monotonic moderation effect, indicating a relationship between CSC and the outcome that is positive at all levels of PC except for very high levels where the relationship became negative. 2.The moderation effect of PC signalled the importance of increasing CSC at lower and moderate levels of PC.	Yes	PC had a negative influence on the optimal level of CSC.	No	N/A

Table 8-18: Summary of the results of testing the hypotheses regarding the matching sub-form of fit (continued)

	Significant R^2 between the linear and quadratic models is NOT required		**Significant R^2 between the linear and quadratic models is required**			
	Moderation sub-form of fit		**Matching sub-form of fit**		**Weak form of the matching sub-form of fit**	
Contingency factor/Hypothesis	Was the interaction term the only significant higher-order term in the quadratic model?	Results	Was either of: (1) the joint significance of both the interaction term and the quadratic one related to CSC, i.e., $(CSC)^2$; or (2) the significance of all higher-order terms observed?	Results	Did the results follow a pattern that differs from those of the moderation and the typical form of the matching sub-forms of fit?	Results
Business-unit size/ Hypothesis 5	Yes	1.Two negative non-monotonic moderation effects, revealing a relationship between CSC and the outcome that is positive at all levels of business-unit size except for higher levels where the relationship became negative. 2.The moderation effect of business-unit size denoted the importance of increasing CSC at lower and moderate levels of business-unit size.	No	N/A	No	N/A
TMS/ Hypothesis 6	No	N/A	No	N/A	No	N/A
TMKA/ Hypothesis 7	Yes	1.One negative non-monotonic moderation effect, indicating a relationship between CSC and the outcome that is positive at all levels of TMKA except for higher levels where the relationship became negative. 2.The moderation effect of TMKA denoted the importance of increasing CSC at lower levels of TMKA.	No	N/A	Yes	TMKA had a positive influence on the optimal level of CSC.

8.6 Conclusion

This chapter aimed to: (1) develop and employ a procedure that encompasses the recommended joint usage of PRA and RSM to test for the matching sub-form of fit; and (2) furnish the results of testing the first seven hypotheses concerning the influence of the contingency factors on the optimal level of CSC, i.e., optimal CSD, from the perspective of the matching sub-form of fit (see Table 8-1). Hence, this chapter assisted in realising the three main contributions of this research and, therefore, attaining the research aim (see Section 1.5). Moreover, this chapter assisted in realising the second minor contribution of this research (see Section 1.5). Accordingly, it contributed to successfully addressing the main limitation of contingency research on optimal CSD and, thus, acquiring the research aim (see Section 1.5).

This chapter described PRA and RSM, the statistical analysis techniques exploited to test the seven matching sub-form of fit's hypotheses. This description covered the developed and employed procedure encompassing the recommended joint usage of PRA and RSM to test the matching sub-form of fit's hypotheses; namely, the two-stage procedure involving the recommended combined usage of PRA and RSM. In addition, this chapter assessed the assumptions of PRA and RSM and furnished details about the additional data preparation conducted prior to beginning the analysis. Furthermore, it presented and summarised the results of testing the seven hypotheses regarding the matching sub-form of fit. These results showed that none of the seven hypotheses was supported, and, accordingly, none of the contingency factors positively impacts on the optimal level of CSC from the viewpoint of the matching sub-form of fit. Nevertheless, the results revealed that PC has a negative effect on the optimal level of CSC from the standpoint of the matching sub-form of fit. Moreover, the results provided that, apart from competition and TMS, the remaining contingency factors - i.e., cost structure, organisational culture, business-unit size and TMKA - have an influence on the optimal level of CSC from the perspective of the moderation sub-form of fit and/or the weak form of the matching one. Having developed and employed a procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit - i.e., the two-stage procedure - and provided the results of testing the hypotheses regarding the matching sub-form of fit, the next chapter will provide the results of testing the hypothesis regarding the system form of fit.

Chapter nine: Results of testing the hypothesis regarding the system form of fit

9.1 Introduction

This chapter provides the results of testing the eighth and final hypothesis concerning the influence of the contingency factors on the optimal level of CSC, i.e., optimal CSD, from the perspective of the system form of fit, i.e., the system form of fit's hypothesis. This hypothesis deals with the impact of the seven contingency factors, taken together, on the optimal level of CSC, i.e., joint impact (see Sections 3.3.3, 5.3, 5.4, 5.4.2 and 6.3.1.3.1.3). This hypothesis is:

Hypothesis 8: ***The degree of misfit between the contingency factors of (1) competition, (2) cost structure, (3) organisational culture, (4) PC, (5) business-unit size, (6) TMS and (7) TMKA, taken together, and the optimal level of CSC is expected to be negatively related to two outcomes; namely, USEFULNESS and USAGE.***

By testing the joint effect of all of the contingency factors on the optimal level of CSC rather than the individual one for each contingency factor, this chapter complements the previous one, i.e., Chapter eight, to realise the first and third main contributions of this research concerning, respectively, the application of contingency theory with respect to the adopted forms of fit and the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5). Accordingly, it contributes towards accomplishing the research aim of investigating the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit.

This chapter is organised as follows. Section 9.2 describes the statistical analysis technique utilised to test the system form of fit's hypothesis; namely, residual analysis. Section 9.3 provides information about the software employed to conduct residual analysis. Section 9.4 presents the results of testing the system form of fit's hypothesis, while Section 9.5 concludes this chapter.

9.2 Residual analysis

As pointed out in Section 3.3.3, there are three statistical analysis techniques representing different difference-score models that can be used to test the system form of fit's hypotheses (Drazin and Van de Ven, 1985; Chenhall and Chapman, 2006; Burkert et al., 2014). These statistical analysis techniques are theoretical-Euclidian distance, empirical-Euclidian distance and residual analysis.[159] Theoretical-Euclidian distance cannot be applied in this research since it requires the determination, based on theory, of the various levels of CSD that precisely fit, i.e., are optimal for, the different levels of the contingency factors and, then, subtracting them from the actual levels of CSD. Contingency research on optimal CSD has theorised, in general, how the contingency factors and optimal CSD are associated, without determining the exact CSD levels, i.e., values, that are optimal to the various levels of any contingency factor, e.g., four cost pools and two cost drivers for a very low level of competition that equals 1 out of 5. The other two statistical analysis techniques, namely, empirical-Euclidian distance and residual analysis, are relatively similar. The main difference between the two is that, while the former exploits part of the sample, particularly best performing business-units, the latter utilises the full sample to determine the fit line (Burkert et al., 2014). Burkert et al. (2014) recommended the usage of the full rather than part of the sample, i.e., best performers, when deriving the fit line, possibly in order to determine more accurately the location of the fit line. Hence, the residual analysis technique

[159] Theoretical-Euclidian distance belongs to the theoretical version of the difference-score models used to test the system form of fit's hypotheses, while empirical-Euclidian distance and residual analysis belong to the empirical version of the difference-score models utilised to test the system form of fit's hypotheses.

was employed in this research to test the system form of fit's hypothesis. Although residual analysis represents the best alternative of the three statistical analysis techniques, all three techniques have issues that were discussed in the context of their use for testing the matching sub-form of fit's hypotheses (see Section 8.2.1).[160]

Residual analysis has been widely used by contingency research on optimal MCS to test the system form of fit's hypotheses (e.g., Nicolaou, 2000; 2002; Said et al., 2003; Pizzini, 2006; King et al., 2010; Gani and Jermias, 2012). Residual analysis involves two steps (Dewar and Werbel, 1979; Duncan and Moores, 1989; Ittner and Larcker, 2001; Ittner et al., 2003; Said et al., 2003; Pizzini, 2006; Van der Stede et al., 2006; King et al., 2010; Chen and Jermias, 2014). The first is predicting the optimal level of CSC, i.e., optimal CSD, for the business-unit as a function of the contingency factors using regression analysis. In this first step, an assumption is made that business-units, on average, have designed their costing system correctly, and that the regression model captures the benchmark or optimal level of CSC as a function of the contingency factors (Ittner et al., 2002; Chen and Jermias, 2014). The residuals, either positive or negative, of the regression model conducted in the first step represent the distance of each business-unit from the estimated optimal level of CSC. In other words, they represent the extent to which the complexity of the business-unit's costing system differs from the expected optimal one, given the levels of the various contingency factors (Pizzini, 2006). Positive residuals indicate over-fit, whereas negative ones denote under-fit. In essence, the first step of residual analysis is an operationalisation of the selection form of fit (see Section 3.3.1) (Pizzini, 2006). Therefore, the first step of residual analysis furnishes information regarding whether the misfit between all contingency factors,

[160] The matching sub-form of fit and the system form of fit are similar regarding testing the magnitude and sign of the effect of misfit on the outcome (see Section 3.3.3), and, therefore, similar statistical analysis techniques, i.e., difference-score models, have been employed in the literature to test the matching sub-form of fit and the system form of fit's hypotheses. However, the combined usage of PRA with RSM has been, mainly, introduced and promoted as a solution to the problems related to using the difference-score models to test matching sub-form of fit's hypotheses.

taken together, and optimal CSD could represent an actual deviation from the expected direction of the association between all contingency factors, taken together, and optimal CSD by showing how each of the contingency factors is associated with optimal CSD (see Section 3.3.3).

In the second step, the outcome is commonly regressed on one construct, representing the misfit, to examine whether it has a negative influence on the outcome. The misfit construct includes the absolute values of both the positive and negative residuals, and, therefore, fails to differentiate between over- and an under-fit. Researchers have criticised this approach of regressing the outcome on only one construct, representing the misfit, because this fails to test the underlying and shared assumption of the matching sub-form of fit and the system form of fit that both over- and under-fit negatively influence the outcome (e.g., Burkert et al., 2014). For this reason, researchers have recommended separately investigating the effect of each component of the misfit - i.e., both over- and under-fit - on the outcome (Ittner et al., 2002; Burkert et al., 2014). This can be achieved by regressing the outcome on two separate constructs, with the first representing the absolute values of the positive residuals - i.e., over-fit - and the second the absolute values of the negative residuals, i.e., under-fit (Ittner et al., 2003; Van der Stede et al., 2006). The expected sign for the effect of both over-fit and under-fit on the outcome is negative. In this research, the approach of regressing the outcomes on two separate constructs that represent over- and under-fit was adopted in the second step to test for the impact of the misfit on the outcome. Effectively, the second step of residual analysis is an operationalisation of the system form of fit (see Section 3.3.3) (Pizzini, 2006). Having illustrated residual analysis, the next section will provide details about the software used to conduct residual analysis.

9.3 Analysis software

Residual analysis was performed using the same software utilised to conduct CFA; namely, SmartPLS version 3.2.6 (see Section 7.3.1.1) (Ringle et al., 2015). SmartPLS was utilised because, in contrast to other statistical software usually employed to run mediation analysis, e.g., Professor Andrew F. Hayes' macro through SPSS, it enables the obtaining of the residuals of a model that tests, simultaneously, both the direct and indirect effects of the independent variables on the dependent one. This feature was required when carrying out the first step of residual analysis, particularly to obtain the residuals of a regression model that, concurrently, examines the direct and indirect effects of TMKA along with the direct effects of the remaining contingency factors on CSC (see Section 6.3.1.3.1.2).

However, it should be noted that, although SmartPLS was used to perform residual analysis, the regressions of both the first and second steps of residual analysis were conducted using the mean scores, i.e., summated scores, for both the reflective and formative latent constructs. By doing this, the constructs were entered into the model as observable rather than latent, i.e., unobservable.[161] Thus, SmartPLS was not utilised to run a PLS-SEM path model that contains two components, namely, the measurement and structural models, which is the common use among studies (Henseler et al., 2009; Hair et al., 2011; Hair et al., 2014; Hair et al., 2017).[162] The measurement model aims to assess the quality of the latent constructs by assessing their relationships with the associated indicators that comprise the raw data and, hence, directly measured them, whereas the structural model seeks to test the hypothesised relationships between the constructs. The main reason for not including the constructs as latent, as typically done when employing SmartPLS to run PLS-SEM path models, and using

[161] The second step of residual analysis involves only one latent reflective construct, which is USEFULNESS. The remaining constructs, which include the positive and negative residuals and USAGE, are single-indicator constructs.

[162] Although SmartPLS was employed to perform the CFA, i.e., assessment of the latent reflective constructs (see Section 7.3.1.1), it was conducted as a separate step from residual analysis.

the constructs' mean scores instead was to maintain the same form of constructs, i.e., constructs' mean scores, as the only available one when applying the other statistical analysis techniques - i.e., PRA and RSM - to test the hypotheses regarding the matching sub-form of fit (see Section 8.3). Having provided information about the software used to carry out residual analysis, the next section will present the results of testing the system form of fit's hypothesis.

9.4 Results

The results of residual analysis are presented according to its two steps. As explained in Section 9.2, the first step, i.e., regressing CSC on the contingency factors, is an operationalisation of the selection form of fit (see Section 3.3.1), and, thus, it provides information that assists in identifying whether the misfit between all contingency factors, taken together, and optimal CSD - i.e., positive and negative residuals - could represent an actual deviation from the expected direction of the association between all contingency factors, taken together, and optimal CSD (see Section 3.3.3). The results of the second step, i.e., regressing the outcomes on the positive and negative residuals, allow the testing of the hypothesis of the system form of fit. Sections 9.4.1 and 9.4.2 will present the results of the first and second steps of residual analysis, respectively.

9.4.1 Results of the first step

The first step of residual analysis involves regressing the four different measures of CSC on the contingency factors (see Section 9.2). As provided in Section 6.3.2.1.2.1, two of these contingency factors, namely, cost structure and business-unit size, were measured using two different measures. This means that each of the CSC measures can be regressed on the contingency factors using four different combinations of cost structure and business-unit size, which are: (1) CostStructure-MANUFACTURING and SizeEmployees; (2) CostStructure-MANUFACTURING and SizeRevenue; (3) CostStructure-COMBINED and SizeEmployees;

and (4) CostStructure-COMBINED and SizeRevenue. This section provides the detailed results of the first step for only the first and third combinations, and it merely highlights how the results for the second and fourth ones differ from these.[163] The results are presented in this way because, in addition to the significant findings regarding the second and fourth combinations, more significant results were observed for the first and third combinations. Thus, presenting the results of the first step, i.e., the selection form of fit, for the first and third combinations makes it possible to link all of the significant findings to the findings reported in Section 8.4, i.e., the findings related to the matching and moderation sub-forms of fit.

9.4.1.1 Results of the first step for the first combination

Table 9-1 summarises the results of the first step for the first combination of cost structure and business-unit size, which includes CostStructure-MANUFACTURING as the cost structure measure and SizeEmployees as the business-unit size measure. As presented in Table 9-1, except for CSC-developed, the models explain a significant amount of variance in CSC-CostPools (adjusted $R^2 = 0.29$, $p < 0.01$), CSC-CostDrivers (adjusted $R^2 = 0.13$, $p < 0.01$) and CSC-COMPOSITE (adjusted $R^2 = 0.24$, $p < 0.01$).[164] Hence, the results related to the model involving CSC-DEVELOPED as the CSC measure will not be mentioned further.

Regarding the direct influence of the contingency factors on the remaining CSC measures, Table 9-1 conveys that PC has a significant negative influence on each of CSC-CostPools (-

[163] The results of the first step for the second and fourth combinations are provided in Appendix 9-1.
[164] PLS-SEM is a non-parametric method, and, therefore, it does not make any distributional assumptions (Hair et al., 2017). Accordingly, and as noted in footnote 97 in Section 7.3.1.1.2, it uses the bootstrapping non-parametric procedure when testing the significance of any coefficient, e.g., path coefficient or indicators' loadings (Henseler et al., 2009; Hair et al., 2011; Lee et al., 2011; Hair et al., 2014; Sarstedt et al., 2014; Nitzl, 2016; Hair et al., 2017). In addition, the non-parametric nature of PLS-SEM makes the significance of the F-ratio as a measure of evaluating whether the regression model explains a significant amount of variance in the dependent variable, i.e., R^2, irrelevant. This is attributed to the fact that the statistical test of the significance of the F-ratio depends on the *F* distribution (Hair et al., 2010). However, SmartPLS produces the results of significance tests of the R^2 and adjusted R^2. In line with the reason provided for using the adjusted R^2 rather than the unadjusted one (see footnote 136 in Section 8.4.1.1), the significance of the adjusted R^2 was used as a criterion to evaluate whether the regression model explains a significant amount of variance in the dependent variable.

0.14, $p < 0.05$) and CSC-COMPOSITE (-0.13, $p < 0.05$), while SizeEmployees has a significant positive effect on each of CSC-CostPools (0.46, $p < 0.01$), CSC-CostDrivers (0.33, $p < 0.01$) and CSC-COMPOSITE (0.42, $p < 0.01$). Considering, as assumed by the selection form of fit (see Section 3.3.1), that company survival is the outcome measure that indicates the optimality of the level of CSC, the negative and positive effects of PC and business-unit size, respectively, on CSC found in the first step, i.e., from the perspective of the selection form of fit, mean that PC has a negative impact on the optimal level of CSC, while business-unit size has a positive one.

The negative impact of PC on the optimal level of CSC found in the first step, i.e., from the perspective of the selection form of fit, agrees with its negative influence on the optimal level of CSC from the viewpoint of the matching sub-form of fit, as reported in Section 8.4.2.2. However, the only difference between the two is that the selection's negative impact of PC assumes that misfit companies will disappear, whereas the matching's one showed that misfit companies exist but have lower outcome, USAGE, levels compared to fit companies.[165]

In addition, the negative impact of PC on the optimal level of CSC found in the first step, i.e., from the perspective of the selection form of fit, only partially agrees with its non-monotonic negative moderation effect reported in Section 8.4.1.2. First, the selection's negative impact of PC indicates that companies exist, in the case of the non-monotonic negative moderation effect of PC, the outcome is maximised, at extreme opposite values of both PC and CSC, which, to some extent, agrees with the non-monotonic negative moderation effect of PC, whereby the relationship between CSC and the outcome is positive and significant at very low and negative and insignificant at very high values of PC, i.e., the outcome is maximised when PC is very low and CSC is very high and may be so when PC is very high and CSC is

[165] The results in Section 8.4.2.2 revealed that misfit companies are those with similar values of PC and CSC, i.e., high PC and high CSC, or vice versa, while fit companies are those with opposite values of PC and CSC, i.e., high PC and low CSC, or vice versa.

very low. However, at the remaining values of PC, it disagrees with the non-monotonic negative moderation effect that the outcome is maximised, i.e., companies exist, at either the highest or lowest value of CSC. Instead, the selection's negative impact of PC implies that, at the remaining values of PC, there are specific values other than the highest or lowest value of CSC at which companies exist, i.e., the outcome is maximised. Second, the selection's negative impact of PC is consistent with the assumption of the non-monotonic negative moderation effect that the misfit negatively influences the outcome, i.e., causes companies to disappear. Nevertheless, it contradicts the assumption of the non-monotonic negative moderation effect that, based on the level of PC, the misfit is represented by either over- or under-fit, but not both. The selection's negative impact of PC implies that the misfit is represented by both over- and under-fit. Third, the selection's negative impact of PC conflicts with the non-monotonic negative moderation effect of PC, in that the former assumes that misfit companies will disappear, whereas the latter proved that misfit companies exist but have lower outcome, USAGE, levels compared to fit companies.

With respect to the positive effect of business-unit size on the optimal level of CSC found in the first step, i.e., from the perspective of the selection form of fit, this, to a great extent, disagrees with the non-monotonic negative moderation effects of business-unit size, as reported in Section 8.4.2.1.2.[166] First, the selection's positive impact of business-unit size implies that companies exist, in the case of the non-monotonic negative moderation effects of business-unit size, the outcome is maximised, at extreme similar values of business-unit size and CSC, which, to some extent, is inconsistent with the non-monotonic negative moderation effects of business-unit size, whereby the relationship between CSC and the outcome is positive and significant at very low and negative and insignificant at very high values of

[166] The non-monotonic negative moderation effects of business-unit size were found when SizeRevenue is the business-unit size measure, whereas the positive effect of business-unit size on the optimal level of CSC found in first step, i.e., from the perspective of the selection form of fit, was found when both SizeEmployees (this section and Section 9.4.1.3) and SizeRevenue (Sections 9.4.1.2 and 9.4.1.4) are the business-unit size measures.

business-unit size, i.e., the outcome is maximised when business-unit size is very low and CSC is very high and may be so when business-unit size is very high and CSC is very low. Second, at the remaining values of business-unit size, the selection's positive impact of business-unit size contradicts the assumption of the non-monotonic negative moderation effects that the outcome is maximised, i.e., companies exist, at either the highest or lowest value of CSC. Instead, the selection's positive impact of business-unit size means that, at the remaining values of business-unit size, there are specific values other than the highest or lowest value of CSC at which companies exist, i.e., the outcome is maximised. Third, although the selection's positive impact of business-unit size corresponds to the assumption of the non-monotonic negative moderation effects that the misfit negatively influences the outcome, i.e., causes companies to disappear, it disagrees with its assumption that, based on the level of business-unit size, the misfit is represented by either over- or under-fit, but not both. The selection's positive impact of business-unit size implies that the misfit is represented by both over-fit and under-fit. Fourth, the selection's positive impact of business-unit size conflicts with the non-monotonic negative moderation effects of business-unit size, in that the former assumes that misfit companies will disappear, whereas the latter showed that misfit companies exist but have lower outcome, USEFULNESS, levels compared to fit companies.

To determine whether TMKA has a significant indirect influence on CSC through TMS, the significance of the indirect effect can be examined (Zhao, Lynch and Chen, 2010; Hair et al., 2017). Table 9-1 reveals that TMKA has an insignificant indirect impact on each of CSC-CostPools (0.08, $p > 0.05$), CSC-CostDrivers (0.10, $p > 0.05$) and CSC-COMPOSITE (0.10, $p > 0.05$). These results suggest that TMKA has no indirect influence on CSC through TMS. However, as shown in Table 9-1, TMKA has only a significant direct impact on TMS in the three models involving the CSC measures of CSC-CostPools (0.69, $p < 0.01$), CSC-CostDrivers (0.69, $p < 0.01$) and CSC-COMPOSITE (0.69, $p < 0.01$).

9.4.1.2 Results of the first step for the second combination

As mentioned in Section 9.4.1, the second combination of the measures of cost structure and business-unit size includes CostStructure-MANUFACTURING as the cost structure measure and SizeRevenue as the business-unit size measure. The results of the first step for the second combination are almost identical to those for the first one (see Appendix 9-1). In particular, SizeRevenue has a significant positive direct effect on CSC-CostPools, CSC-CostDrivers and CSC-COMPOSITE, while TMKA has a significant positive direct impact on TMS in the models involving these three CSC measures. However, the negative effects of PC on CSC-CostPools and CSC-COMPOSITE become insignificant. The effect of business-unit size on the optimal level of CSC from the perspective of the selection form of fit, i.e., the results of the first step of residual analysis, was linked to its other influences on the optimal level of CSC from the viewpoint of the moderation sub-form of fit, as shown in Section 9.4.1.1.

9.4.1.3 Results of the first step for the third combination

Table 9-2 displays the results of the first step for the third combination, which incorporates CostStructure-COMBINED as the cost structure measure and SizeEmployees as the business-unit size measure. As shown in Table 9-2, except for CSC-developed, the models explain a significant amount of variance in CSC-CostPools (adjusted $R^2 = 0.31$, $p < 0.01$), CSC-CostDrivers (adjusted $R^2 = 0.13$, $p < 0.01$) and CSC-COMPOSITE (adjusted $R^2 = 0.26$, $p < 0.01$). Therefore, the results related to the model involving CSC-DEVELOPED as the CSC measure will not be mentioned further. Regarding the direct influence of the contingency factors on the remaining CSC measures, Table 9-2 reveals that both CostStructure-COMBINED and PC have a significant negative effect on each of CSC-CostPools (-0.20 (p <

0.01), -0.14 ($p < 0.05$), respectively) and CSC-COMPOSITE (-0.17 ($p < 0.01$), -0.13 ($p < 0.05$), respectively), while SizeEmployees has a significant positive influence on each of CSC-CostPools (0.45, $p < 0.01$), CSC-CostDrivers (0.33, $p < 0.01$) and CSC-COMPOSITE (0.41, $p < 0.01$).

The negative effects of cost structure and PC on CSC found in the first step, i.e., from the perspective of the selection form of fit, indicate their negative influence on the optimal level of CSC, while the positive one of business-unit size on CSC found in the first step conveys its positive impact on the optimal level of CSC. The findings pertaining to PC and business-unit size from the standpoint of the selection form of fit were linked to their other findings from the viewpoints of the matching and moderation sub-forms of fit, as shown in Section 9.4.1.1. Regarding cost structure, its selection's negative impact on the optimal level of CSC found in the first step, to a great extent, disagrees with its positive influence on the optimal level of CSC from the perspective of the weak form of the matching sub-form of fit reported in Section 8.4.2.3.2.[167] First, the selection's negative impact of cost structure can be conceived as a fit line running from low values of cost structure and high values of CSC to high values of cost structure and low values of CSC, which is the opposite of the fit line according to the matching's positive effect of cost structure. Second, although both agree on the negative influence of the misfit, the selection's negative impact of cost structure assumes that misfit companies will disappear, whereas the matching's one proved that misfit companies exist but have lower outcome, USEFULNESS, levels compared to fit companies.

In addition, the selection's negative impact of cost structure on the optimal level of CSC found in the first step, to a great extent, disagrees with the dominant non-monotonic positive moderation effects of cost structure, as reported in Sections 8.4.1.1 and 8.4.2.1.1. First, the

[167] Both the selection and weak matching effects of cost structure were found when CostStructure-COMBINED is the cost structure measure.

selection's negative impact of cost structure implies that companies exist at extreme opposite values of cost structure and CSC, in the case of the dominant non-monotonic positive moderation effects of cost structure, the outcome is maximised, which is, to a great extent, inconsistent with the dominant non-monotonic positive moderation effects of cost structure, whereby the relationship between CSC and the outcome is negative and insignificant at very low and positive and significant at very high values of cost structure, i.e., the outcome is maximised when cost structure and CSC are both very high and may be so when both are very low. Second, at the remaining values of cost structure, the selection's negative impact of cost structure contradicts the implication of the dominant non-monotonic positive moderation effects of cost structure that the outcome is maximised, i.e., companies exist, at either the highest or lowest value of CSC. Instead, the selection's negative impact of cost structure denotes that, at the remaining values of cost structure, there are specific values other than the highest or lowest value of CSC at which companies exist, i.e., the outcome is maximised. Third, although the selection's negative impact of cost structure conforms with the assumption of the dominant non-monotonic positive moderation effects of cost structure that the misfit negatively influences the outcome, i.e., causes companies to disappear, it disagrees with its assumption that, based on the level of cost structure, the misfit is represented by either over- or under-fit, but not both. The selection's negative impact of cost structure implies that the misfit is represented by both over- and under-fit. Fourth, the selection's negative impact of cost structure conflicts with the dominant non-monotonic positive moderation effects of cost structure, in that the former assumes that misfit companies will disappear, whereas the latter proved that misfit companies exist but have lower outcome, USEFULNESS, levels compared to fit companies.

Concerning the indirect effect of TMKA on CSC through TMS, Table 9-2 indicates that TMKA has an insignificant indirect impact on each of CSC-CostPools (0.09, $p > 0.05$), CSC-

CostDrivers (0.10, $p > 0.05$) and CSC-COMPOSITE (0.10, $p > 0.05$). These results suggest that TMKA has no indirect influence on CSC through TMS. However, as presented in Table 9-2, TMKA has only a significant direct impact on TMS in the three models involving the CSC measures of CSC-CostPools (0.69, $p < 0.01$), CSC-CostDrivers (0.69, $p < 0.01$) and CSC-COMPOSITE (0.69, $p < 0.01$).

9.4.1.4 Results of the first step for the fourth combination

As provided in Section 9.4.1, the fourth combination of the measures of cost structure and business-unit size consists of CostStructure-COMBINED as the cost structure measure and SizeRevenue as the business-unit size measure. The results of the first step for the fourth combination are almost identical to those for the third one (see Appendix 9-1). In particular, SizeRevenue has a significant positive direct effect on CSC-CostPools, CSC-CostDrivers and CSC-COMPOSITE, while TMKA has a significant positive direct impact on TMS in the models involving these three CSC measures. Nevertheless, the negative effects of CostStructure-COMBINED and PC on CSC-CostPools and CSC-COMPOSITE become insignificant. The influence of business-unit size on the optimal level of CSC from the perspective of the selection form of fit, i.e., the results of the first step of residual analysis, was linked to its other effects on the optimal level of CSC from the viewpoint of the moderation sub-form of fit in Section 9.4.1.1. Having presented the results of the first step of residual analysis, the next section will provide the results of the second step.

Table 9-1: The results of the first step for the first combination of the cost structure and business-unit size measures (CostStructure-MANUFACTURING and SizeEmployees)[a]

	CSC measure							
	CSC-CostPools		**CSC-CostDrivers**		**CSC-COMPOSITE**		**CSC-DEVELOPED**	
Variable	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
COMP	0.04	1.10	0.05	1.10	0.05	1.10	0.05	1.08
CostStructure-MANUFACTURING	-0.13	1.02	-0.04	1.02	-0.10	1.02	0.02	1.03
CultureDetail	0.07	2.00	0.01	2.00	0.03	2.00	-0.04	1.88
CultureOutcome	0.00	2.28	-0.09	2.28	-0.05	2.28	0.04	2.41
CultureControl	-0.08	1.72	0.04	1.72	-0.01	1.72	0.16	1.68
PC	**-0.14***	1.08	-0.05	1.08	**-0.13***	1.08	-0.02	1.06
SizeEmployees	**0.46****	1.15	**0.33****	1.15	**0.42****	1.15	0.13	1.14
TMS	0.12	2.24	0.15	2.24	0.14	2.24	0.02	2.37
TMKA	0.04	2.18	0.05	2.18	0.07	2.18	0.13	2.44
Indirect effect of TMKA:								
TMKA direct impact on TMS	**0.69****	N/A	**0.69****	N/A	**0.69****	N/A	0.73**	N/A
TMKA indirect impact on the CSC	0.08	N/A	0.10	N/A	0.10	N/A	0.01	N/A
Adjusted R^2	**0.29****		**0.13****		**0.24****		0.05	

*** p < 0.05, ** p < .01.**

a. The significance tests are based on 5000 bootstrap samples.

b. The coefficients are standardised, as produced by SmartPLS.

Table 9-2: The results of the first step for the third combination of the cost structure and business-unit size measures (CostStructure-COMBINED and SizeEmployees)[a]

	CSC measure							
	CSC-CostPools		**CSC-CostDrivers**		**CSC-COMPOSITE**		**CSC-DEVELOPED**	
Variable	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
COMP	0.03	1.10	0.05	1.10	0.04	1.10	0.06	1.08
CostStructure-COMBINED	**-0.20****	1.03	-0.04	1.02	**-0.17****	1.03	-0.04	1.04
CultureDetail	0.07	2.00	0.01	2.00	0.02	2.00	-0.05	1.88
CultureOutcome	-0.02	2.27	-0.09	2.28	-0.06	2.27	0.04	2.41
CultureControl	-0.07	1.72	0.04	1.72	-0.01	1.72	0.16	1.67
PC	**-0.14***	1.08	-0.05	1.08	**-0.13***	1.08	-0.02	1.06
SizeEmployees	**0.45****	1.15	**0.33****	1.15	**0.41****	1.15	0.13	1.14
TMS	0.13	2.25	0.15	2.24	0.15	2.25	0.02	2.37
TMKA	0.05	2.17	0.05	2.18	0.07	2.17	0.14	2.45
Indirect effect of TMKA:								
TMKA direct impact on TMS	**0.69****	N/A	**0.69****	N/A	**0.69****	N/A	0.73**	N/A
TMKA indirect impact on the CSC	0.09	N/A	0.10	N/A	0.10	N/A	0.02	N/A
Adjusted R^2	**0.31****		**0.13****		**0.26****		0.05	

*** p < 0.05, ** p < .01.**

a. The significance tests are based on 5000 bootstrap samples.

b. The coefficients are standardised, as produced by SmartPLS.

9.4.2 Results of the second step

The second step of residual analysis involves regressing the outcome measures - i.e., USEFULNESS and USAGE - on the absolute values of the positive residuals - i.e., over-fit - and negative residuals, i.e., under-fit, of each of the regression models related to the CSC measures conducted in the first step. As provided in Section 9.4.1, each regression model related to the CSC measures was performed four times, one for each of the four combinations of the cost structure and business-unit size measures. The results of the second step of residuals analysis were the same for all four combinations of the cost structure and business-unit size measures. Given this, this section will present the results for only the first combination as an example, while those related to the second, third and fourth combinations are provided in Appendix 9-2. Before presenting the results, it is important to note that the second step of residual analysis was carried out for the models that only explained a significant amount of variance, i.e., significant adjusted R^2, in the CSC measures, i.e., dependent variables, in the first step. Hence, the second step was not performed for the models related to CSC-DEVELOPED because, as provided in Section 9.4.1, these failed to explain a significant amount of variance in CSC-DEVELOPED in the first step of residual analysis.

The first combination of the measures of cost structure and business-unit size includes CostStructure-MANUFACTURING as the cost structure measure and SizeEmployees as the business-unit size measure. Table 9-3 summarises the results of the second step for the first combination. As presented in Table 9-3 (Panels A, B, and C), the adjusted R^2 values for all of the models are low and insignificant. This indicates that the misfit between all contingency factors, taken together, and the optimal level of CSC, as presented by the positive and negative residuals, does not have any detrimental, i.e., negative, impact on the outcomes. Therefore, the system form of fit's hypothesis, i.e., Hypothesis 8, is not supported.

In fact, even if the misfit between all contingency factors, taken together, and the optimal level of CSC had proved to be significant and negative, Hypothesis 8 would not have been supported, as the misfit does not represent an actual deviation from the expected direction, i.e., positive, of the association between all contingency factors, taken together, and optimal CSD. This is because most of the contingency factors showed unexpected, i.e., negative, individual associations with the optimal level of CSC in the first step of residual analysis (see Sections 3.3.3, 9.2 and 9.4.1), suggesting that the expected positive association between all contingency factors, taken together, and the optimal level of CSC cannot be assumed to be supported.

Table 9-3: The results of the second step for the first combination of the cost structure and business-unit size measures (CostStructure-MANUFACTURING and SizeEmployees)[a]

Panel A:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.07	1.26	0.03	1.26
	Negative-Residuals	-0.06	1.26	0.04	1.26
CSC-CostPools	**Adjusted R^2**	0.00		-0.01	

Panel B:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.03	1.20	-0.01	1.20
	Negative-Residuals	-0.04	1.20	-0.10	1.20
CSC-CostDrivers	**Adjusted R^2**	-0.01		0.00	

Panel C:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.06	1.24	0.00	1.24
	Negative-Residuals	-0.05	1.24	-0.03	1.24
CSC-COMPOSITE	**Adjusted R^2**	0.00		-0.01	

*** $p < 0.05$, ** $p < .01$.**

a. The significance tests are based on 5000 bootstrap samples.

b. The coefficients are standardised, as produced by SmartPLS.

9.5 Conclusion

This chapter provided the results of testing the eighth and last hypothesis relating to the influence of the seven contingency factors, taken together, on the optimal level of CSC, i.e., joint influence or the system form of fit's hypothesis. Given this, this chapter complemented the preceding chapter, which was concerned with the individual impact of each contingency factor, to realise the first and third main contributions of this research and, thus, acquire the research aim (see Section 1.5).

This chapter explained residual analysis, which was the statistical analysis technique used to test the system form of fit's hypothesis. In addition, this chapter furnished information about the software utilised to perform residual analysis. Furthermore, it showed the results, which indicated the rejection of the system form of fit's hypothesis. Nevertheless, the nature of the residual analysis statistical analysis technique incorporates, as well as testing for the effect of the contingency factors on the optimal level of CSC from the perspective of the system form of fit, an examination of the influence of the contingency factors on the optimal level of CSC from the viewpoint of the selection form of fit. This examination assisted in determining whether the misfit between all contingency factors, taken together, and optimal CSD could represent an actual deviation from the expected direction of the association between all contingency factors, taken together, and optimal CSD, as it showed how each of the contingency factors is associated with optimal CSD. The results of this examination revealed that each of cost structure and PC has a negative impact, whereas business-unit size has a positive effect on the optimal level of CSC. Having provided the results of testing the matching sub-form of fit's hypotheses in Chapter eight and those of testing the system form of fit's hypothesis in this chapter, the next chapter will discuss the results of testing the hypotheses, i.e., the third main contribution of this research.

Chapter ten: Discussion

10.1 Introduction

The objective of this chapter is to discuss the results of testing the hypotheses related to the influence of the contingency factors on the optimal level of CSC, i.e., optimal CSD, from the perspectives of the matching sub-form of fit - i.e., the hypotheses regarding the matching sub-form of fit - and the system form of fit, i.e., the hypothesis regarding the system form of fit. Thus, this chapter contributes to realising the third main contribution of this research concerning the results of testing the matching sub-form of fit and the system form of fit's hypotheses (see Section 1.5). Hence, it assists in achieving the research aim of investigating the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. The third main contribution is the outcome of the first and/or second main contributions of this research relating to, respectively, the application of contingency theory with respect to the adopted forms of fit and the statistical analysis techniques exploited to test for the matching sub-form of fit (see Section 1.5).

This chapter is organised as follows. Section 10.2 revisits the first and second main contributions of this research before discussing the results of testing the matching sub-form of fit and the system form of fit's hypotheses, i.e., the third main contribution, in Section 10.3. Section 10.4 concludes this chapter.

10.2 Revisiting the main research contributions

10.2.1 The first main contribution: the application of the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory when examining the effect of the contingency factors on optimal CSD

As explained in Section 4.4.2, this research argues that the impact of the contingency factors on optimal CSD should be examined from the viewpoints of the matching sub-form of fit of the interaction form of fit and the system form of fit rather than the selection form of fit or the moderation sub-form of fit of the interaction form of fit.[168] In comparison to the selection form of fit that has been employed by most contingency research on optimal CSD (e.g., Krumwiede, 1998a; Clarke et al., 1999; Drury and Tayles, 2005; Ismail and Mahmoud, 2012) (see Sections 4.2.2 and 4.3.2), the interaction form of fit, including the matching and moderation sub-forms of fit, and system form of fit are more realistic. This is because the selection form of fit makes the equilibrium assumption, meaning that all surviving companies are assumed to have optimal CSD (Chenhall and Chapman, 2006; Burkert et al., 2014). The interaction and system forms of fit, however, do not make such an assumption, and, hence, do not deem that all surviving companies have optimal CSD (Chenhall, 2003; 2007; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Burkert et al., 2014). Due to the equilibrium assumption, the selection form of fit considers the unrealistic outcome measure of company survival rather than real outcome measures to be a sufficient indicator for the optimality of CSD (Drazin and Van de Ven, 1985; Chenhall, 2003; Gerdin and Greve, 2004; Chenhall and Chapman, 2006; Meilich, 2006; Sousa and Voss, 2008). Prior literature, however, has suggested (Donaldson, 2001; 2006; Ittner and Larcker, 2001; Luft and Shields, 2003; Hartmann, 2005; Meilich, 2006; Burkert et al., 2014) and found (e.g., Frey and Gordon, 1999; Cagwin and Bouwman, 2002; Ittner et al., 2002; Said et al., 2003; Gerdin, 2005b; King et al., 2010; Gani and Jermias, 2012; Chen and Jermias, 2014; Krumwiede and Charles, 2014;

[168] For a detailed discussion of the various forms and sub-forms of fit of contingency theory, see Section 3.3.

Maiga et al., 2014) that companies differ with regard to the optimality of CSD or MCS as a result of being at various levels of selection fit, thereby disproving the equilibrium assumption held by the selection form of fit.

With respect to the interaction form of fit, the matching sub-form of fit assumes a curvilinear relationship between CSD and the outcome that is shifted by the contingency factor, meaning that, for each level of the contingency factor, there is only one level of CSD that delivers the maximum level of outcome, i.e., the optimal level (Schoonhoven, 1981; Donaldson, 2001; Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014). However, the moderation sub-form of fit assumes a linear relationship between CSD and the outcome that fluctuates at different levels of the contingency factor, meaning that the contingency factor affects the strength and/or form of the linear relationship between CSD and the outcome (Chenhall and Chapman, 2006; Meilich, 2006; Gerdin and Greve, 2008; Burkert et al., 2014). Given the curvilinear nature of the relationship between CSD and the outcome, it has been argued that the matching sub-form of fit is more realistic and appropriate than the moderation one by contingency theory (Donaldson, 2001; 2006; Chenhall and Chapman, 2006; Meilich, 2006). The curvilinear relationship between CSD and the outcome is sounder than the linear one, given that it: (1) maintains the congruence or matching idea characterising the concept of fit that has been adopted by seminal contingency theory studies, which asserts that fit occurs and, thus, the outcome is highest when the level of the contingency factor matches the CSD level and that any mismatch decreases the outcome; (2) shows regions of scarcity, optimal and excess of CSD; and (3) does not assume a fixed balance of the benefits and drawbacks of CSD (Donaldson, 2001; 2006; Meilich, 2006).

The CSD literature also supports the matching sub-form of fit over the moderation one. The CSD literature has stressed the significance of having optimal CSD or CSD that meets the cost-benefit consideration, which represents a point where the marginal cost - i.e., the costs of measurements - and benefit, i.e., reducing the costs of errors, related to improving the costing system by increasing its complexity are equal and, accordingly, suggests that a curvilinear relationship exists between CSD and the outcome (e.g., Cooper, 1988b; 1989a; Cooper and Kaplan, 1991; Estrin et al., 1994; Innes and Mitchell, 1998; Kaplan and Cooper, 1998; Drury and Tayles, 2000; Pizzini, 2006; Brierley, 2008a; Stuart, 2013; Drury, 2015). Moreover, it has been asserted that optimal CSD is affected by different contingency factors, such as PC (Cooper, 1988b; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). Taken together, the CSD literature has suggested that the relationship between the contingency factors and optimal CSD conforms to the matching sub-form of fit, which assumes a curvilinear relationship between CSD and the outcomes that is shifted by the contingency factors.

Although the system form of fit corresponds to the matching sub-form of fit in viewing the relationship between CSD and the outcome to be curvilinear that is shifted by the contingency factor, the former is more thorough because it considers the joint influence of all of the contingency factors on this curvilinear relationship rather than the individual influence of each one, as is the case under the latter (Chenhall and Chapman, 2006; Burkert et al., 2014). In other words, the system form of fit deals with the combined impact of all of the contingency factors on optimal CSD, whereas the matching sub-form of fit is concerned with the individual impact of each contingency factor on optimal CSD.[169]

Despite the superiority of the matching sub-form of fit and the system form of fit, as explained above, there is a dearth of their application by contingency research on optimal CSD. As noted in Section 4.4.2, only Abernethy et al. (2001) and Ittner et al. (2002) exploited the matching sub-form of fit, but both of these studies suffer from limitations. The

[169] Like the matching sub-form of fit, the selection form of fit and moderation sub-form of fit are concerned with the effect of each contingency factor, independent from the effects of other contingency factors, on optimal CSD (see Sections 3.3.1, 3.3.2 and 3.3.2.2).

system form of fit, to the author's knowledge, has not been used. Given the above, and as mentioned in Section 4.4.2, this research adds to the contingency-optimal CSD literature by applying the more realistic and appropriate matching sub-form of fit of the interaction form of fit and the more realistic, appropriate and thorough system form of fit when examining the influence of the contingency factors on optimal CSD.

10.2.2 The second main contribution: the development and employment of a procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit

As mentioned in Sections 6.3.2.3 and 8.2.1, the combined usage of PRA and RSM has been introduced and encouraged as a procedure for overcoming problems, such as reducing a three-dimensional relationship to a two-dimensional one, that are associated with various difference-score models that have been utilised to test the congruence/fit/matching hypotheses (e.g., Edwards and Parry, 1993; Edwards, 1994; 1996; 2002; 2007).[170] Furthermore, the joint usage of PRA and RSM has the ability to reveal precisely whether the matching sub-form of fit or the moderation one is supported (Donaldson, 2006; Meilich, 2006; Burkert et al., 2014). Given the advantages of the combined usage of PRA and RSM, contingency theory researchers have recommended its use when testing the matching sub-form of fit's hypotheses, i.e., in contingency theory research (Donaldson, 2006; Burkert et al., 2014). Nonetheless, they have not explained, in detail, how to use PRA together with RSM to test for the matching sub-form of fit. To the author's knowledge, no contingency study has built on the introduction to PRA and RSM provided by Donaldson (2006), Meilich (2006) and Burkert et al. (2014) to develop further and apply a testing procedure that: (1) is suitable for the contingency theory context with regard to identifying whether the matching sub-form of fit or the moderation one is the correct sub-form of fit that accurately reflects the true relationship between the contingency factor and the optimal OS or system, such as MCS or

[170] For a detailed discussion of the problems associated with the difference-score models and how the usage of PRA together with RSM overcomes these, see Section 8.2.1.

CSD; and (2) takes into account the correct way of applying PRA and RSM, as provided by the work of Professor Jeffery Edwards and colleagues, the main promotor of the combined usage of PRA and RSM outside the territory of contingency theory.

Given the above, and as pointed out in Section 8.2, this research adds to the general contingency theory literature, including the contingency-optimal MCS and contingency-optimal CSD literature by developing and employing a procedure that encompasses the recommended joint usage of PRA and RSM to test for the influence of the contingency factors on optimal CSD from the perspective of the matching sub-form; namely, the two-stage procedure involving the combined usage of PRA and RSM. Having revisited the first two main contributions of this research, the next section will discuss the results of testing the various hypotheses, which represents the third main contribution of this research that is the consequence of the first and/or the second main contributions discussed in this section.

10.3 The third main contribution: discussion of the results of testing the hypotheses

This section discusses the results of testing the hypotheses developed in Sections 5.4, 6.3.1.3.1.2, 6.3.1.3.1.3 and 6.3.1.3.2. The discussion covers the matching sub-form of fit's hypotheses (Section 10.3.1) and the system form of fit's hypothesis (Section 10.3.2).

10.3.1 Discussion of the results of testing the hypotheses related to the matching sub-form of fit (Hypotheses 1-7)

10.3.1.1 Hypothesis 1: Competition

In Section 5.4.1.1, it was hypothesised that competition has a positive influence on the optimal level of CSC from the perspective of the matching sub-form of fit, i.e., Hypothesis 1. Using this more realistic and appropriate sub-form of fit (see Section 10.2.1) and applying the developed two-stage procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit (see Section 10.2.2), the results showed that competition does not positively impact on the optimal level of CSC and, thus, did not support Hypothesis 1 (see Section 8.5). Contrary to expectations, the implication of these results is that competition is not positively relevant to the optimal level of CSC from the viewpoint of the matching sub-form of fit. This finding and its associated implication add to the extant literature that has not examined the effect of competition on the optimal level of CSC from the standpoint of the matching sub-form of fit, using a procedure involving the recommended combined usage of PRA and RSM that, among other things, is capable of precisely revealing whether the effect takes the form of matching, weak matching or moderation.

The finding that competition does not influence the optimal level of CSC and the associated implication are comparable with those reported by many contingency studies on optimal CSD (e.g., Booth and Giacobbe, 1998; Chen et al., 2001; Cagwin and Bouwman, 2002; Chongruksut and Brooks, 2005; Cohen et al., 2005; Drury and Tayles, 2005; Brierley, 2007; 2008b; 2011; Ismail and Mahmoud, 2012), but conflict with those reported by others who found either a positive (e.g., Nguyen and Brooks, 1997; Malmi, 1999; Al-Omiri and Drury, 2007; 2013; Al-Omiri, 2012; Jusoh and Miryazdi, 2016) or negative impact (Bjørnenak, 1997) of competition on optimal CSD. It is difficult to determine the reasons for these different results across studies, including this research, given the inconsistency of studies regarding one or more aspects, such as the method used to operationalise CSD, the form of fit, i.e., selection versus interaction, adopted to examine the relationship between the contingency factor and optimal CSD, the measure utilised for the contingency factor, the statistical analysis techniques employed and the selected sample. This fact is applicable between and within studies that have found/failed to find a positive effect of competition on optimal CSD.

Notwithstanding the new finding that competition does not have a positive matching influence on the optimal level of CSC, there are five possible explanations why the current research results fail to support the hypothesised positive matching impact of competition on the optimal level of CSC, i.e., Hypothesis 1. First, it might simply be the case that prior literature has exaggerated the importance of competition regarding the optimal level of CSC when, in fact, the former is irrelevant to the latter. Second, it is probable that the measurement of competition used in this research, i.e., COMP, is unable to measure correctly this contingency factor (see Section 6.3.2.1.2.1). As suggested by Brierley (2011), the measurement of competition may need to be extended to include the contingency factor's many dimensions, e.g., price, marketing and product quality and variety, which were shown by Khandwalla (1972) to have different effects on the complexity of control systems. Hence, it is possible that the measurement of competition used in this research needs further refinement by incorporating the contingency factor's various dimensions. Third, for behavioural or cost-benefit considerations, it is possible that the required continuous efforts to control and reduce costs in the highly competitive environments are facilitated by other methods, e.g., JIT purchasing, rather than increasing CSC.

Fourth, it is possible that the degree of variation in the COMP construct was insufficient to allow statistical support to be found regarding the positive matching effect of competition on the optimal level of CSC. This is reflected in the adjacent 25th, 50th, 75th and 90th percentile values of the construct, which are, on a five-point scale, 3.33, 4, 4.33 and 4.67, respectively, with 56.5% of the business-units having the median COMP value of 4 and above. In addition, the mean value (3.86) of COMP is high (see Section 7.4.2.1). Collectively, these statistics indicate that most Saudi business-units, regardless of their optimal levels of CSC, face higher levels of competition, which might be attributed to Saudi Arabia joining the WTO in 2005 (WTO, 2017).

Fifth, it is possible that the positive effect of competition on the optimal level of CSC is conditioned, i.e., moderated, by whether the business-unit is a price maker, i.e., is able to determine the selling price of the products, or a price taker, i.e., is unable to determine the selling price of the products. Price maker business-units need more accurate cost information because they use this information as direct input in determining the sale prices of their products (Drury and Tayles, 2006; Al-Omiri and Drury, 2013). However, price taker business-units do not require such accurate cost information because they use this information for profitability analysis purposes to determine the profitability of the products, with the objective of ensuring that only profitable products are produced and providing attention-directing information to highlight potential unprofitable products for more detailed studies (ibid). Therefore, it is likely that competition will have a stronger positive influence on the optimal level of CSC when the business-unit is a price maker than when it is a price taker.

10.3.1.2 Hypothesis 2: Cost Structure

Hypothesis 2 anticipated that cost structure has a positive impact on the optimal level of CSC from the viewpoint of the matching sub-form of fit (see Section 5.4.1.2). Utilising this more realistic and appropriate sub-form of fit (see Section 10.2.1) and exploiting the developed two-stage procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit (see Section 10.2.2), the results showed that cost structure does not positively affect the optimal level of CSC and, accordingly, did not support Hypothesis 2 (see Section 8.5). Contradictory to anticipations, the implication of these results is that cost structure is not positively relevant to the optimal level of CSC from the standpoint of the matching sub-form of fit. The exploitation of the developed two-stage procedure, however, revealed that cost structure influences the optimal level of CSC from the perspective of the weak form of the matching sub-form of fit (see Sections 8.4.2.3.2 and 8.5). In addition, it showed that cost structure impacts on the optimal level of CSC from the viewpoint of the moderation sub-form of fit even though it was argued that the matching sub-form of fit reflects the relationship between the contingency factors and optimal CSD more accurately than does the moderation one (see Sections 8.4.1.1, 8.4.2.1.1, 8.5, 4.4.2 and 10.2.1).

The results relating to the weak form of the matching sub-form of fit revealed that cost structure has a positive effect on the optimal level of CSC. The results pertaining to the moderation sub-form of fit conveyed that the dominant trend of the moderation effects of cost structure is non-monotonic and positive, indicating a relationship between CSC and the outcome that is negative and insignificant at very low values, positive and insignificant at low values, positive and predominantly significant at moderate values and positive and significant at high and very high values of cost structure. As discussed in Section 8.4.2.3.2, the results of these sub-forms of fit only partially agree with each other, and they differ in many aspects, including the levels at which the outcome is maximised across all values of cost structure except for the extreme values and the impact of both over- and under-fit on the outcome. These differences were caused by the distinct assumptions associated with the matching and moderation sub-forms of fit (see Sections 3.3.2.1, 3.3.2.2, 4.4.2 and 10.2.1). Despite these differences, the partial agreement between the results of the two sub-forms of fit brings the implications of these results, to some extent, into line with each other.

First, the results of the weak form of the matching sub-form of fit indicated that cost structure is positively associated with the optimal level of CSC, i.e., the first element of the matching's influence, as conveyed by finding that the first principal axis runs from low values of both cost structure and CSC to higher values of both constructs (see Section 8.4.2.3.2). These results mean that the outcome is maximised at extreme similar values of both cost structure and CSC. The results of the moderation sub-form of fit, to some extent, supported this by providing that the dominant trend of the moderation effects of cost structure is non-monotonic and positive, revealing a relationship between CSC and the outcome that is negative and insignificant at very low values and positive and significant at very high values of cost structure, i.e., the outcome is maximised when cost structure and CSC are both very high and may be so when both are very low (see Sections 8.4.1.1, 8.4.2.1.1 and 8.4.2.3.2). Second, the results of the weak form of the matching sub-form of fit revealed that the misfit, including both over- and under-fit, between cost structure and the optimal level of CSC has a negative effect on the outcome, i.e., the second element of the matching's influence, as conveyed by finding significant negative curvatures of both the second principal axis and the numerical-misfit line (see Section 8.4.2.3.2). Although the moderation sub-form of fit assumes that the misfit is represented by either over- or under-fit, but not both, its results always imply a negative influence of misfit.

In aggregate, the implication of the results of the weak form of the matching sub-form of fit that, to have optimal levels of CSC, business-units with lower/moderate/higher proportions of indirect costs should have lower/moderate/higher levels of CSC, to some extent, is supported by that regarding the moderation sub-form of fit, i.e., the dominant trend of the moderation effects, that, to have optimal levels of CSC, business-units with moderate and higher proportions of indirect costs should have higher levels of CSC, whereas those with lower proportions of indirect costs are unaffected by this and so may be better off having lower levels of CSC. Recognising the similarities and differences between the results and the associated implications of the two sub-forms of fit, the results and implication of the weak form of the matching sub-form of fit are considered to be more reliable and, thus, deemed to be those for cost structure. This is because both contingency theory and the CSD literature support the matching sub-form of fit over the moderation one (e.g., Cooper, 1988b; Donaldson, 2001; 2006; Meilich, 2006; Pizzini, 2006; Drury, 2015) (see Sections 4.4.2 and 10.2.1). The implication of the results of the weak form of the matching sub-form of fit is unaffected by the results of the first step of residual analysis, whereby cost structure has a negative impact on the optimal level of CSC from the standpoint of the selection form of fit (see Section 9.4.1.3), implying that, to have optimal levels of CSC, business-units with lower/moderate/higher proportions of indirect costs ought to have higher/moderate/lower levels of CSC. This is due to the selection form of fit's main limitation of considering company survival as the outcome measure that represents the optimality of the level of CSC (see Sections 3.3.1, 4.4.2 and 10.2.1).[171]

The finding that cost structure does not have a positive matching effect on the optimal level of CSC but, instead, a positive weak matching one and the associated implications add to the extant literature. This is because the existing literature has failed to examine the influence of cost structure on the optimal level of CSC from the viewpoint of the matching sub-form of fit, using a procedure encompassing the recommended joint usage of PRA and RSM that, among other things, is capable of accurately determining whether the influence takes the form of matching, weak matching or moderation.

Even though the matching sub-form of fit was not supported, the implication of the positive weak matching impact of cost structure on the optimal level of CSC that, to have optimal levels of CSC, business-units with lower/moderate/higher proportions of indirect costs should have lower/moderate/higher levels of CSC agrees with the expectations regarding the relevance of cost structure to the optimal level of CSC (see Section 5.4.1.2). This implication also conforms with those reported by several contingency studies on optimal CSD (e.g., Bjørnenak, 1997; Brierley, 2007; Al-Omiri, 2012; Al-Omiri and Drury, 2013; Jusoh and Miryazdi, 2016), but contradicts those reported by others who found either a negative effect (Pokorná, 2015) or no effect (e.g., Nguyen and Brooks, 1997; Clarke et al., 1999; Malmi, 1999; Chen et al., 2001; Al-Mulhem, 2002; Brown et al., 2004; Chongruksut and Brooks,

[171] For a detailed discussion of the differences between the results of the selection form of fit and the interaction one, including the moderation and weak form of the matching sub-forms of fit, related to cost structure, see Section 9.4.1.3.

2005; Cohen et al., 2005; Drury and Tayles, 2005; Khalid, 2005; Al-Omiri and Drury, 2007; Brierley, 2008b; 2011; Nassar et al., 2009; Ahamadzadeh et al., 2011; Ismail and Mahmoud, 2012; Charaf and Bescos, 2013; Rbaba'h, 2013) of cost structure on optimal CSD. The diverse results across studies, including this research, might be attributed to the issue of inconsistency across studies, mentioned in Section 10.3.1.1.

Notwithstanding the new finding that cost structure does not have a positive matching influence on the optimal level of CSC but, instead, a positive weak matching one, there is a possible explanation for the lack of support of the results of this research for the hypothesised positive matching impact of cost structure on the optimal level of CSC, i.e., Hypothesis 2. More specifically, it is possible that the cost structure measures used in this research - i.e., CostStructure-MANUFACTURING and CostStructure-COMBINED - cannot accurately measure this contingency factor (see Section 6.3.2.1.2.1). As suggested by Drury and Tayles (2005) and Al-Omiri and Drury (2007), the proper measurement of cost structure should only include, when calculating the proportion of indirect costs, the relevant types of indirect costs of the batch- and product-level that demand higher levels of CSC in order to assign them to products accurately. This means that the other types of indirect costs that are irrelevant to CSC, due to either the ease, unit-level indirect costs, or the impossibility, facility-level indirect costs, of accurately assigning them to products, should not be included in the cost structure measures. However, and as pointed out by Al-Omiri and Drury (2013), obtaining information about the percentages of the different types of indirect costs is difficult when the questionnaire is the adopted data collection method. In this research, this assertion was confirmed by the participants in the exploratory interviews when they indicated the extended amount of time needed to calculate these percentages, which might decrease the response rate if a question about these percentages were to be included on the questionnaire. Hence, the questionnaire used in this research did not include questions about the proportions of the various types of indirect costs. A possible solution to this problem, as recommended by Drury and Tayles (2005) and Al-Omiri and Drury (2007; 2013), is to utilise a case study research strategy that permits the researcher to engage in higher levels of interaction with the participants. This, in turn, would allow the researcher to identify the proportions of the different types of indirect costs and, subsequently, examine the effect of cost structure using an appropriate measure derived from these proportions on optimal CSD.

In addition, a further issue with the CostStructure-COMBINED measure, which represents the percentage of the sum of indirect manufacturing costs and non-manufacturing costs to total costs, is that it encompasses both direct and indirect non-manufacturing costs (see Section 6.3.2.1.2.1). The related question on the questionnaire, i.e., Q21, did not differentiate between the two proportions of non-manufacturing costs. Although it is reasonable to assume that most of the non-manufacturing costs are indirect, questions about both the direct and indirect non-manufacturing costs should be included, and that only the indirect proportion of non-manufacturing costs is incorporated into the cost structure measure.[172] Nonetheless, cost structure should be measured in the manner suggested above. Given the limitation of the CostStructure-COMBINED measure, the results for cost structure pertaining to CostStructure-COMBINED, which represent almost all of results for cost structure, should be interpreted with caution.

10.3.1.3 Hypotheses 3a-3c: Organisational culture

In Section 5.4.1.3, it was hypothesised that the three organisational culture dimensions of outcome orientation, attention to detail and tight versus loose control have a positive effect on the optimal level of CSC from the standpoint of the matching sub-form of fit, i.e., Hypotheses 3a-3c. Adopting this more realistic and appropriate sub-form of fit (see Section 10.2.1) and

[172] Examples of studies that measured cost structure as the percentage of indirect costs, including both manufacturing and non-manufacturing, to total costs include Drury and Tayles (2005) and Al-Omiri and Drury (2007).

employing the developed two-stage procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit (see Section 10.2.2), the results showed that organisational culture, including its three dimensions, does not positively influence the optimal level of CSC and, accordingly, did not support Hypotheses 3a-3c (see Section 8.5). Contrary to expectations, the implication of these results is that organisational culture is not positively relevant to the optimal level of CSC from the perspective of the matching sub-form of fit. However, the employment of the developed two-stage procedure revealed that organisational culture, including its three dimensions, negatively impacts on the optimal level of CSC from the viewpoint of the weak form of the matching sub-form of fit (see Sections 8.4.2.3.3 and 8.5). The implication of these results is that, to have optimal levels of CSC, business-units with an organisational culture that is characterised as less/moderately/more outcome-oriented, detail-oriented or control-focused ought to have higher/moderate/lower levels of CSC.

The finding that organisational culture, including its three dimensions, does not have a positive matching effect on the optimal level of CSC, but instead a negative weak matching one and the associated implications add to the extant literature. This is because the present literature has not examined the influence of organisational culture, including its three dimensions, on the optimal level of CSC from the perspective of the matching sub-form of fit, using a procedure involving the recommended combined usage of PRA and RSM that, among other things, is capable of precisely revealing whether the influence takes the form of matching, weak matching or moderation.

Although the matching sub-form was not supported, the implication of the negative weak matching impact of organisational culture on the optimal level of CSC that, to have optimal levels of CSC, business-units with an organisational culture that is characterised as less/moderately/more outcome-oriented, detail-oriented or control-focused should have higher/moderate/lower levels of CSC contradicts the predications concerning the relevance of organisational culture to the optimal level of CSC (see Section 5.4.1.3). In addition, this implication conflicts with those reported by other contingency studies on optimal CSD that found a positive effect of organisational culture on optimal CSD (Baird et al., 2004; Charaf and Bescos, 2013) and those conveyed by studies on ABC success that found a positive influence of organisational culture on ABC success (Baird et al., 2007; Zhang et al., 2015). The dissimilar results of this research from other contingency studies may be caused by the issue of inconsistency with respect to one or more of the aspects stated in Section 10.3.1.1.

Despite the new finding that organisational culture, including its three dimensions, does not have a positive matching effect on the optimal level of CSC but, instead, a negative weak matching one, there are two possible explanations why the research results do not support the hypothesised positive matching influence of organisational culture on the optimal level of CSC, i.e., Hypotheses 3a-3c. First, it is possible that the measurements, i.e., constructs, of organisational culture used in this research - i.e., CultureOutcome, CultureDetail and CultureControl - cannot precisely measure the three organisational culture dimensions (see Section 6.3.2.1.2.1). Although these measurements were adopted from the CSD literature (Baird et al., 2004; 2007), they have not been, intensively, validated across different research contexts due to the limited research into the relationship between organisational culture and optimal CSD. Thus, it is possible that these measurements require further refinements in order to be capable of accurately capturing the various dimensions of organisational culture. This could be achieved by using a case study research strategy, where the researcher can closely observe and determine the organisational culture of the business-units. The greater interaction between the researcher and the participants allowed by the case study strategy facilitates the identification of more accurate and influential indicators for the cultural dimensions that characterise the organisational culture of the business-units. For example, instead of using general questions related to the extent to which the business-unit appreciates different values to determine whether or not it has an organisational culture that is more detail-oriented, the case study strategy might identify better questions, such as ones concerning the preparation of certain managerial and production reports that normally include a great amount of details, in order to determine the magnitude of the attention to detail cultural dimension of the business-unit.

Second, it may be that the variation in the CultureOutcome, CultureDetail and CultureControl constructs was insufficient to permit statistical support for the positive matching impact of the corresponding cultural dimensions on the optimal level of CSC to be found. This is mirrored in the close 25th, 50th, 75th and 90th percentile values of the constructs. On a five-point scale, these values are 3.60, 4, 4.40 and 5 for CultureOutcome, with 58.5% of the business-units having the median CultureOutcome value of 4 and above, 3.42, 4, 4.67 and 5 for CultureDetail, with 61.5% of the business-units having the median CultureDetail value of 4 and above and 2.90, 3.50, 4 and 4.25 for CultureControl, with 54.5% of the business-units having the median CultureControl value of 3.5 and above. In addition, the mean value of each of CultureOutcome (4), CultureDetail (3.92) and CultureControl (3.45) is high (see Section 7.4.2.1). In aggregate, these statistics indicate that the organisational culture of most Saudi business-units, regardless of their optimal levels of CSC, are more outcome-oriented, detail-oriented and control-focused, possibly due to the characteristics of the national culture of Saudi Arabia, which includes wide power distance, strong uncertainty avoidance, high collectivism and being masculine (Hofstede, 1980; 1984a; 1984b). These national culture characteristics can be argued to promote an organisational culture that is more outcome-oriented, detail-oriented and control-focused. More specifically, the emphasis on the importance of working hard, the close and moral connection between the employee and the organisation and the great focus on performance and admiration to successful achievers, related, respectively, to the strong uncertainty avoidance, high collectivism and being masculine national culture characteristics, inspire a more outcome-oriented organisational culture. The stress on being careful and risk-averse, linked with the strong uncertainty avoidance national culture characteristic, promotes a more detail-oriented organisational culture. The belief in the functionality of hierarchies and the need for written rules and regulations, associated, respectively, with the wide power distance and strong uncertainty avoidance national culture characteristics, encourage a more control-focused organisational culture.[173]

The new finding that organisational culture has a negative weak matching effect on the optimal level of CSC is contradictory to predictions. A possible explanation for this is that it is possible that the assumption made by this research that the optimality of the level of CSC in terms of balancing the costs of measurements and costs of errors can be expressed by the USEFULNESS and USAGE measures is incorrect (see Section 5.2). This means that it would be possible to find, given the level of organisational culture, CSC levels that are less optimal in terms of balancing the costs of measurements and costs of errors to be optimal in terms of USEFULNESS and USAGE. In other words, it is possible to find a negative matching or weak matching effect of organisational culture on the optimal level of CSC with respect to USEFULNESS and USAGE. There are two possible explanations for this.

First, it might be that the influence of organisational culture on the optimal level of CSC in terms of USEFULNESS and USAGE is conditioned, i.e., moderated, by the business-unit structure. The impact of organisational culture on any organisational aspect or practice, including optimal CSD with respect to USEFULNESS and USAGE, is more likely to be apparent and conveyed in business-units with mechanistic structures, such as formalised and centralised structures, where formal procedures and systems dominate, and the power and

[173] For further details about the national culture characteristics, see Hofstede (1980).

control of the business-unit are distributed among a relatively few individuals (Zhang et al., 2015). However, the effect of organisational culture on any organisational aspect or practice, including optimal CSD in terms of USEFULNESS and USAGE, is less likely to be evident and transmitted in business-units with organic structures, such as less formalised and decentralised structures, where informal procedures and systems predominate, and the power and control of the business-unit are allocated between a relatively high number of individuals (ibid). In fact, the characteristics of organic structures - i.e., less formalisation and decentralisation - could lead to the reverse relationship between organisational culture and any related organisational aspect and practice.

For instance, it is possible, because of decentralisation, to find individuals who are responsible for different parts of the business-unit requiring their subordinates to perform tasks in a way that is consistent with their personal desires, but incompatible with the overall organisational culture. This could occur in the accounting and finance function, which is, typically, responsible for CSD. For example, the chief accountant or finance manager may prefer, for many reasons, to have very detailed cost information when the organisational culture of their business-unit is characterised as less detail-oriented or less control-focused. Therefore, such cost information, generated typically by costing systems with higher levels of CSC, is likely to be found useful and used in decision-making. Accordingly, it is possible that the positive influence of organisational culture on the optimal level of CSC with respect to USEFULNESS and USAGE is observed in business-units with mechanistic structures, whereas a negative one is found in those with organic structures. In support of this possible explanation, Zhang et al. (2015) found positive interaction effects of organisational culture and mechanistic structures on ABC success, while Gosselin (1997) found a positive impact of each of the formalisation and centralisation structures on ABC implementation.

Second, it is probable that the influence of organisational culture on the optimal level of CSC in terms of USEFULNESS and USAGE is conditioned, i.e., moderated, by the extent to which the wishes of the family members controlling and managing family-owned business-units regarding the costing system is in line with the organisational culture of the business-unit. Family-owned is the legal form of most business-units operating in Saudi Arabia (Joshi et al., 2011; Hanware, 2016, April 12; Schumpeter, 2016, February 4). If the family members take important managerial roles in the family-owned business-unit, it is plausible to expect that the organisational culture will reflect the values, norms and beliefs of those family members. It is also reasonable to expect that these family members will have wishes related to any organisational aspects and practices, e.g., optimal CSD, that are partially or fully inconsistent with their values, norms and beliefs - i.e., organisational culture - and, thus, the best interest of their business-unit. Given this, the impact of organisational culture on the optimal level of CSC with respect to USEFULNESS and USAGE is likely to be positive when the wishes of these family members regarding the costing system conform with the organisational culture of the business-unit. Otherwise, the effect of organisational culture on the optimal level of CSC in terms of USEFULNESS and USAGE is likely to be negative.

For example, when the organisational culture is best served by higher levels CSC, e.g., more detail-oriented, these family members may be unwilling to invest in the costing system by increasing its complexity and prefer lower levels of CSC instead, because they think that they have enough knowledge about their business-unit, and that their business-unit has grown and been profitable since its establishment without the need for such a costly investment. For business-units that are controlled and managed by such family members, the cost information provided by costing systems with lower levels of CSC are more likely to be perceived as useful and utilised in decision-making. In contrast, when the organisational culture is best supported by lower levels of CSC, e.g., less detail-oriented, these family members might wish to invest in the costing system by increasing its complexity as a way of showing their good conduct and conformance to the emergent norms to other family members within the same business-unit or in other business-units within the same holding company. For business-units that are controlled and managed by such family members, the cost information provided by costing systems with higher levels of CSC are more likely to be considered useful and exploited in decision-making.

10.3.1.4 Hypothesis 4: PC

Hypothesis 4 expected PC to have a positive influence on the optimal level of CSC from the perspective of the matching sub-form of fit (see Sections 5.4.1.4 and 6.3.1.3.2). Using this more realistic and appropriate sub-form of fit (see Section 10.2.1), utilising a sufficiently comprehensive multi-dimensional PC measure (see Sections 4.4.3.3, 6.3.1.2.4 and 6.3.2.1.2.1) and applying the developed two-stage procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit (see Section 10.2.2), the results showed that PC has a negative impact on the optimal level of CSC and, hence, did not support Hypothesis 4 (see Sections 8.4.2.2 and 8.5). Moreover, the application of the developed two-stage procedure revealed that PC affects the optimal level of CSC from the viewpoint of the moderation sub-form of fit even though it was argued that the matching sub-form of fit represents the relationship between the contingency factors and optimal CSD more accurately than the moderation one (see Sections 8.4.1.2 and 10.2.1). It conveyed that the moderation influence of PC is non-monotonic and negative, indicating a relationship between CSC and the outcome that is positive and significant at very low, low and moderate values, positive and insignificant at high values and negative and insignificant at very high values of PC. As discussed in Section 8.4.2.2, the results of these sub-forms of fit only partially agree with each other, and they differ in many aspects, including the levels at which the outcome is maximised across all values of PC except for the extreme values, and the effect of both over- and under-fit on the outcome. These differences are caused by the different assumptions held by the matching and moderation sub-forms of fit (see Sections 3.3.2.1, 3.3.2.2, 4.4.2 and 10.2.1). Notwithstanding the differences, the partial agreement between the results of the two sub-forms of fit brings the implications of these results, to some extent, into line with each other.

First, the results of the matching sub-form of fit showed that PC is negatively associated with the optimal level of CSC, i.e., the first element of the matching's influence, as reflected by finding the Matching-Fit-Line running from low values of PC and high values of CSC to high values of PC and low values of CSC (see Section 8.4.2.2). These results mean that the outcome is maximised at extreme opposite values of both PC and CSC. The results of the moderation sub-form of fit, to some extent, supported this by indicating that the moderation effect is non-monotonic and negative, revealing a relationship between CSC and the outcome that is positive and significant at very low values and negative and insignificant at very high values of PC, i.e., the outcome is maximised when PC is very low and CSC is very high and may be so when PC is very high and CSC is very low (see Sections 8.4.1.2 and 8.4.2.2). Second, the results of the matching sub-form conveyed that the misfit, including both over- and under-fit, between PC and the optimal level of CSC has a negative impact on the outcome, i.e., the second element of the matching's influence, as demonstrated by the significant negative curvatures of both the second principal axis and the numerical-fit line (see Section 8.4.2.2). Although the moderation sub-form of fit assumes that the misfit is represented by either over- or under-fit, but not both, its results always imply a negative effect of misfit.

Overall, the implication of the results of the matching sub-form of fit that, to have optimal levels of CSC, business-units with lower/moderate/higher levels of PC should have higher/moderate/lower levels of CSC, to some extent, corresponds with that of the moderation sub-form of fit that, to have optimal levels of CSC, business-units with lower and moderate levels of PC should have higher levels of CSC, whereas those with higher levels of PC are unaffected by this and so may be better to have lower levels of CSC. Realising the similarities and differences between the results and the associated implications of the two sub-forms of fit, the results and the implication of the matching sub-form of fit are considered more reliable and, therefore, deemed to be the one for PC because both contingency theory and the CSD literature support the matching sub-form of fit over the moderation one (see Sections 4.4.2 and 10.2.1). The implication of the results of the matching sub-form of fit is also supported by the results of the first step of residual analysis that PC has a negative impact on the optimal level of CSC from the standpoint of the selection form of fit (see Sections 9.4.1.1 and 9.4.1.3), which imply that, to have optimal levels of CSC, business-units with lower/moderate/higher levels of PC ought to have higher/moderate/lower levels of CSC.

The finding that PC negatively influences the optimal level of CSC from the perspective of the matching sub-form of fit and the associated implication add to the extant literature that has failed to examine the impact of PC on the optimal level of CSC from the viewpoint of the matching sub-form of fit, using a procedure encompassing the recommended joint usage of PRA and RSM that, among other things, is capable of determining accurately whether the impact takes the form of matching, weak matching or moderation. Although the matching sub-form of fit was supported, its results and associated implication disagree with the expectations regarding the relevance of PC to the optimal level of CSC (see Sections 5.4.1.4 and 6.3.1.3.2). Nonetheless, it accords with that relating to organisational culture (see Section 10.3.1.3).

The implication of the negative matching influence of PC on the optimal level of CSC that, to have optimal levels of CSC, business-units with lower/moderate/higher levels of PC should have higher/moderate/lower levels of CSC is consistent with those reported by several contingency studies on optimal CSD that have used the product customisation PC dimension as a measure of PC (Bjørnenak, 1997; Drury and Tayles, 2005; Schoute, 2011). Given the fact that product diversity and product customisation are likely to be higher in job-order and batch production compared to mass, i.e., continuous, production, the implication of the negative matching impact of PC also conforms to those reported by other studies that found that mass production companies use ABC more than companies that employ job-order and batch production (Krumwiede, 1998a; Ittner et al., 2002; Schoute, 2011). However, it is inconsistent with those reported by most of the contingency studies on optimal CSD that found, using various PC dimensions to measure PC, either a positive (e.g., Nguyen and Brooks, 1997; Krumwiede, 1998a; Malmi, 1999; Abernethy et al., 2001; Al-Mulhem, 2002; Ittner et al., 2002; Chongruksut and Brooks, 2005; Drury and Tayles, 2005; Khalid, 2005; Al-Omiri, 2012; Al-Omiri and Drury, 2013; Jusoh and Miryazdi, 2016) or no effect (e.g., Clarke et al., 1999; Chen et al., 2001; Brown et al., 2004; Al-Omiri and Drury, 2007; Brierley, 2007; 2008b; 2011; Nassar et al., 2009; Ismail and Mahmoud, 2012) of PC on optimal CSD.[174] The various results across studies, including this research, might be attributed to the issue of inconsistency across studies, mentioned in Section 10.3.1.1.

Despite the new finding that PC has a negative influence on the optimal level of CSC from the standpoint of the matching sub-form of fit, there are two possible explanations why this influence contrasts with the hypothesised positive one, i.e., Hypothesis 4. The first possible explanation is that the business-units may use techniques and/or systems that make costing systems with lower/higher levels of CSC optimal for higher/lower and moderate levels of PC. More specifically, to simplify the manufacturing and support processes, business-units with higher levels of PC may adopt the JIT production philosophy (Lammert and Ehrsam, 1987; Foster and Horngren, 1988; Cooper and Kaplan, 1991; Gunasekaran and Sarhadi, 1998;

[174] The positive effect of PC on optimal CSD found by Drury and Tayles (2005) was observed when PC was measured by the product diversity PC dimension

Bowhill and Lee, 2002; Fullerton and McWatters, 2004), which has been argued to demand lower levels of CSC (Foster and Horngren, 1988; Hoque, 2000; Al-Omiri and Drury, 2007; Drury, 2015). JIT business-units normally create separate production cells within the factory, each devoted to producing a single product or a family of similar products (Bowhill and Lee, 2002; Al-Omiri and Drury, 2007; Horngren, Datar and Rajan, 2012; Drury, 2015). All of the manufacturing processes are performed within the cell, and, accordingly, the costs of the cell can be easily assigned to the cell's product or family of similar products. However, in non-JIT business-units, different unrelated products are typically manufactured within the same production departments, making the assignment of the production departments costs, which are common to all unrelated products, more difficult. In addition, in JIT business-units, workers within each production cell are usually multitasking and sufficiently skilled to perform most or all of the support activities, thereby facilitating the assignment of support activities' costs to the cell's product or family of similar products (Bowhill and Lee, 2002; Drury, 2015). In contrast, in non-JIT business-units, there exist specific support departments that provide support for all of the production departments, within which different, unrelated products are typically produced, thereby hindering the assignment of specific support departments' costs to products. Furthermore, in JIT production environments, the ideal batch size is one, meaning that batch-level activities/costs become unit-level activities/costs or are removed (Hoque, 2000). Related to this, JIT business-units can identify and eliminate non-value-added activities, thereby reducing the indirect costs (Hoque, 2000; Drury, 2015). Moreover, in JIT production environments, the main concern is the time required for the process (Hoque, 2000; Al-Omiri and Drury, 2007), thereby justifying the usage of time-related volume-based cost drivers, i.e., labour and machine hours. In short, it is reasonable to find that lower levels of CSC are optimal for business-units with higher levels of PC, because such business-units might have used JIT production, which reduces the higher costs of errors associated with the usage of lower levels of CSC at higher levels of PC and, hence, balances them with the lower costs of measurements associated with lower levels of CSC.

Concerning this possible explanation, Bowhill and Lee (2002) found that, to deal with the higher levels of PC that result from the increased number of product families, each containing a wide range of products, one of the two cases included in their study implemented a number of changes associated with the JIT philosophy. These changes discouraged amendments being made to the design of the simple costing system used to ensure the accuracy of the product costs because the amount of indirect costs that needed to be assigned to the different product families and individual products decreased. This decline resulted from, as mentioned above, the capability of JIT to reduce the number of support departments by employing, in the manufacturing cells, multitasking and skilled staff who can perform the support activities.

In contrast, to obtain a wide range of benefits, such as enhancing control, improving productivity and speed and reducing costs, business-units with moderate and lower levels of PC might use ERP systems (e.g., Davenport, 1998; Abu-Shanab, Abu-Shehab and Khairallah, 2015; Circa, Almasan, Margea and Margea, 2015), in which costing systems with typically higher levels of CSC are embedded (Baxendale and Jama, 2003; Friedl, Hammer, Pedell and Küpper, 2009). Therefore, the costs of measurements associated with using these embedded costing systems become very low. The expectation that ERP systems is used in business-units with moderate and lower PC levels is, however, difficult to apply to business-units with higher levels of PC. This is because ERP systems, by imposing its logic of using standardised processes across all business-units, may fail or weaken the competitive advantage of business-units with higher levels of PC, related to the utilisation of distinctive, flexible processes to produce diverse and customised products (Zach and Olsen, 2011). In addition, the usage of ERP systems might be low because of gaps between the decision support provided by the ERP systems and that required by business-units with higher levels of PC (Aslan, Stevenson and Hendry, 2012; 2015). An example of a potential gap of this nature is the decision support provided by ERP systems regarding the detailed scheduling of arrival times of jobs at the various machines and that required by business-units with higher PC levels concerning the usage of a flexible planning approach. In sum, for business-units with moderate and lower levels of PC, it is plausible to find that higher levels of CSC are optimal, because such business-units might have used ERP systems, which help to reduce the higher costs of measurements associated with higher levels of CSC and, accordingly, balance them with the lower costs of errors related to the usage of higher levels of CSC at moderate and lower levels of PC.

The second possible explanation is similar to that provided for the weak negative matching influence of organisational culture on the optimal level of CSC, which indicated the possibility that the assumption made by this research that the optimality of the level of CSC in terms of balancing the costs of measurements and costs of errors can be expressed by the USEFULNESS and USAGE measures is incorrect (see Section 5.2). This suggests that it is possible to find, given the level of PC, CSC levels that are less optimal regarding the balance of the costs of measurements and costs of errors to be optimal in terms of USEFULNESS and USAGE. In other words, it is possible to find a negative matching or weak matching effect of PC on the optimal level of CSC in terms of USEFULNESS and USAGE. A possible explanation for this is that it is possible that, due to behavioural considerations, business-units may find it unfeasible to design, implement or operate with high complex costing systems when the level of PC is high, whereas they find it beneficial to do so when the level of PC is low. Highly complex costing systems are difficult to design, implement and operate, which could negatively impact on the sustainability of such systems (Lammert and Ehrsam, 1987; Cooper, 1990b). Employees might express resistance to highly complex costing systems either in the design, implementation or operation stage, rendering their usage impossible or very difficult (Shields and Young, 1989; Argyris and Kaplan, 1994; Pattison and Arendt, 1994; Malmi, 1997). However, it is possible that employees' resistance to highly complex costing systems is only encountered by business-units with higher levels of PC because the amount of work across the different functions - e.g., manufacturing, support and administration - is more likely to be high already, and employees are unwilling to assume any further burden related to providing the detailed information required by the more complex costing systems. To satisfy the desires of their employees and, ultimately, maintain the flow of the work and the business, it is plausible to expect that these business-units will not change their CSD by increasing its complexity. Accordingly, cost information generated by costing systems with lower levels of CSC is more likely to be considered useful and utilised in decision-making by business-units with higher levels of PC. Business-units with lower levels of PC will probably not experience employee resistance to highly complex costing systems, given that there is probably a relatively low amount of work across the different functions, and so employees are willing to work more with the objective of developing and expanding the business. To satisfy the willingness of their employees, it is reasonable to anticipate that these business-units will engage in frequent changes, including increasing their CSC, that is, generally, presumed to provide more detailed and accurate cost information. Thus, cost information furnished by costing systems with higher levels of CSC is more likely to be perceived as useful and exploited in decision-making by business-units with lower levels of PC.

10.3.1.5 Hypothesis 5: Business-unit size

In Section 5.4.1.5, it was hypothesised that business-unit size has a positive impact on the optimal level of CSC from the viewpoint of the matching sub-form of fit, i.e., Hypothesis 5. Utilising this more realistic and appropriate sub-form of fit (see Section 10.2.1) and exploiting the developed two-stage procedure involving the recommended combined usage of

PRA and RSM to test for the matching sub-form of fit (see Section 10.2.2), the results showed that business-unit size does not positively affect the optimal level of CSC and, accordingly, did not support Hypothesis 5 (see Section 8.5). Contrary to expectations, the implication of these results is that business-unit size is not positively relevant to the optimal level of CSC from the standpoint of the matching sub-form of fit.

Nevertheless, the exploitation of the developed two-stage procedure revealed that business-unit size influences the optimal level of CSC from the perspective of the moderation sub-form of fit although it was argued that the matching sub-form of fit is a better indicator of the relationship between the contingency factors and optimal CSD than the moderation one (see Sections 8.4.2.1.2, 8.5 and 10.2.1). It conveyed that the moderation effects of business-unit size are non-monotonic and negative, indicating a relationship between CSC and the outcome that is positive and significant at very low, low and moderate values, either positive or negative and insignificant at high values and negative and insignificant at very high values of business-unit size (see Section 8.4.2.1.2). The implication of these results is that, to obtain optimal levels of CSC, small and medium-sized business-units should have higher levels of CSC, whereas large business-units are unaffected by this and so might benefit from having lower levels of CSC. This implication is unaffected by the results of the first step of residual analysis that business-unit size has a positive influence on the optimal level of CSC from the viewpoint of the selection form of fit (see Section 9.4.1), which imply that, to have optimal levels of CSC, small/medium/large business-units should have lower/moderate/higher levels of CSC. This is attributed to the selection form of fit's main limitation of considering company survival to be the outcome measure that represents the optimality of the level of CSC (see Sections 3.3.1, 4.4.2 and 10.2.1).[175]

[175] For a detailed discussion of the differences between the results of the selection form of fit and the moderation sub-form of fit related to business-unit size, see Section 9.4.1.1.

The finding that business-unit size does not have a positive matching impact on the optimal level of CSC but, instead, a non-monotonic negative moderation one and the associated implications add to the extant literature. This is because the existing literature has not examined the effect of business-unit size on the optimal level of CSC from the standpoint of the matching sub-form of fit, using a procedure involving the recommended combined usage of PRA and RSM that, among other things, is capable of revealing precisely whether the effect takes the form of matching, weak matching or moderation.

Although the matching sub-form of fit was not supported, the implication of the non-monotonic negative moderation influence of business-unit size that, to have optimal levels of CSC, small and medium-sized business-units ought to have higher levels of CSC, whereas large business-units are unaffected by this and so may benefit from having lower levels of CSC conflicts with the expectations concerning the relevance of business-unit size to the optimal level of CSC (see Section 5.4.1.5). Nonetheless, this implication is, to some extent, consistent with those pertaining to organisational culture (see Section 10.3.1.3) and PC (see Section 10.3.1.4). Furthermore, it, to some extent, corresponds with the negative impact of business-unit size on optimal CSD found by Joshi et al. (2011) in the GCC countries that include Saudi Arabia. However, the implication of the non-monotonic negative moderation effect of business-unit size, to some extent, conflicts with those reported by many contingency studies on optimal CSD that have found either a positive (e.g., Innes and Mitchell, 1995; Nguyen and Brooks, 1997; Krumwiede, 1998a; Clarke et al., 1999; Malmi, 1999; Hoque, 2000; Innes et al., 2000; Chen et al., 2001; Al-Mulhem, 2002; Drury and Tayles, 2005; Khalid, 2005; Al-Omiri and Drury, 2007; 2013; Brierley, 2007; 2008b; 2011; Nassar et al., 2009; Elhamma and Moalla, 2015) or no influence (e.g., Gosselin, 1997; Cohen et al., 2005; Chongruksut and Brooks, 2005; Schoute, 2011; Ismail and Mahmoud, 2012) of business-unit size on optimal CSD. Moreover, the finding that the moderating impact of business-unit size is non-monotonic and negative contradicts those reported by other contingency studies on optimal CSD that found either a positive (Elhamma, 2012) or no moderation effect (Cagwin and Bouwman, 2002; Krumwiede and Charles, 2014) of business-unit size.[176] The different results across studies, including this research, may be caused by the issue of inconsistency across studies, mentioned in Section 10.3.1.1.

Notwithstanding the new finding that business-unit size does not have a positive matching influence on the optimal level of CSC but, instead, a non-monotonic negative moderating one, there is one possible explanation for the lack of support by the results of this research for the hypothesised positive matching impact of business-unit size on the optimal level of CSC, i.e., Hypothesis 5. More specifically, business-unit size may not have been a good proxy for the contingency factor, whose effect on the optimal level of CSC was intended to be examined by this research and other contingency studies on optimal CSD. In other words, business-unit size may have been incapable of reflecting the characteristics of the business-units relating to the intended contingency factor. To illustrate and in the context of this research, many reasons have been stated that support the anticipated positive influence of business-unit size on the optimal level of CSC (see Section 5.4.1.5). These reasons are related to the different characteristics of business-units, such as the availability of financial and staff resources, the ability to benefit from the economics of scale advantage and the extent of product diversity. Instead of business-unit size, the organisational life cycle stage may be a better proxy for mirroring the business-units' characteristics related to the intended contingency factor (Kallunki and Silvola, 2008).

Drawing on the life cycle research, Kallunki and Silvola (2008) provided the characteristics of business-units in the growth, maturity and revival organisational life cycle stages that

[176] Although insignificant at the 5% level, Cagwin and Bouwman (2002) reported results similar to those of this research, in that a significant negative moderation effect of business-unit size on the relationship between ABC and improvement in financial performance was found at the 10% level.

impact on optimal CSD. These characteristics cover the reasons that were argued by this research and other studies to underlie the expected positive effect of business-unit size on the optimal level of CSC. In fact, in addition to the availability of resources, the extent of competition and product diversity, the degree of complexity of the administrative tasks and the level of formality and bureaucracy within the structure, these characteristics include business-unit size. Kallunki and Silvola (2008) argued that ABC is expected to be used more by business-units in the maturity and revival stages than those in the growth stage because the former business-units are larger in size and have more resources, higher competition and lower profitability, higher product diversity, more complex administrative tasks and more formal and bureaucratic structures. The study found support for the anticipated differences between the characteristics that influence optimal CSD of business-units in the maturity and revival stages and those in the growth stage. In addition, the study reported that, within each of the three organisational life cycle stages, business-units differed in terms of their size. Furthermore, the study found that, after controlling for business-unit size and other contingency factors, ABC is used significantly more by mature and revival business-units compared to growth ones.

Regarding the new finding that business-unit size has a non-monotonic negative moderation effect only, Kallunki and Silvola's (2008) results also provide a possible explanation why the implication of this effect is incongruent with the predications. Specifically, it is possible that a considerable number of large business-units are in the growth stage, whereas a large number of small and medium-sized business-units are in the maturity or revival stages, justifying the speculation that lower levels of CSC are optimal for the former, and the observation that higher levels of CSC are optimal for the latter. In support of the possibility that small business-units are in the maturity or revival stages and, thus, operate with higher levels of CSC, Kallunki and Silvola (2008), as noted above, observed differences in business-unit size within each of the three organisational life cycles stages, and found that organisational life cycle stage, after controlling for business-unit size and other contingency factors, has a significant impact on ABC usage. Related to this, Kallunki and Silvola (2008) also asserted that small business-units are likely to use ABC if they have a managerial need to do so because of their life cycle stage. In fact, prior studies found that ABC is widely used by small business-units (Jänkälä and Silvola, 2012; Rundora et al., 2013), and that ABC usage contributes to increasing the growth and profitability of small business-units (Jänkälä and Silvola, 2012).

Furthermore, there are two further possible explanations for the implication of the non-monotonic negative moderating effect of business-unit size failing to match expectations. The first is that some respondents may have provided the size of their company rather than their business-unit, which would result in misidentifying small business-units, with optimal CSD of lower levels of CSC, to be large. Alternatively, it is possible that some respondents provided information about the costing system of their company rather than their business-unit, which would lead to misidentifying small business-units, with optimal CSD of lower levels of CSC, as having optimal CSD of higher levels of CSC. The latter could occur when the business-units form part of companies that have integrated costing systems as a part of their ERP system.

The second possible explanation is similar to that provided for the weak negative matching effect of organisational culture and the negative matching influence of PC, which revealed the likelihood that the assumption made by this research that the optimality of the level of CSC in terms of balancing the costs of measurements and costs of errors can be indicated by the USEFULNESS and USAGE measures is erroneous (see Section 5.2). This means that it is possible to find, given the size of the business-unit, CSC levels that are less optimal in terms of the balance of the costs of measurements and costs of errors to be optimal regarding

USEFULNESS and USAGE. In other words, it is possible to find an unexpected matching or moderation effect of business-unit size on the optimal level of CSC with respect to USEFULNESS and USAGE. A possible explanation for this is that it might be that the business-units use the costing systems more to influence employees' behaviour to act in a certain way that achieves specific objectives rather than to obtain accurate individual product costs (Hiromoto, 1988; Merchant and Shields, 1993). Taking cost reduction as an example of an intended objective of the business-units, large business-units may use the costing system to reduce the labour costs, given that these business-units have a large number of employees. To this end, these business-units might use the less complex costing systems that rely mainly on the cost driver of direct labour hours. In fact, the dramatic increase in labour costs during the last decade in Saudi Arabia supports this.

The Saudi government, through the Ministry of Labour and Social Development, has been attempting to decrease the percentage of foreign workers by implementing the Saudization policy in the private sector. This policy imposes restrictions on the maximum percentage of foreign workers within the total workforce that can be employed within a business-unit, and high fees on the visas and residency and work permits for the foreign workforce. In addition, the Saudization policy provides support for business-units that employ Saudi nationals by paying part of the salary of some of the Saudi workforce and increasing the allowed percentage of foreign workers to the total workforce. Notwithstanding this support, the government-supported Saudi workforce remains expensive and may equal or exceed the increased costs of the foreign workforce. In short, the challenge facing Saudi business-units is the growing costs of the workforce. Given the above, it is plausible to expect that reducing the labour costs will be the main concern especially for large Saudi business-units, and that these business-units use the less complex costing systems that rely on the cost driver of direct labour hours to reduce the labour costs. In other words, it is probable that, to influence employees' behaviour to, ultimately, achieve certain objectives, large business-units find useful and utilise cost information in their decision-making that is generated by costing systems with lower levels of CSC.

Continuing with cost reduction as an example of a desired objective of business-units and given the restrictions imposed by the Saudization policy, labour costs might be less of an issue for small and medium-sized business-units, because they have a small number of employees. These business-units may focus on reducing other types of cost, such as maintenance and quality costs. To accomplish this, these business-units might use more complex costing systems to identify, accurately, the costs of the various activities involved in the maintenance and quality and find ways to reduce them by eliminating non-value-added activities. In other words, it is likely that, to influence employees' behaviour towards, ultimately, achieving certain objectives, small and medium-sized business-units consider useful and use cost information in their decision-making that is provided by costing systems with higher levels of CSC.

10.3.1.6 Hypothesis 6: TMS

Hypothesis 6 predicted that TMS has a positive effect on the optimal level of CSC from the standpoint of the matching sub-form of fit (see Section 5.4.1.6). Adopting this more realistic and appropriate sub-form of fit (see Section 10.2.1) and employing the developed two-stage procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit (see Section 10.2.2), the results showed that TMS does not positively influence the optimal level of CSC and, thus, did not support Hypothesis 6 (see Section 8.5). Contrary to anticipations, the implication of these results is that TMS is not positively relevant to the optimal level of CSC from the perspective of the matching sub-form of fit. This finding and the associated implication add to the extant literature that has not examined the impact of TMS on the optimal level of CSC from the viewpoint of the matching sub-form of fit, using a procedure encompassing the recommended joint usage of PRA and RSM that, among other things, is capable of accurately determining whether the impact is matching, weak matching or moderation in nature. Nevertheless, the findings pertaining to TMS should be interpreted with caution, given the possible influence of non-response bias, as a significant difference for TMS was found between early and late respondents (see Section 6.3.2.2).

The finding that TMS does not affect the optimal level of CSC and the associated implication contrast with those reported by contingency studies on optimal CSD that found a positive influence of TMS on optimal CSD (Krumwiede, 1998a; Brown et al., 2004; Maelah and Ibrahim, 2007) and those provided by most studies on ABC success that found a positive impact of TMS on ABC success (e.g., Shields, 1995; McGowan and Klammer, 1997; Anderson and Young, 1999; Baird et al., 2007; Byrne, 2011). The divergent results of this research compared with those of other contingency studies might be attributed to the issue of inconsistency related to one or more of the aspects mentioned in Section 10.3.1.1.

Despite the new finding that TMS does not have a positive matching effect on the optimal level of CSC, there are two possible explanations for the lack of support by the results of this research for the hypothesised positive matching influence of TMS on the optimal level of CSC, i.e., Hypothesis 6. First, it is possible that the measurement of TMS used in this research, i.e., TMS, cannot correctly measure this contingency factor (see Section 6.3.2.1.2.1). The TMS measurement, i.e., construct, might need to be extended to cover important actions of TMS, including actions related to providing key resources, enhancing organisational receptivity to any new change and ensuring that lower-level managers develop a common understanding of the vital objectives and principles related to the new change (Dong et al., 2009). These different TMS actions have been shown by Dong et al. (2009) to have different effects on the outcomes of ERP system implementation. Dong et al. (2009)

found that resources provision is important for project completion, enhancing organisational receptivity to any new change is crucial for users' satisfaction and skilfulness and ensuring that lower-level managers develop a common understanding of the vital objectives and principles of the new change is critical for achieving favourable organisational impacts.

Second, it is possible that the variation in the TMS construct was insufficient to allow statistical support for its positive influence on the optimal level of CSC to be found. This is reflected in the adjacent 25th, 50th, 75th and 90th percentile values of the construct, which are, on a five-point scale, 3.67, 4, 4.67 and 5, respectively, with 71.5% of the business-units having the median TMS value of 4 and above. In addition, the mean value (4.10) of TMS is high (see Section 7.4.2.1). Jointly, these statistics indicate that most Saudi business-units, regardless of their optimal levels of CSC, receive higher levels of TMS for the costing system, which might be attributed to the higher levels of knowledge and awareness among Saudi business-units' top management regarding the importance of cost information in decision-making (TMKA mean = 4.12, see Section 7.4.2.1). This is also confirmed by the results of the first step of residual analysis, which showed that TMKA has a significant positive impact on TMS (see Section 9.4.1).

10.3.1.7 Hypothesis 7: TMKA

In Section 6.3.1.3.1.2, it was hypothesised that TMKA has a positive influence on the optimal level of CSC from the perspective of the matching sub-form of fit, i.e., Hypothesis 7. Using this more realistic and appropriate sub-form of fit (see Section 10.2.1) and employing the developed two-stage procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit (see Section 10.2.2), the results showed that TMKA does not positively impact the optimal level of CSC and, hence, did not support Hypothesis 7 (see Section 8.5). Contrary to expectations, the implication of these results is that TMKA is not positively relevant to the optimal level of CSC from the viewpoint of the matching sub-form of fit. However, the application of the developed two-stage procedure revealed that TMKA affects the optimal level of CSC from the standpoint of the weak form of the matching sub-form of fit (see Sections 8.4.2.3.4 and 8.5). In addition, it revealed that TMKA influences the optimal level of CSC from the perspective of the moderation sub-form of fit even though it was argued that the matching sub-form of fit better represents the relationship between the contingency factors and optimal CSD than the moderation one (see Sections 8.4.1.3, 8.5 and 10.2.1).

The results pertaining to the weak form of the matching sub-form of fit conveyed that TMKA has a positive impact on the optimal level of CSC. The results related to the moderation sub-form of fit showed that the moderating effect of TMKA is non-monotonic and negative, revealing a relationship between CSC and the outcome that is positive and significant at very low and low values, positive and insignificant at moderate values and negative and insignificant at high and very high values of TMKA. As discussed in Section 8.4.2.3.4, the results of these sub-forms of fit, to a great extent, disagree with each other regarding many aspects, including the levels at which the outcome is maximised along all values of TMKA and the effect of both over- and under-fit on the outcome. This disagreement is due not only to the distinct assumptions held by the matching and moderation sub-forms of fit (see Sections 3.3.2.1, 3.3.2.2, 4.4.2 and 10.2.1), but also the dissimilar messages related to the influence of TMKA on the optimal level of CSC that each sub-form of fit attempts to reveal.

The results pertaining to the weak form of the matching sub-form of fit suggest that, to have optimal levels of CSC, business-units with lower/moderate/higher levels of TMKA should have lower/moderate/higher levels of CSC. The results relating to the moderation sub-form of fit imply that, to have optimal levels of CSC, business-units with lower levels of TMKA should have higher levels of CSC, whereas those with moderate and higher levels of TMKA are unaffected by this and so may benefit from having lower levels of CSC. Acknowledging the differences between the results and the associated implications of the two sub-forms of fit, the results and the implication relating to the moderation sub-form of fit are considered more reliable and, therefore, assumed to be the ones for TMKA. This is because the results relating to the weak form of the matching sub-form of fit showed that the first principal axis only runs in an area of the surface where TMKA is at higher values, and so it is impossible to determine from the surface whether the first principal axis follows the same behaviour of running from low values of both TMKA and CSC to high values of both constructs across the complete range of TMKA values (see Section 8.4.2.3.4).

The finding that TMKA does not have a positive matching effect on the optimal level of CSC but, instead, a non-monotonic negative moderation one and the associated implications add to the extant literature. This is because the present literature has not examined the impact of TMKA on the optimal level of CSC from the viewpoint of the matching sub-form of fit, using a procedure involving the recommended combined usage of PRA and RSM that, among other things, is capable of precisely revealing whether the impact is matching, weak matching or moderation in nature.

Although the matching sub-form of fit was not supported, the implication of the non-monotonic negative moderation effect of TMKA that, to have optimal levels of CSC, business-units with lower levels of TMKA should have higher levels of CSC, whereas business-units with moderate and higher levels are unaffected by this and so may benefit from having lower levels of CSC is inconsistent with the expectations regarding the relevance of TMKA to the optimal level of CSC (see Section 6.3.1.3.1.2). Nevertheless, this implication, to some extent, accords with those relating to organisational culture (see Section 10.3.1.3), PC (see Section 10.3.1.4) and business-unit size (see Section 10.3.1.5). More importantly, the results concerning TMKA should be interpreted with caution, given the possible influence of non-response bias as a significant difference for TMKA was observed between early and late respondents (see Section 6.3.2.2).

The implication of the non-monotonic negative moderation effect of TMKA is inconsistent with the results of other contingency studies on optimal CSD that found either a positive (Al-Khadash and Mahmoud, 2010) or no influence (Al-Khadash and Feridun, 2006) of TMKA on optimal CSD. The divergent results of this research from other studies may be caused by the issue of inconsistency with respect to one or more of the aspects stated in Section 10.3.1.1.

Despite the new finding that TMKA does not have a positive matching effect on the optimal level of CSC but, instead, a non-monotonic negative moderation one, there are three possible explanations for the lack of support by the results of this research for the hypothesised positive matching influence of TMKA on the optimal level of CSC, i.e., Hypothesis 7. First, it is possible that the measurement of TMKA used in this research, i.e., TMKA, cannot measure this contingency factor precisely. As mentioned in Section 6.3.2.1.2.1, the TMKA construct, i.e., measurement, was developed by the researcher, given the lack of examination of the influence of TMKA in the prior literature. The developed TMKA measurement may need further refinement through, for example, adding additional questions about whether top management staff hold management and cost accounting-related qualifications and/or have attended management and cost accounting-related continuous professional education programs. It is more likely that staff members who hold such qualifications and/or attend such programs are more knowledgeable and aware of the importance of cost information in decision-making compared to those who do not.

Second, it may be that the variation in the TMKA construct was insufficient to permit the finding of statistical support for its positive impact on the optimal level of CSC. This is mirrored in the close 25th, 50th, 75th and 90th percentile values of the construct, which are, on a five-point scale, 3.67, 4, 4.92 and 5, respectively, with 71.5% of the business-units having the median TMKA value of 4 and above. In addition, the mean value (4.12) of TMKA is high. Together, these statistics indicate that the top management of most Saudi business-units, regardless of their optimal levels of CSC, have higher levels of knowledge and awareness the importance of cost information in decision-making. The higher levels of TMKA may be caused by the increased awareness among Saudi business-units of the importance of assigning overhead costs to products to generate relevant cost information for decision-making, resulting from, for example, hiring more knowledgeable recent graduates who have been educated overseas in countries, such as the UK or USA, where the topic of overhead costs assignment is well-described in the main management and cost accounting textbooks (in the UK, Drury, 2015; and in USA, Horngren et al., 2012).

Third, it is possible that TMKA does not have a direct effect on the optimal level of CSC. The exploratory interview findings (see Section 6.3.1.2.1) and prior literature (see Section 6.3.1.3.1.2) suggest that TMS mediates the influence of TMKA on the optimal level of CSC. The indirect impact of TMKA on the optimal level of CSC through TMS was examined from the perspective of the selection form of fit when performing the first step of residual analysis, and, contrary to expectations, was insignificant (see Section 9.4.1).[177] Nonetheless, as noted in Section 6.3.1.3.1.2, this indirect effect cannot be tested from the viewpoint of the matching sub-form of fit.

With respect to the new finding that TMKA has only a non-monotonic negative moderation influence, a possible explanation why the implication of this influence is inconsistent with expectations is similar to that provided for the weak negative matching impact of

[177] Examining the indirect effect of a contingency factor, e.g., TMKA, on a dependent variable representing CSD or MCS through a mediator variable representing another contingency factor, e.g., TMS, belongs to the selection form of fit rather than the mediation sub-form of fit (Burkert et al., 2014). This is because the latter requires the mediator variable to be CSD or MCS, and the dependent variable to be an outcome variable expressing the optimality of CSD or MCS.

organisational culture, the negative matching effect of PC and the non-monotonic negative moderation influence of business-unit size, which indicated the possibility that the assumption made by this research that the optimality of the level of CSC in terms of balancing the costs of measurements and costs of errors can be indicated by the USEFULNESS and USAGE measures is inappropriate (see Section 5.2). This suggests that it is possible to find, given the level of TMKA, CSC levels that are less optimal in terms of the balance of the costs of measurements and costs of errors to be optimal regarding USEFULNESS and USAGE. In other words, it is possible to find an unexpected matching or moderation impact of TMKA on the optimal level of CSC with respect to USEFULNESS and USAGE. A possible explanation for this is that, instead of TMKA, the level of knowledge and awareness of the cost accountant/s might be the influential contingency factor. To illustrate, it is possible that the top management of most Saudi business-units delegate the authority for designing the costing system to the cost accountant/s. This might be due to many reasons, such as the large amount of management and supervision-related responsibility that needs to be performed by the top management. In this case, the cost information supplied by costing systems with lower/higher levels of CSC is likely to be perceived as useful and used in decision-making by business-units with lower/higher levels of knowledge and awareness among the cost accountant/s, regardless of the level of TMKA. Given the above, it is plausible to speculate that cost information generated by costing systems with lower levels of CSC is considered useful and exploited in decision-making by business-units with moderate and higher levels of TMKA, and observe that cost information furnished by costing systems with higher levels of CSC is deemed useful and utilised in decision-making by business-units with lower levels of TMKA.

10.3.2 Discussion of the results of testing the hypothesis regarding the system form of fit (Hypothesis 8)

Hypothesis 8 anticipated that the different contingency factors included in the research model impact the optimal level of CSC from the viewpoint of the system form of fit, meaning that the seven contingency factors have a joint effect on the optimal level of CSC (see Sections 5.4.2 and 6.3.1.3.1.3). More precisely, this anticipation was operationalised through anticipating that the degree of misfit between the seven contingency factors, taken together, and the optimal level of CSC has a significant negative influence on the two outcomes - i.e., USEFULNESS and USAGE - representing the optimality of the level of CSC (see Section 3.3.3). Utilising this more realistic, appropriate and thorough form of fit (see Section 10.2.1), the results of residual analysis showed that the contingency factors do not have a joint impact on the optimal level of CSC and, therefore, did not support Hypothesis 8 (see Section 9.4). In particular, the results of the second step of residual analysis showed that none of the regression models was significant, i.e., low and insignificant adjusted R^2 values (see Section 9.4.2), indicating that the misfit between the seven contingency factors, taken together, and the optimal level of CSC does not affect the outcomes. In addition, the results of the first step of residual analysis indicated that this misfit does not represent an actual deviation from the expected positive association between the seven contingency factors, taken together, and the optimal level of CSC, as this association seemed to be negative rather than positive (see Sections 9.4.2 and 9.4.1). Accordingly, the results showed that the contingency factors do not influence the optimal level of CSC from the standpoint of the system form of fit. Contrary to expectations, the implication of the results reported above is that the joint impact of the seven contingency factors is unconnected to the optimal level of CSC (see Sections 5.4.2 and 6.3.1.3.1.3). This finding and the associated implication add to the extant literature that failed to examine the effect of any combination of contingency factors on the optimal level of CSC from the perspective of the system form of fit.

Compared with other contingency studies on optimal MCS, the finding that the seven contingency factors do not have a joint influence on the optimal level of CSC is comparable to those reported by several studies that failed to find a joint impact of contingency factors on optimal MCS (e.g., Selto et al., 1995), but conflicts with those reported by other studies that found a joint effect of contingency factors on optimal MCS (e.g., Nicolaou, 2000; 2002; Said et al., 2003; King et al., 2010).

Notwithstanding the new finding that the examined contingency factors do not have a joint effect on the optimal level of CSC, there are three possible explanations for the lack of support for the hypothesised combined influence of the examined contingency factors on the optimal level of CSC, i.e., Hypothesis 8. First, although residual analysis was the best statistical analysis technique available to test the system form of fit's hypothesis (see Section 9.2), it suffers from many problems that might have obscured the observation of the joint impact of the seven contingency factors on the optimal level of CSC (see Sections 9.2 and 8.2.1). Even though efforts have been made to perform residual analysis appropriately (see Section 9.2), it is impossible to identify the extent to which, if any, these efforts mitigated the issues associated with the use of this technique.

Second, although this research attempted to include the contingency factors that were found to be strongly related to the optimal level of CSC by the literature and relevant to the Saudi context, it is possible that the list of the seven contingency factors included in the research model was insufficiently comprehensive to explain a large amount of variance in the dependent variable, i.e., the optimal level of CSC, and so more influential contingency factors may have been omitted. Examples of these contingency factors include organisational life cycle (Kallunki and Silvola, 2008), business-unit strategy (Gosselin, 1997; Krumwiede and Charles, 2014), business-unit structure (Gosselin, 1997; Elhamma and Moalla, 2015), national culture (Brewer, 1998), the extent of ERP system usage (Maiga et al., 2014), the extent of JIT usage (Hoque, 2000; Al-Omiri and Drury, 2007), business-unit legal form (Pokorná, 2015) and the purposes of using the costing system (Schoute, 2009).

Third, given that the system form of fit involves simultaneous testing for the effect of the misfit between many contingency factors and the optimal level of CSC on the outcome, it is probable that the failure to find significant individual effects of the misfit between each of the seven contingency factors and the optimal level of CSC on the outcome, i.e., the effects of the contingency factors on the optimal level of CSC from the viewpoint of the matching sub-form of fit, prevented the observation of support for the influence of the misfit between all seven contingency factors and the optimal level of CSC on the outcome, i.e., the impact of the contingency factors on the optimal level of CSC from the standpoint of the system form of fit. Although the results revealed that most contingency factors affect the optimal level of CSC from the perspectives of the moderation and/or weak form of the matching sub-forms of fit, the results showed that, while negative, only PC influences the optimal level of CSC from the viewpoint of the matching sub-form of fit.

10.4 Conclusion

The objective of this chapter was to discuss the results of testing the hypotheses concerning the influence of the contingency factors on the optimal level of CSC, i.e., optimal CSD, from the perspectives of the matching sub-form of fit and the system form of fit. These results represent the third main contribution of this research. Therefore, this chapter assisted in realising the third main contribution of this research, which is the outcome of the first and/or second main contributions, and, accordingly, acquiring the research aim (see Section 1.5).

This chapter revisited the first and second main contributions. In addition, it discussed the results of testing the hypotheses, which represent the third main contribution of this research. The results of testing the hypotheses revealed interesting implications regarding the impacts of the seven contingency factors on the optimal level of CSC. From the viewpoint of the matching sub-form of fit, there are four implications. First, contrary to expectations, the seven contingency factors are not positively relevant to the optimal level of CSC from the standpoint of the matching sub-form of fit. Second, conforming to anticipations and based on a weak matching effect, business-units with lower/moderate/higher proportions of indirect costs should have lower/moderate/higher levels of CSC in order for their CSC levels, i.e., CSD, to be optimal. Third, contrary to expectations and based on weak matching influences for organisational culture and a matching impact for PC, business-units with an organisational culture that is characterised as less/moderately/more outcome-oriented, detail-oriented or control-focused and business-units with lower/moderate/higher levels of PC ought to have higher/moderate/lower levels of CSC in order for their CSC levels to be optimal. Fourth, contrary to anticipations and based on moderation effects, small and medium-sized business-units and those with lower levels of TMKA should have higher levels of CSC in order for their CSC levels to be optimal, whereas large business-units and those with moderate and higher levels of TMKA are unaffected by this and so may benefit from having lower levels of CSC. From the perspective of the system form of fit, the joint influence of the seven contingency factors, contrary to expectations, is unrelated to the optimal level of CSC. Having discussed the results of testing the hypotheses, the next chapter will conclude this thesis.

Chapter eleven: Conclusion

11.1 Introduction

This chapter concludes this thesis, which sought to contribute towards furnishing an appropriate understanding of the influences on optimal CSD by addressing the main limitation of contingency research on optimal CSD. This chapter is organised as follows. Section 11.2 provides an outline of this research and Section 11.3 furnishes a summary of the research findings. Section 11.4 points out the research contributions. Section 11.5 provides the implications of this research for theory and practice, together with the research limitations, each of which includes suggestion/s for future research. Section 11.6 concludes this chapter.

11.2 Outline of the research

Given that less optimal CSDs are linked with problems that might ultimately adversely impact on the overall performance of companies (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Ittner et al., 2002; Pizzini, 2006; Stuart, 2013; Drury, 2015), a proper understanding of the influences on optimal CSD is vital. Optimal CSD minimises the sum of the costs relating to the measurements demanded by the costing system - i.e., the costs of measurements - and the costs incurred as a result of making poor decisions based on inaccurate product costs, i.e., the costs of errors (Cooper, 1990a; Kaplan and Cooper, 1998; Stuart, 2013; Drury, 2015). The problems associated with less optimal CSDs are concerned with both forms indicating the lack of CSD optimality; namely, less complex and more complex than required costing systems (Cooper, 1988b; 1989c; Cooper and Kaplan, 1991; Stuart, 2013; Drury, 2015). Although the former are less costly in terms of measurement, they generate distorted product costs that can lead to making inaccurate product-related decisions, i.e., they are more costly regarding errors. Despite providing more accurate product costs that can assist in making enlightened product-related decisions, i.e., they are less costly with respect to errors, the latter, more complex than required costing systems, are more costly in terms of measurement.

The optimal CSD literature argues that the optimality of CSD is affected by different factors, meaning that it does not hinge solely on the CSD itself, e.g., ABC versus TCS or more complex versus less complex, but on the extent to which the CSD conforms to the internal and external circumstances, i.e., contingency factors, facing an organisation (Kaplan and Cooper, 1998; Cagwin and Bouwman, 2002; Ittner et al., 2002; Pizzini, 2006; Maiga et al., 2014; Drury, 2015). Given this, the optimal CSD literature has aligned the idea of optimal CSD is influenced by various factors to contingency theory (e.g., Drazin and Van de Ven, 1985; Donaldson, 2001). Contingency theory asserts that there is no universal optimal CSD that is equally appropriate for all organisations, but that optimal CSD is affected by different contingency factors, such as the organisation's technology, environment and size (see Chapter three) (Otley, 1980; 2016; Fisher, 1995; 1998; Donaldson, 2001; Haldma and Lääts, 2002; Chenhall, 2003; 2007; Hartmann, 2005; Burkert et al., 2014).

The idea that optimal CSD is impacted by different factors has inspired a large number of researchers to explore the effect of an extensive range of contingency factors on optimal CSD, operationalised from the perspective of either ABC adoption or the level of CSC (see Chapter four). Nevertheless, the issue with this research strand, including contingency research on both ABC adoption and CSC, is that it has failed to generate an appropriate understanding of the influences on optimal CSD. This is, possibly, because of the main limitation of this research strand, which is the lack of an appropriate application of contingency theory with respect to the adopted forms of fit (see Section 4.4.2). More specifically, contingency research on optimal CSD has failed to apply the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory. Related to this limitation, contingency theory researchers have not furnished an elaborate outline of the joint application of the superior statistical analysis techniques of PRA and RSM to test for the matching sub-form of fit.

Given: (1) the main limitation of contingency research on optimal CSD that might have contributed to the research issue; and (2) the importance of operating with optimal CSD, this research aimed to investigate the influence of different contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. To accomplish this aim, this research developed, based on contingency theory, the CSD literature and the findings of the exploratory stage of the empirical work of this research, and empirically tested a research model symbolising a set of hypotheses concerning the effect of different contingency factors on optimal CSD, where: (1) the matching sub-form of fit, which is more realistic and appropriate, and the system form of fit, which is more realistic, appropriate and thorough, are adopted; and (2) a procedure encompassing the recommended joint usage of PRA and RSM is developed and employed to test for the matching sub-form of fit (see Chapter five and Section 6.3.1.3). In addition to the main limitation, this research and, therefore, the research model considered the four minor limitations of contingency research on optimal CSD. This is because these four minor limitations are linked to the two components investigated in this research; namely, the contingency factors and optimal CSD. Accordingly, it is crucial to address these in order to account successfully for the main limitation of contingency research on optimal CSD and, thus, achieve the research aim. The four minor limitations include: (1) the utilisation of the less appropriate perspective of ABC adoption to operationalise CSD by the contingency research on ABC adoption sub-strand of contingency research on optimal CSD; (2) the failure to examine the impact of organisational factors relating to the organisation's management and employees on optimal CSD; and (3) the lack of usage of a comprehensive multi-dimensional CSC measure that captures all of the CSC dimensions identified in the literature by the contingency research on CSC sub-strand of contingency research on optimal CSD; and (4) the failure to employ a sufficiently comprehensive multi-dimensional PC measure that accounts for multiple dimensions of the PC dimensions discussed in the literature by both sub-strands of contingency research on optimal CSD (see Section 4.4.3). The four minor limitations were considered through: (1) operationalising CSD in terms of the level of CSC; (2) examining the effect of organisational factors pertaining to the organisation's management and employees, such as TMS and organisational culture; (3) developing and confirming a comprehensive multi-dimensional CSC measure that captures all of the CSC dimensions identified in the literature and using this measure along with other CSC measures employed by prior literature to measure CSC; and (4) developing a sufficiently comprehensive multi-dimensional PC measure that covers the most indicative PC dimensions discussed in the literature and using this to measure PC.

To test the research model - i.e., research hypotheses - and, hence, furnish generalisable findings, the survey strategy was adopted (see Chapter six). The data were gathered from business-units operating in the Saudi manufacturing industry, excluding the oil and natural gas production and extraction sector (see Sections 6.2 and 6.3.2.1.4.1). The application of the selected survey strategy involved two stages; namely, the exploratory stage and the model-testing stage (see Section 6.3).

The exploratory stage comprised the collection and analysis of qualitative data to obtain information that assisted in: (1) ensuring that the research model incorporated relevant contingency factors that influence the optimal level of CSC - i.e., optimal CSD - and appropriate outcome measures representing the optimality of the level of CSC; and (2) measuring many constructs included in the research model. To collect the qualitative data, 20 semi-structured interviews were conducted with costing and production staff in eight Saudi manufacturing business-units. The interview guide utilised for these interviews was prepared following the recommendations of many researchers (e.g., Lillis, 1999; King and Horrocks, 2010). The qualitative data were analysed using template analysis (e.g., King, 1998; 2004; King et al., 2002; King and Brooks, 2017), and the results of the exploratory stage, among other things: (1) asserted the relevance of the contingency factors included in the research model and uncovered one additional contingency factor, namely, TMKA, to be indirectly associated with CSC and, hence, the optimal level of CSC via TMS; and (2) confirmed the appropriateness of the selected outcome measures - i.e., USEFULNESS and USAGE - for representing the optimality of the level of CSC; (3) confirmed that the developed fourth measure of CSC, i.e., CSC-DEVELOPED, covers the construct's dimensions; and (4) showed that the PC construct should be measured by six dimensions.

The model-testing stage encompassed the acquisition and analysis of quantitative data from a large number of cases to test the research model. To obtain the quantitative data, a mixed-mode questionnaire was utilised (de Leeuw, 2005; Dillman et al., 2014), which was designed, constructed, pre-tested and administered according to "The Tailored Design Method" (Dillman et al., 2014). The questionnaire was administered to 368 Saudi business-units, and 233/204 total/usable responses were received, representing response rates of 63.3% and 55.4%, respectively.

The analysis of the quantitative data started by performing the preliminary analysis, which contained three aspects; namely, examining and preparing the data regarding issues related to missing data, inconsistent questionnaire answers, outliers and normality, assessing the quality of the reflective and formative latent constructs included in the research model and performing the descriptive analysis (see Chapter seven). CFA with PLS-SEM as the estimation method was exploited to evaluate the quality of the reflective constructs.

Following that, the analysis of the quantitative data proceeded to test the research hypotheses, i.e., research model. First, a procedure encompassing the recommended combined usage of PRA and RSM was developed and employed to test the hypotheses related to the effect of the various contingency factors on the optimal level of CSC from the viewpoint of the matching sub-form of fit, i.e., the matching sub-form of fit's hypotheses (see Chapter eight). Then, residual analysis was adopted to test the hypothesis concerning the influence of the various contingency factors on the optimal level of CSC from the standpoint of the system form of fit, i.e., the system form of fit's hypothesis (see Chapter nine). Having provided an outline of this research, the next section will furnish a summary of the research findings.

11.3 Summary of the research findings

The research model represents eight hypotheses. Of these, seven relate to the impact of the seven contingency factors on the optimal level of CSC from the viewpoint of the matching sub-form of fit and one concerns the effect of the seven contingency factors on the optimal level of CSC from the standpoint of the system form of fit. The matching sub-form of fit's hypotheses, i.e., Hypotheses 1-7, anticipated that each of the seven contingency factors has a positive influence on the optimal level of CSC from the perspective of the matching sub-form of fit. Contrary to expectations, the findings of the developed procedure involving the recommended joint usage of PRA and RSM to test for matching sub-form of fit hypotheses revealed that none of the seven hypotheses is supported and, therefore, the seven contingency factors are not positively relevant to the optimal level of CSC from the viewpoint of the matching sub-form of fit. Nevertheless, the findings conveyed that, apart from competition and TMS, i.e., Hypothesis 1 and 6, respectively, the contingency factors have other impacts on the optimal level of CSC.[178]

[178] Several contingency factors, namely, cost structure, PC, business-unit size and TMKA, were found to affect the optimal level of CSC from the perspective of more than one form/sub-form of fit. The effects provided in

First, the results indicated that cost structure, i.e., Hypothesis 2, has a positive impact on the optimal level of CSC from the standpoint of the weak form of the matching sub-form of fit. In line with anticipations, the implication of these results is that, to have optimal levels of CSC, business-units with lower/moderate/higher proportions of indirect costs should have lower/moderate/higher levels of CSC.

Second, the results showed that organisational culture, including its three dimensions of outcome orientation, attention to detail and tight versus loose control, i.e., Hypothesis 3a-3c, has a negative effect on the optimal level of CSC from the perspective of the weak form of the matching sub-form of fit, while PC, i.e., Hypothesis 4, has a negative one from the viewpoint of the matching sub-form of fit. Contrary to expectations, the implication of these results is that, to have optimal levels of CSC, business-units with an organisational culture that is characterised as less/moderately/more outcome-oriented, detail-oriented or control-focused and business-units with lower/moderate/higher levels of PC ought to have higher/moderate/lower levels of CSC.

Third, the results revealed that business-unit size and TMKA, i.e., Hypothesis 5 and 7, respectively, influence the optimal level of CSC from the standpoint of the moderation sub-form of fit. Both moderation effects were non-monotonic and negative. Contrary to anticipations, the implication of these results is that, to have optimal levels of CSC, small and medium-sized business-units and those with lower levels of TMKA should have higher levels of CSC, whereas large business-units and those with moderate and higher levels of TMKA are unaffected by this and so may benefit from having lower levels of CSC.

The system form of hypothesis, i.e., Hypothesis 8, predicted that the seven contingency factors have a joint impact on the optimal level of CSC. The results of the second step of

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this section are those that were argued in Section 10.3.1 to be more reliable and, accordingly, deemed to be the ones for these contingency factors.

residual analysis revealed that all regression models lack significance, while those of the first step implied that the misfit between the seven contingency factors, taken together, and the optimal level of CSC does not represent an actual deviation from the expected positive association between the seven contingency factors, taken together, and the optimal level of CSC. These results suggest that the system form of fit's hypothesis is not supported. Contrary to expectations, the implication of these results is that the joint effect of the seven contingency factors is not relevant to the optimal level of CSC. Having provided a summary of the research findings, the next section will discuss the research contributions.

11.4 Research contributions

This research makes several contributions to knowledge. The discussion of these contributions is divided into the main contributions related to the main limitation of contingency research on optimal CSD (Section 11.4.1) and minor contributions (Section 11.4.2).

11.4.1 Main contributions related to the main limitation of contingency research on optimal CSD

This research makes three main contributions to knowledge by addressing the main limitation of contingency research on optimal CSD concerning the lack of an appropriate application of contingency theory regarding the adopted forms of fit, which may have prevented this research strand from providing a proper understanding of the influences on optimal CSD. The first main contribution is from the theoretical perspective, and concerns the application of contingency theory with respect to the adopted forms of fit. This research contributes to the contingency-optimal CSD literature by utilising the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit when examining the influence of seven contingency factors on the optimal level of CSC. As discussed in Section 4.4.2, most of the contingency studies on optimal CSD used the selection form of fit, which assumes that surviving companies do not differ with regard to the optimality of CSD, i.e., equilibrium assumption (Chenhall and Chapman, 2006; Meilich, 2006; Burkert et al., 2014). Thus, the selection form of fit accounts for the optimality of CSD by using the unrealistic outcome measure of company survival rather than real outcome measures (Chenhall, 2003; Meilich, 2006; Sousa and Voss, 2008). However, as argued by many researchers, it is possible to have differences in the optimality of CSD due to differences in selection fit (Donaldson, 2001; 2006; Ittner and Larcker, 2001; Luft and Shields, 2003; Hartmann, 2005; Meilich, 2006; Burkert et al., 2014). This is supported by the findings of several studies that have reported differences in the optimality of MCS, including CSD, between the surviving companies (e.g., Frey and Gordon, 1999; Cagwin and Bouwman, 2002; Ittner et al., 2002; Said et al., 2003; Gerdin, 2005b; King et al., 2010; Gani and Jermias, 2012; Chen and Jermias, 2014; Krumwiede and Charles, 2014; Maiga et al., 2014).

Although other contingency studies on optimal CSD utilised the realistic interaction form of fit that does not make the equilibrium assumption and, hence, expects that surviving companies have differences in the optimality of CSD, most studies have used the moderation sub-form of fit rather than the matching one of the interaction form of fit. Contingency theory (e.g., Donaldson, 2001; 2006; Chenhall and Chapman, 2006; Meilich, 2006) advocates the matching sub-form of fit over the moderation one because of the former’s assumed curvilinear relationship between CSD and the outcome, which is considered more logical and, therefore, realistic and appropriate than the linear one postulated by the latter sub-form of fit. Likewise, the CSD literature supports the matching sub-form of fit over the moderation one since the former accurately characterises the relationships between the contingency factors and optimal CSD (e.g., Cooper, 1988b; Cooper and Kaplan, 1991; Innes and Mitchell, 1998; Pizzini, 2006; Drury, 2015). The literature review identified only two studies that used the matching sub-form of fit (Abernethy et al., 2001; Ittner et al., 2002). Nevertheless, both suffer from many shortcomings, such as testing the influence of only a limited number of contingency factors on optimal CSD.

In addition, to the author's knowledge, no contingency study on optimal CSD has adopted the system form of fit. Even though the system form of fit shares the interaction one's rejection of the equilibrium assumption (Drazin and Van de Ven, 1985; Chenhall, 2003; 2007) and the matching sub-form of fit's assumption about the curvilinearity of the relationship between CSD and the outcome, it uniquely differs from the other forms of fit, including both the selection and interaction ones, by dealing with the joint impact of all of the contingency factors on optimal CSD rather than the individual effect of each one (Chenhall and Chapman, 2006; Meilich, 2006; Burkert et al., 2014).

The second main contribution of this research is from the methodological perspective, and is related to the statistical analysis techniques exploited to test for the matching sub-form of fit. In Section 8.2.1, it was mentioned that, although contingency theory researchers have promoted the combined usage of PRA and RSM rather than the problematic difference-score models to test the matching sub-form of fit's hypotheses (Donaldson, 2006; Burkert et al., 2014), they have not illustrated this in detail. Hence, this research contributes to the general contingency theory literature, including the contingency-optimal MCS and contingency-optimal CSD literature, by developing, based on the PRA/RSM and contingency theory literature, and employing a procedure involving the recommended combined usage of PRA and RSM to test for the matching sub-form of fit's hypotheses; namely, the two-stage procedure encompassing the recommended joint usage of PRA and RSM.

The third main contribution of this research is from the theoretical perspective, and is the outcome of the first and/or second main contributions. The third main contribution concerns the results of testing the hypotheses related to the impact of the various contingency factors on the optimal level of CSC, i.e., optimal CSD, from the viewpoints of the matching sub-form of fit and the system form of fit. The results of testing the hypotheses are new and add to the extant literature. Therefore, this research contributes to the contingency-optimal CSD literature by providing these results. The results of testing the hypotheses and their associated implications were summarised earlier in Section 11.3.

11.4.2 Minor contributions

This research makes ten minor contributions to knowledge. Four of these are discussed in Section 11.4.2.1, and are concerned with the ways in which this research considered the four minor limitations of contingency research on optimal CSD. As provided in Sections 4.4.1, 4.4.3, 5.3 and 11.2, a consideration of these four minor limitations of contingency research on optimal CSD is required because they pertain to the two components investigated in this research - i.e., the contingency factors and optimal CSD - and, accordingly, necessary to be accounted for in order to address successfully the main limitation of contingency research on optimal CSD and, thus, achieve the research aim. The remaining six minor contributions are discussed in Section 11.4.2.2, and are related to the enhancement of the quality of contingency research.

11.4.2.1 Minor contributions related to the four minor limitations of contingency research on optimal CSD

This research makes four theoretical minor contributions to the contingency-optimal CSD literature by accounting for the four minor limitations of contingency research on optimal CSD. First, it was illustrated that the contingency research on ABC adoption sub-strand of contingency research on optimal CSD suffered from the limitation of using the less appropriate perspective of ABC adoption to operationalise CSD (see Section 4.4.3.1). Operationalising CSD in terms of ABC adoption ignores the fact that both ABC and TCS can vary in their level of complexity and, thus, does not capture the variations in CSD that exist in practice (Drury and Tayles, 2000; 2005), raising concerns about the validity of the findings. In addition, it disregards the difficulty of correctly distinguishing ABC adopters from non-adopters in questionnaire studies caused by the various views and opinions held by practitioners regarding the meaning of ABC, which can lead to the erroneous identification of ABC adopters and non-adopters (e.g., Malmi, 1996; Dugdale and Jones, 1997; Drury and Tayles, 2005) and so, ultimately, invalid findings. Hence, although not the first research that operationalise CSD in terms of the level of CSC, this research contributes to the contingency-optimal CSD literature by adding to the few contingency studies on optimal CSD that operationalised CSD with respect of the level of CSC.

Second, it was noted that the contingency research on CSC sub-strand of contingency research on optimal CSD suffered from the limitation related to the failure to examine the influence of organisational factors related to the organisation’s management and employees on optimal CSD (see Section 4.4.3.2.1). Prior research has stressed the importance of various organisational factors pertaining to the organisation’s management and employees, such as TMS, in relation to enabling the adoption and success of innovative management accounting techniques, such as ABC, a complex costing system (e.g., Shields and Young, 1989; Innes and Mitchell, 1990a; Argyris and Kaplan, 1994; Shields, 1995; Krumwiede, 1998b; Baird et al., 2004). Therefore, this research contributes to the contingency-optimal CSD literature by examining the impact of three organisational contingency factors concerning the organisation’s management and employees on the optimal level of CSC. These organisational factors are organisational culture and TMS, adopted from prior literature, and TMKA, identified from the exploratory stage of the empirical work of this research.

Third, it was discussed that the contingency research on CSC sub-strand of contingency research on optimal CSD suffered from the limitation concerning the lack of using a comprehensive multi-dimensional CSC measure that captures all of the CSC dimensions identified in the literature (see Section 4.4.3.2.2). Compared to single- or incomprehensive multi-dimensional CSC measures, utilising a comprehensive multi-dimensional CSC measure is more likely to increase the likelihood of uncovering the true effect of the contingency factors on the optimal level of CSC. Accordingly, this research contributes to the contingency-optimal CSD literature by developing, through performing an extensive literature review, a comprehensive multi-dimensional CSC measure that covers all of the identified CSC dimensions, confirming this measure by conducting exploratory interviews with costing and production staff in eight Saudi manufacturing business-units and using this, along with other measures, to measure CSC.

Fourth, it was explained that contingency research on optimal CSD, including its two sub-strands, suffered from the limitation related to the failure to use a sufficiently comprehensive multi-dimensional PC measure that includes multiple dimensions of the PC dimensions discussed in the literature (see Section 4.4.3.3). PC has been one of the most important and well-researched contingency factors that promotes the modification of optimal CSD (e.g., Kaplan, 1983; 1984b; 1984a; 1986a; Johnson and Kaplan, 1987; Cooper, 1988a; 1988b; Cooper and Kaplan, 1991; Jones, 1991; Estrin et al., 1994; Malmi, 1999). Compared to single- or incomprehensive multi-dimensional PC measures, a sufficiently comprehensive multi-dimensional PC measure is more likely to increase the probability of detecting the true influence of PC on the optimal level of CSC. Given this, this research contributes to the contingency-optimal CSD literature by developing, through performing an extensive literature review and conducting exploratory interviews with costing and production staff in eight Saudi manufacturing business-units, a sufficiently comprehensive multi-dimensional PC measure that encompasses the most expressive PC dimensions and using this to measure PC.

11.4.2.2 Minor contributions concerning the enhancement of the quality of contingency research

In addition to the four theoretical minor contributions pertaining to the four minor limitations of contingency research on optimal CSD, this research makes six other minor contributions concerning the enhancement of the quality of contingency research. The first minor contribution is also from the theoretical perspective, and is related to the criticisms raised against contingency research on optimal MCS, of which CSD represents a part (Chenhall, 2003; 2007), in relation to the lack of a proper application of contingency theory (see Section 3.4). An example of these criticisms includes the failure to use appropriate verbal statements for and statistical analysis techniques to test the contingency hypotheses. Accounting for these criticisms is crucial for strengthening the results and constructing knowledge in a systemic manner (e.g., Otley, 1980; 2016; Fisher, 1995; 1998; Chapman, 1997; Hartmann and Moers, 1999; Chenhall, 2003; 2007; Hartmann, 2005). Thus, this research contributes to the contingency-optimal MCS literature, including the contingency-optimal CSD literature, by addressing most of the raised criticisms against contingency research on optimal MCS and so, consequently, providing a practical example of conducting contingency theory research that strengthens the results and establishes knowledge in a systemic way.

The second minor contribution is from the empirical perspective, and relates to the research context (see Section 1.6.1). This research contributes to the contingency-optimal CSD literature by conducting this research in Saudi Arabia, a developing country that has witnessed vast, quick changes to its manufacturing and business environments, e.g., adopting the NIS and joining WTO, the anticipated results of which will have implications for optimal CSD. In addition, carrying out this research in Saudi Arabia is in line with the increasing interest in conducting accounting research in developing countries, and enhances knowledge about a new context.

The third, fourth, fifth and sixth minor contributions are from the methodological perspective. Regarding the third, this research contributes to the contingency-optimal CSD literature by providing a practical example of how the survey strategy can be applied in a more refined way. This research applied the survey strategy in two stages, where an exploratory qualitative stage is used before a primary model-testing quantitative stage. The exploratory qualitative stage, which involved conducting semi-structured interviews with costing and production staff, informed the development of the questionnaire used in the model-testing stage and enhanced the quality of the adopted survey strategy in two ways. First, the exploratory qualitative stage assisted in validating the importance and enhancing the researcher's understanding of the investigated phenomenon, i.e., optimal CSD, and its unexplored research context; namely, Saudi Arabia (for example, see Euske, Lebas and McNair (1993), Davila (2000), Sandino (2007), Delaney and Guilding (2011) and Al-Sayed and Dugdale (2016)). This was achieved by conducting in-depth discussions with participants regarding the importance and design of the employed costing system, the business-unit's characteristics and competitive and production environments, and by taking tours around the factories of most business-units. Second, the exploratory qualitative stage contributed to improving the internal validity and strengthening the causal inferences (Ittner, 2014). This was accomplished through the role that the exploratory qualitative stage played, regarding: (1) ensuring that the research model is applicable to the Saudi context, where a limited number of studies on optimal CSD have been conducted, in that it includes relevant contingency factors that have been either identified from existing literature or unknown to the extant literature; (2) confirming the suitability of the outcome measures selected for CSD optimality; (3) developing more comprehensive measures for the CSC and PC constructs, and (4) enhancing the researcher's understanding of the mechanisms underlying the relationships between the various contingency factors and optimal CSD (for example, see Chow, Shields and Wu (1999), Wang (1999), and Giacobbe, Matolcsy and Wakefield (2016)).

With respect to the fourth contribution, this research contributes to the contingency-optimal CSD literature by introducing and employing a unique formula of mixed-mode questionnaire using three contact modes, including visits, phone calls and e-mails, and two questionnaire modes; namely, online and paper (see Section 6.3.2.1.4.2). This distinguished formula of mixed-mode questionnaire is beneficial. More specifically, the usage of multiple contact modes makes it possible to cover research populations that cannot be covered using a single contact mode, whereas the usage of multiple questionnaire modes assists in improving the response rate and, hence, reducing the probability of non-response bias (de Leeuw, 2005; Dillman et al., 2014). The benefit of using multiple contact modes is needed when conducting research in contexts, such as developing countries, for which there is a lack of comprehensive databases, i.e., sampling frames, that detail companies in different industries and sectors. In addition, the initial contact mode used, visits or phone calls, made it possible to identify the most appropriate person to answer the questionnaire and, therefore, increased the credibility of the questionnaire answers.

Regarding the fifth contribution, this research contributes to the contingency-optimal CSD literature by introducing and highlighting the differences between the two approaches to measuring the latent constructs, namely, the reflective approach and the formative one, and illustrating and applying the quality evaluation process of each approach (see Section 7.3). This is important because researchers might, inaccurately, conclude that the formative constructs were poorly measured or need to be divided into more than one construct when, in fact, these researchers were applying reflective constructs' quality assessment criteria (e.g., Al-Omiri and Drury, 2007).

Concerning the sixth contribution, this research contributes to the contingency-optimal CSD literature by introducing and utilising CFA with PLS-SEM as the estimation method, following the procedure described by Tenenhaus and Hanafi (2010), to evaluate the quality of the reflective constructs. PLS-SEM researchers have proved the superiority of PLS-SEM over CB-SEM for sample sizes lower than 250 (Reinartz et al., 2009), which is a larger sample size than that acquired by most contingency studies on optimal CSD, and, more importantly, recommended its usage when the underlying data population is not known, as tends to be the case in social science research (Sarstedt et al., 2016).

11.5 Implications for theory and practice, research limitations and suggestions for future research

This section discusses the implications of this research for theory (Section 11.5.1) and practice (Section 11.5.2), as well as its limitations (Section 11.5.3). Each of these sections includes suggestion/s for future research.

11.5.1 Implications for theory and suggestions for future research

The findings of this research have implications for theory regarding two main aspects; namely, the forms of fit applied by contingency research on optimal CSD along with the statistical analysis techniques utilised to test for them and the outcome measures for optimal CSD. For the first aspect, as discussed in Section 10.3, the findings of testing the matching sub-form of fit's hypotheses, employing the two-stage procedure involving the recommended combined usage of PRA and RSM developed by this research, are contrary to expectations. This is because none of these hypotheses was supported, and, when other effects were found, i.e., weak matching or moderation, they predominantly contradicted prior theory and the empirical evidence provided by contingency studies on optimal CSD that primarily applied the selection form of fit and, to a lesser extent, the matching and moderation sub-forms of fit. Although the findings of this research are tentative, given that they are the outcome of the exploratory approach of the combined usage of PRA and RSM and, thus, require further validation, they cast some doubts on the validity of the results provided by selection studies on optimal CSD. In fact, the total disagreement between the results related to the influence of cost structure (see Section 9.4.1.3) and business-unit size (see Section 9.4.1.1) on the optimal level of CSC from the perspective of the selection form of fit - i.e., the first step of residual analysis - and those concerning the impact of both contingency factors on the optimal level of CSC from the viewpoints of, respectively, the weak form of the matching sub-form and the moderation one found in this research support these doubts.[179] For example, business-unit size was found to have a positive effect on the optimal level of CSC from the standpoint of the selection form of fit, while its influence on the optimal level of CSC from the perspective of the moderation sub-form of fit was non-monotonic and negative. The implications of these results differ. The selection effect suggests that, to have optimal levels of CSC, small/medium-sized/large business units should have lower/moderate/higher levels of CSC. However, the moderation impact indicates that, to have optimal levels of CSC, small and medium-sized business-units ought to have higher levels of CSC, whereas large business-units are unaffected by this and so may benefit from having lower levels of CSC.

In addition, acknowledging that the findings of this research are tentative, they cast some doubts on the validity of the results of matching and moderation studies on optimal CSD that included similar contingency factors to those employed by this research (Abernethy et al., 2001; Cagwin and Bouwman, 2002; Ittner et al., 2002; Elhamma, 2012; Krumwiede and Charles, 2014). This is because matching studies have derived their findings using either a case study research strategy, which involved a small number of cases (Abernethy et al., 2001), or the less optimal residual analysis statistical analysis technique to test for the

[179] Cost structure was found to affect the optimal level of CSC from the standpoints of the weak form of the matching sub-form of fit and the moderation one. However, as mentioned in Section 10.3.1.2, the weak matching effect was argued to be more reliable and, accordingly, considered to be the one for cost structure.

matching sub-form of fit (Ittner et al., 2002), whereas moderation studies obtained their findings without testing for the more realistic and appropriate matching sub-form of fit (Cagwin and Bouwman, 2002; Elhamma, 2012; Krumwiede and Charles, 2014).

The doubts raised by this research regarding the validity of the findings of prior selection, matching and moderation studies on optimal CSD are not underestimated by the fact that the findings of the latter studies generally agree with each other and, thus, disagree with those of this research, for three reasons. First, the inherited shortcoming of the selection form of fit related to the equilibrium assumption threatens the validity of the results of selection studies on optimal CSD (see Sections 3.3.1 and 4.4.2). Second, only five of the matching and moderation studies on optimal CSD included similar contingency factors to those incorporated in this research (Abernethy et al., 2001; Cagwin and Bouwman, 2002; Ittner et al., 2002; Elhamma, 2012; Krumwiede and Charles, 2014), making any support that they provide for the findings of selection studies on optimal CSD not robust. Third, as mentioned above, the few matching and moderation studies on optimal CSD suffered from limitations, e.g., using the less optimal residual analysis statistical analysis technique, that can affect the generalisability and/or validity of their findings.

Nevertheless, it should be acknowledged that, even though the two-stage procedure involving the recommended combined usage of PRA and RSM to test the matching sub-form of fit's hypotheses, which was developed and employed by this research, contributes to the general contingency theory literature, including the contingency-optimal MCS and contingency-optimal CSD literature, the joint usage of PRA with RSM involves the assumption that the predictor constructs are free from measurements errors (Edwards, 2002). This, however, is unrealistic, given that there are many situations that can cause measurement errors and, accordingly, affect the validity of the findings (see for example, Hair et al., 2010; Hair et al., 2017).

The above suggests that future research should examine the influence of the contingency factors on optimal CSD, where: (1) the matching sub-form of fit is applied; and (2) a modified version of the two-stage procedure involving the recommended combined usage of PRA and RSM, whereby the PRA part is developed to account for measurement errors, is exploited.[180] This is required to validate the findings reported by this research and contingency studies on optimal CSD that employed primarily the selection form of fit and, to a lesser extent, the matching and moderation sub-forms of fit, with the objective of confirming, or, if necessary, refining the relationships between the contingency factors and optimal CSD proposed by prior contingency research on optimal CSD. Eventually, this will assist in providing a proper understanding of the influences on optimal CSD.

With respect to testing the system form of fit's hypothesis, it is, as mentioned in Section 10.3.2, original in the optimal CSD context. The finding of this research that the contingency factors do not have a joint impact on the optimal level of CSC is tentative and insufficient to raise concerns about the applicability of this form of fit, i.e., the existence of a joint impact of the contingency factors on optimal CSD, to the optimal CSD context, for three reasons. First, although the residual analysis statistical analysis technique used in this research to test the system form of fit's hypothesis was the best choice and efforts were made to apply it properly, it remains a limited statistical analysis technique (see Sections 9.2, 8.2.1 and 10.3.2). Second, even though this research sought to include the contingency factors that were found to be strongly related to optimal CSD in prior literature and applicable to the Saudi context, it is possible that the list of the seven contingency factors included in the research model is limited in explaining a large amount of the variance in the dependent variable, i.e., optimal CSD (see Section 10.3.2). Third, other contingency studies found support for the joint effect of the contingency factors on optimal MCS (e.g., Nicolaou, 2000;

[180] For further details about the issue of applying PRA in the SEM context that considers measurement errors, see Burkert et al. (2014).

2002; Said et al., 2003; King et al., 2010). Given the above, future research should conduct further investigation on the influence of the contingency factors on optimal CSD from the standpoint of the system form of fit, taking into consideration the development and employment of a better statistical analysis technique and the inclusion of other influential contingency factors, such as business-unit structure, national culture, the extent of JIT usage and business-unit legal form.[181] This will assist in validating the findings of this research and, ultimately, furnishing an appropriate understanding of the influences on optimal CSD.

With respect to the second aspect, the findings of this research, which were mostly unexpected, suggest that it is unknown whether the outcome measures that were used by this research and certain interaction studies on optimal CSD - i.e., USEFULNESS and USAGE - can capture the original definition of optimal CSD concerning balancing the costs of measurements and costs of errors. To illustrate this, the negative effect of PC on optimal CSD found in this research is used. As provided in Section 10.3.1.4, there are two possible explanations for the negative influence of PC on the optimal level of CSC in terms of USEFULNESS and USAGE. First, if USUFULNESS and USAGE are assumed truly to reflect the extent to which CSD balances the costs of measurements and costs of errors, the negative relationship suggests that these costs are balanced in situations when PC is high and CSC is low, and vice versa. Second, if USEFULNESS and USAGE are doubted to reflect the extent to which CSD balances the costs of measurements and costs of errors, the negative relationship indicates that CSDs that are less optimal in terms of balancing the costs of measurements and costs of errors are optimal in terms of USEFULNESS and USAGE. The first explanation suggests that the association between the costs of measurements and the level of CSC or the costs of errors and its causes, e.g., the level of PC, differs from what was

[181] Nevertheless, it should be noted that the number of contingency factors that can be included in questionnaire studies is limited, given the large number of questions required to measure accurately each contingency factor, which results in increasing the length of the questionnaire and, accordingly, threating the response rate.

proposed by prior literature (e.g., Cooper, 1988b). For example, it indicates that the costs of measurements decrease as the level of CSC increases. The second explanation raises the question of why the less optimal CSDs in terms of balancing the costs of measurements and costs of errors that may negatively affect companies' overall performance are optimal in terms of USEFULNESS and USAGE, and the question of whether the former have any harmful impact on companies' overall performance, given that their output, i.e., cost information, is perceived as useful and used in decision-making. Given, as discussed above, the uncertainty about the adequacy of the USEFULNESS and USAGE measures to capture accurately the original definition of optimal CSD, it appears that using outcome measures related to companies' overall performance is the best available alternative to capture the original definition of optimal CSD. Using outcome measures related to performance is also substantiated by the difficulty of applying outcome measures that can capture precisely the extent to which CSD balances the costs of measurements and costs of errors when conducting empirical research and the fact that the ultimate objective of having an optimal CSD that balances the costs of measurements and costs of errors is to contribute positively towards companies' overall performance. The above, however, does not indicate a total disagreement with the suggestion made by many researchers regarding the avoidance of using financial performance as an outcome measure to reflect the optimality of MCS (e.g., Otley, 2016), which was initially followed by this research when selecting the USEFULNESS and USAGE outcome measures. This is because this research agrees with this suggestion with respect to the importance of including many control variables that may affect overall performance, and also promotes the use of non-financial performance outcome measures along with the financial ones. Including control variables and using outcome measures related to non-financial performance will reduce the magnitude of problems associated with the usage of financial performance as a sole outcome measure. Given the above, future research should use outcome measures related to both financial and non-financial performance as surrogates for CSD optimality, and also include the control variables that may influence them. This will assist in validating the findings of both this research and prior contingency studies and, eventually, providing a proper understanding of the influences on optimal CSD.

11.5.2 Implications for practice and the associated suggestion for future research

Given that this research involved the collection of qualitative and quantitative data concerning optimal CSD from practitioners in the exploratory and model-testing stages of the adopted survey strategy, the findings of this research are likely to be relevant to, and thus, have implications for, practice. The survey applied in this research can be considered as the most comprehensive survey conducted in Saudi Arabia regarding optimal CSD and its influences. This survey serves practitioners working in the Saudi manufacturing industry, including its various sub-sectors, by providing descriptive information about different contingencies affecting optimal CSD, applied CSDs and the extent of their optimality. In addition, it serves them by providing four main implications with respect to how to operate with an optimal CSD considering the business-unit's surrounding contingencies.[182] First, to operate with an optimal CSD, business-units do not need to consider the level of competition and TMS. Second, to have an optimal CSD, business-units with lower/moderate/higher proportions of indirect costs ought to have lower/moderate/higher levels of CSC. Third, to work with an optimal CSD, business-units with an organisational culture that is characterised as less/moderately/more outcome-oriented, detail-oriented or control-focused and business-units with lower/moderate/higher levels of PC should have higher/moderate/lower levels of CSC. Fourth, to operate with an optimal CSD, small and medium-sized business-units and

[182] The four main implications can also be relevant to practitioners working in the manufacturing industry in other countries, given that the implications were produced using: (1) the more realistic and appropriate matching sub-form of fit; and (2) the recommended combined usage of PRA and RSM. Both the matching sub-form of fit and combined usage of PRA and RSM have not been utilised by prior contingency research on optimal CSD conducted in either developed or developing countries.

those with lower levels of TMKA ought to have higher levels of CSC, whereas large business-units and those with moderate and higher levels of TMKA are not influenced by this and so might be better off working with lower levels of CSC.

Nonetheless, as mentioned in Section 11.5.1, the findings of this research mostly contradicted expectations, are tentative and, hence, need to be validated by future research. Therefore, it might be wise to postpone recommending practitioners to work according to the four implications noted above until this research has been replicated and, most importantly, practitioners' opinions and reflections about these findings have been obtained by future research. To accomplish the latter, future research should exploit the cross-sectional field studies strategy, which "involves limited-depth studies conducted at a nonrandom selection of field sites, thus laying somewhere between in-depth cases and broad-based surveys" (Lillis and Mundy, 2005, p. 120). This strategy is suitable for refining an existing theory through resolving issues related to the nature of the constructs involved in the theory, the relationships between these constructs and their empirical interpretation (ibid). Moreover, this strategy enables researchers to discover the reasons that may explain the conflicting findings, ambiguities or tensions existing in prior research, and may also assist in revealing un-hypothesised relationships between the constructs (ibid).

In short, the cross-sectional field studies strategy offers great potential for confirming or disconfirming the findings of this research and, accordingly, contributes to providing a proper understanding of the influences on optimal CSD. If the findings of this research are confirmed, this strategy may also prove beneficial for uncovering the reasons why these findings are predominantly inconsistent with prior literature and the extent to which some of the possible explanations provided for these findings confirm these. If the findings of this research are disconfirmed, the cross-sectional field studies strategy may also prove helpful in revealing more valid findings.

11.5.3 Research limitations and suggestions for future research

Like all other research, this research suffers from a number of limitations that should be addressed by future research. First, this research is limited to the use of contingency theory alone, and fails to utilise other theories that might provide rich insights that would assist in furnishing an appropriate understanding of the influences on optimal CSD. Thus, future research should draw on other theories, such as behavioural and social theories, and combine these with contingency theory's concepts. Behavioural theories are concerned with how the design and usage of the accounting system is influenced by the employees or how the accounting system is designed and used to impact on employees' behaviour, job satisfaction and, most importantly, performance, as well as the overall organisational performance (Ryan et al., 2002). These theories can be combined with contingency theory's concepts through, for example, examining the moderator role of the personality factors of, for instance, the management and cost accountants on the relationship between the various contingency factors and optimal CSD (Chenhall, 2007). Social theories are concerned with studying the accounting system within the context of the social system of which the accounting system represents a part (Ryan et al., 2002). These theories can be combined with contingency theory's concepts through, for example, examining the effect of the factors that represent the regulation by the authoritative bodies on optimal CSD, which brings about desirable results for the business-units and society as a whole (Donaldson, 1995; Chenhall, 2007).

Second, while this research used many CSC measures, of which the multi-dimensional comprehensive one was developed and confirmed by this research, it is limited to focusing on only one element of MCS; namely, CSD. As the costing system forms part of the MCS, erroneous results and incorrect conclusions regarding the effects of the contingency factors on optimal CSD could be obtained if other related elements of MCS, e.g., budgeting or balance scorecard, or even relevant controls of the broader organisational controls, e.g., informal controls, to CSD were excluded or not controlled (for further details about this issue, see Otley, 1980; 2016; Fisher, 1998; Chenhall, 2003). Hence, future research should broaden the horizons of contingency research on optimal CSD by accounting for other related elements of MCS or controls of the broader organisational controls.

Third, as discussed in Section 10.3.1, it is possible that the measurements of the contingency factors of competition, cost structure, organisational culture, TMS and TMKA used in this research are limited. Therefore, future research should refine the measurements of these contingency factors in the ways suggested in Section 10.3.1 and, subsequently, examine their influence on optimal CSD from the perspectives of the matching sub-form of fit and the system form of fit. For cost structure, the refinement of its measure and examination of its impact can be best achieved through exploiting the case study research strategy (see Section 10.3.1.2).

Fourth, as explained in Section 10.3.1.5, it is possible that business-unit size is a limited proxy for and lacks the ability to reflect the characteristics of the contingency factor whose impact on optimal CSD was intended to be examined both in this research and in other contingency studies on optimal CSD. Accordingly, future research should use and evaluate the appropriateness of the organisational life cycle as a proxy for the intended contingency factor (see Section 10.3.1.5).

Fifth, although conducting this research in Saudi Arabia contributed to the contingency-optimal CSD literature, the findings may only be applicable to the Saudi manufacturing industry, excluding the oil and natural gas production and extraction sector, and, thus, the generalisability of the findings of this research across the Saudi non-manufacturing industry or both the manufacturing and non-manufacturing industries of other national contexts might be invalid. Given this, future research should replicate this research in the Saudi non-manufacturing industry and/or both the manufacturing and non-manufacturing industries of other national contexts.

Sixth, the sample of business-units selected from one of the two databases - i.e., MODON and RCJY - that represented the sampling frame is limited. Even though the largest industrial cities and the two ones located close to the home town of the researcher were utilised from the MODON database, the other industrial cities included in this database were not used for compelling reasons, and, hence, the sample might not represent the whole Saudi manufacturing industry, excluding the oil and natural gas production and extraction sector (see Section 6.3.2.1.4.1). Therefore, in addition to the industrial cities included in the MODON database that were exploited by this research, future research should utilise the other industrial cities included in this database to confirm the findings of this research.

Lastly, this research is limited to the cross-sectional collection of data at a single point of time and, accordingly, association rather than causation, i.e., cause-and-effect, can be claimed regarding the impact of the contingency factors on optimal CSD, i.e., dependence relationships (Ryan et al., 2002; Chenhall, 2007; Hair et al., 2010; Bryman and Bell, 2011). Future research should perform longitudinal research that involves collecting data at more than one point of time and, thus, accounts for the time period during which the events occur. This, in turn, would allow longitudinal research to provide evidence about the sequence of the events required for claiming causation about the dependence relationships (Hair et al., 2010).

11.6 Conclusion

Contingency research on optimal CSD has suffered due to the main limitation pertaining to the lack of an appropriate application of contingency theory in relation to the adopted forms of fit. This main limitation might have prevented this research strand from furnishing a proper understanding of the influences on optimal CSD. Nevertheless, an appropriate understanding of the influences on optimal CSD is important, given that less optimal CSDs are connected with problems (Cooper, 1988b; 1989c; 1990a; Cooper and Kaplan, 1991; Kaplan and Cooper, 1998; Stuart, 2013; Drury, 2015) that may, eventually, damage companies' overall performance (Ittner et al., 2002; Pizzini, 2006; Stuart, 2013). This research attempted to assist in providing a proper understanding of the impacts on optimal CSD through addressing the main limitation of contingency research on optimal CSD. Thus, it made major theoretical and methodological contributions to the contingency-optimal CSD literature and/or the general contingency theory literature by investigating the influence of various contingency factors on optimal CSD, where: (1) the more realistic and appropriate matching sub-form of fit and the more realistic, appropriate and thorough system form of fit of contingency theory are applied; and (2) a procedure involving the recommended combined usage of PRA and RSM is developed and employed to test for the matching sub-form of fit. In addition, throughout addressing the main limitation of contingency research on optimal CSD, this research made further minor theoretical contributions to the contingency-optimal CSD literature by considering the four minor limitations of contingency research on optimal CSD that are important to consider in order to address successfully the main limitation of this research strand and, hence, attain the research aim. Furthermore, this research made other minor theoretical, empirical and methodological contributions to the contingency-optimal CSD literature and/or contingency-optimal MCS literature that enhance the quality of contingency research. It is hoped that this research will open up opportunities for conducting further research on the contingency-optimal CSD, contingency-optimal MCS and general contingency areas.

Appendix 4-1: A summary of selection studies on ABC adoption

Table 1: A summary of selection studies on ABC adoption

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(Bjørnenak, 1997) (first, group 1)	1. Norway. 2. 132 manufacturing companies.	Survey (questionnaire).	57% (40%).	1. Cost structure with the ABC adoption stage. 2. PC (customisation) with the ABC adoption stage (**negative**). 3. Competition with the ABC adoption stage (**negative**). 4. Size with the ABC knowledge stage.	1. PC (product diversity). 2. The current design of costing system.
(Booth and Giacobbe, 1998) (first, group 1)	1. Australia. 2. 635 manufacturing companies.	Survey (questionnaire).	32.6% (11.6%).	1. Cost structure with both the initiation of interest and ABC adoption as an idea stages. 2. PC (product diversity) with the ABC adoption as an idea stage. 3. Size with the initiation of interest stage.	1. Competition. 2. The role of consultants. 3. Information sources.
(Krumwiede, 1998a) (first, group 1)	1. The USA. 2. 778 manufacturing business-units.	Survey (questionnaire).	28.9% (36%).	1. PC (product diversity and mass production) with ABC adoption. 2. Size with ABC adoption. 3. TMS with ABC implementation. 4. Time since ABC adoption with ABC implementation.	1. Degree of decision usefulness of cost information. 2. TQM usage. 3. Lean production usage. 4. Information technology quality. 5. Non-accounting ownership. 6. Clarity and consensus for ABC objectives. 7. Training. 8. Number of ABC purposes.
(Brown et al., 2004) (first, group 1)	1. Australia. 2. 1279 manufacturing and non-manufacturing business-units.	Survey (questionnaire).	12.5% (20%).	1. TMS with the initiation of interest stage. 2. Internal champion support with both the initiation of interest and adoption stages. 3. Size with the initiation of interest stage.	1. Cost structure. 2. The role of consultants. 3. PC (product diversity). 4. Relative advantage.

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(Brierley, 2008b) (first, group 1)	1. The UK. 2. 673 manufacturing business-units.	Survey (questionnaire).	41.6% (2.5%).	1. Size with all ABC adoption stages.	1. Competition. 2. PC (customisation). 3. Cost structure.
(Schoute, 2011) (first, group 1)	1. The Netherlands. 2. 2108 medium-sized manufacturing companies.	Survey (questionnaire).	9% (10.5%).	1. Curvilinear relationship between PC (product diversity) and ABC adoption and usage. 2. AMT negatively moderate the relationship between PC (product diversity) and ABC usage. 3. PC (mass production) with ABC adoption and usage. 4. PC (customisation) with ABC usage (**negative**).	1. Size. 2. TQM usage. 3. JIT usage.
(Jusoh and Miryazdi, 2016) (first, group 1)	1. Iran. 2. 400 publicly-listed manufacturing companies.	Survey (questionnaire).	47% (17.5%).	1. PC (product diversity) with the consideration, adoption and infusion stages. 2. Perceived environmental uncertainty with the consideration, adoption and infusion stages (**negative**). 3. Strategy-analyser with the consideration, adoption and infusion stages. 4. Cost structure with the adoption stage. 5. Competition with the adoption stage.	1. Information technology quality.
(Innes and Mitchell, 1995) (first, group 2)	1. The UK. 2. 1000 largest manufacturing and non-manufacturing companies.	Survey (questionnaire).	25.1% (19.5%).	1. Size.	2. Industry.

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(Nguyen and Brooks, 1997) (first, group 2)	1. Australia. 2. 350 manufacturing companies.	Survey (questionnaire).	34% (12.5%).	1. PC (product complexity and general question about PC). 2. Size. 3. Competition.	1. Cost structure. 2. Manufacturing flexibility. 3. PC (product diversity). 4. PC (frequency of new products introductions). 5. PC (frequency of changes in products and manufacturing processes).
(Clarke et al., 1999) (first, group 2)	1. Ireland. 2. 511 manufacturing companies.	Survey (questionnaire).	41% (12%).	1. Nationality. 2. Size.	1. Manufacturing sector. 2. PC (product diversity). 3. Cost structure.
(Innes et al., 2000) (first, group 2)	1. The UK. 2. 1000 and non-manufacturing companies.	Survey (questionnaire).	22.9% (17.5%).	1. Industry (financial). 2. Size.	None.
(Chen et al., 2001) (first, group 2)	1. Hong Kong. 2. 810 listed and large non-listed manufacturing and non-manufacturing companies.	Survey (questionnaire).	11% (15.5%).	1. Size.	1. Industry. 2. PC (product diversity). 3. PC (customisation). 4. Competition. 5. Cost structure.
(Al-Mulhem, 2002) (first, group 2)	1. Saudi Arabia. 2. 224 manufacturing companies.	Survey (questionnaire).	27.6% (14.5%).	1. Size. 2. PC (product diversity).	1. Cost structure.

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(Chongruksut and Brooks, 2005) (first, group 2)	1. Thailand. 2. 292 publicly-listed manufacturing and non-manufacturing companies.	Survey (questionnaire).	34.59% (35.64%).	1. PC (product diversity). 2. Intensity of capital equipment.	1. Size. 2. Industry. 3. Structure. 4. Competition. 5. Manufacturing flexibility. 6. Cost structure. 7. PC (frequency of new products introductions).
(Cohen et al., 2005) (first, group 2)	1. Greece. 2. 570 manufacturing and non-manufacturing companies.	Survey (questionnaire).	15.4% (40.9%).	None.	1. Cost structure. 2. Competition. 3. The trend of overhead costs. 4. Size.
(Khalid, 2005) (first, group 2)	1. Saudi Arabia. 2. Largest 100 manufacturing and non-manufacturing companies.	Survey (questionnaire).	39% (33.3%).	1. Size. 2. PC (product diversity).	1. Cost structure.
(Maelah and Ibrahim, 2007) (first, group 2)	1. Malaysia. 2. 1257 publicly-listed manufacturing companies and multinational manufacturing companies.	Survey (questionnaire).	8.6% (36%).	1. The decision usefulness of accounting information (the level of competition and the need for cost data in the costs reduction and pricing decisions). 2. Organization support (TMS and non-accounting ownership). 3. Performance measurement (internal measures).	1. The potential of costs distortion. 2. Information technology quality. 3. Training. 4. Performance measurement (learning and growth).

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	Sample characteristics	Research strategy	Response (ABC adoption) rates	Influential contingency factors	Uninfluential contingency factors
(Chongruksut, 2009) (first, group 2)	1. Thailand. 2. 480 publicly-listed manufacturing and non-manufacturing companies.	Survey (questionnaire).	22.5% (44%).	1. Industry (manufacturing). 2. Size.	1. Structure. 2. Environment (e.g., PC, manufacturing flexibility and competition). 3. Organisational culture.
(Nassar et al., 2009) (first, group 2)	1. Jordan. 2. 88 publicly-listed manufacturing business-units.	Survey (questionnaire).	63.9% (16.4%).	1. Size.	1. Manufacturing sector. 2. PC (product diversity). 3. Cost structure.
(Al-Khadash and Mahmoud, 2010) (first, group 2)	1. Jordan. 2. 67 publicly-listed industrial companies.	Survey (questionnaire).	97% (15%).	1. Level of managers' awareness of the importance of using ABC.	None.
(Ahamadzadeh et al., 2011) (first, group 2)	1. Iran. 2. 170 publicly-listed manufacturing and non-manufacturing companies.	Survey (questionnaire).	33.5% (7%).	None.	1. Size. 2. Industry. 3. Cost structure. 4. The importance of cost information. 5. PC (product diversity).
(Brierley, 2011) (first, group 2)	1. The UK. 2. 673 manufacturing business-units.	Survey (questionnaire).	41.6% (3.5%).	1. Size.	1. PC (customisation). 2. Cost structure. 3. Competition.

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(Joshi et al., 2011) (first, group 2)	1. GCC countries. 2. 244 publicly-listed manufacturing and non-manufacturing companies.	Survey (questionnaire).	23.4% (40%).	2. Size (**negative**).	1. Mode of operations (foreign versus domestic). 2. Industry. 3. Country.
(Al-Omiri, 2012) (first, group 2)	1. Saudi Arabia. 2. 1000 manufacturing and non-manufacturing business-units.	Survey (questionnaire).	27% (29.2%).	The study found significant differences between ABC adopters and non-adopters in relation to 11 motives, including: 1. Changes in the company's cost structure. 2. Changes in the company's manufacturing environment. 3. Changes in the company's competitive environment.	All related motives are significant.
(Charaf and Bescos, 2013) (first, group 2)	1. Morocco. 2. 301 largest manufacturing and non-manufacturing companies.	1. Survey (questionnaire). 2. Three semi-structured interviews.	20.60% (22.6%).	1. The importance of cost information in decision-making. 2. Organisational culture (outcome orientation and innovation).	1. Cost structure. 2. PC (not stated). 3. Organisational culture (team orientation and attention to detail).
(Pokorná, 2015) (first, group 2)	1. The Czech Republic. 2. 6363 Medium and large-sized manufacturing and non-manufacturing companies.	Survey (questionnaire).	8.61% (22%).	1. Size. 2. Legal form (joint-stock companies). 3. The majority owner's country of origin (ABC adoption rate is higher among companies with foreign capital compared to companies with exclusively local capital (except Germany and the "other" category)). 4. Cost structure (**negative**).	1. Industry.

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(Al-Khadash and Feridun, 2006) (first, group 3)	1. Jordan. 2. 59 publicly-listed industrial companies.	Survey (questionnaire).	94.9% (10.7%).	None.	1. Level of managers' awareness of the importance of using ABC.
(Askarany et al., 2010) (first, group 3)	1. New Zealand. 2. 366 manufacturing and non-manufacturing companies.	Survey (questionnaire).	39.5% (22.5%).	1. Size.	1. Industry.
(Gosselin, 1997) (second)	1. Canada. 2. 415 manufacturing business-units.	Survey (questionnaire).	39% (30.4%).	1. Strategy (prospector and analyser) with activity management. 2. Structure (vertical differentiation) with ABC adoption. 3. Structure (centralisation and formalisation) with ABC implementation.	1. Size.
(Baird et al., 2004) (second)	1. Australia. 2. 400 manufacturing and non-manufacturing business-units.	Survey (questionnaire).	46% (78.1%).	1. Size with activity analysis and activity cost analysis. 2. Organisational culture (innovation, outcome orientation and tight versus loose control) with activity analysis and activity cost analysis. 3. Decision usefulness of cost information with ABC. 4. Organisational culture (outcome orientation and tight versus loose control) with ABC.	None.

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(Askarany et al., 2010) (second)	1. New Zealand. 2. 366 manufacturing and non-manufacturing companies.	Survey (questionnaire).	39.5% (22.5%).	1. Industry: the adoption of ABC is higher in the manufacturing industry compared to the non-manufacturing one.	1. Size.
(Malmi, 1999) (third)	1. Finland. 2. Four surveys: 1240 manufacturing and non-manufacturing business-units.	1. Four surveys (questionnaire). 2. 10 semi-structured interviews. 3. Archival data.	39.5% as an average of the four surveys (23.2% as a total of the four surveys).	1. Competition. 2. Size. 3. PC (product diversity).	1. Cost structure. 2. Strategy. 3. PC (customisation). 4. PC (production type). 5. PC (make-to-order versus make-to-stock).
(Hoque, 2000) (fourth)	1. New Zealand. 2. 120 manufacturing companies.	Survey (questionnaire).	59.2% (41%).	1. JIT production (**negative**). 2. Automation. 3. Size.	None.
(Askarany et al., 2007) (fourth)	1. Australia. 2. 200 manufacturing companies working in the plastic and chemical sectors.	Two surveys (questionnaire).	1. First survey: 25% (14%). 2. Second survey: 15% (22%).	1. Technological changes in manufacturing practices (first survey).	None.

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(Kallunki and Silvola, 2008) (fourth)	1. Finland. 2. 500 manufacturing and non-manufacturing companies.	Survey (questionnaire).	21% (28%).	1. Organisational life cycle stage (ABC is used more in the maturity and revival stages than the growth stage). 2. Size.	1. Age. 2. PC (product diversity). 3. PC (customisation). 4. CEO educational level. 5. Venture capital investors. 6. Stock market listing. 7. Industry.
(Mclellan and Moustafa, 2013) (fourth)	1. GCC countries. 2. 453 manufacturing and non-manufacturing companies.	Survey (questionnaire).	34% (N/A).	None.	1. Legal form. 2. Nationality. 3. Size. 4. Industry.
(Rbaba'h, 2013) (fourth)	1. Jordon. 2. 92 publicly-listed manufacturing companies.	Survey (questionnaire).	89% (19.5%).	None.	1. Industry. 2. Size. 3. PC (product diversity). 4. Cost structure.
(Rundora et al., 2013) (fourth)	1. South Africa. 2. 80 Small manufacturing companies.	Survey (questionnaire).	60% (33.3%).	1. Age. 2. Size.	None.
(John, 2014a) (fourth)	1. Nigeria. 2. 500 general, cost and management accountants and financial managers who work in 24 manufacturing publicly-listed companies.	Survey (questionnaire).	Not stated (Not stated).	1. PC (product diversity).	None.

Table 1: A summary of selection studies on ABC adoption (continued)

Study and (approach)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Influential contingency factors**	**Uninfluential contingency factors**
(John, 2014b) (fourth)	1. Nigeria. 2. 500 general, cost and management accountants and financial managers who work in 24 manufacturing publicly-listed companies.	Survey (questionnaire).	Not stated (Not stated).	1. Size.	None.
(Elhamma and Moalla, 2015) (fourth)	1. Morocco. 2. 412 manufacturing and non-manufacturing companies.	Survey (questionnaire).	15% (12.9%).	1. Structure (vertical decentralization). 2. Size.	1. Perceived environmental uncertainty. 2. Industry.

Appendix 4-2: A summary of interaction studies on ABC adoption

Table 1: A summary of interaction studies on ABC adoption

Study and (sub-form of fit)	**Sample characteristics**	**Research strategy**	**Response (ABC adoption) rates**	**Outcome variable/s**	**Findings**
(Frey and Gordon, 1999) (moderation)	1. The USA. 2. 622 manufacturing business-units.	Survey (questionnaire).	10% (24.4%).	Financial performance (return on investment).	**Influential contingency factors:** Strategy (ABC was associated with better return on investment in business-units who follow a differentiation strategy). **Uninfluential contingency factors:** None.
(Cagwin and Bouwman, 2002) (moderation)	1. The USA. 2. 962 manufacturing and non-manufacturing business-units.	Survey (questionnaire).	21.2% (31.8%).	Improvement in financial performance (return on investment).	**Influential contingency factors:** 1. PC (product diversity and frequency of changes to products and production processes). 2. Usage of other strategic initiatives (e.g., JIT and TQM). **Uninfluential contingency factors:** 1. Information technology sophistication. 2. Competition. 3. The level of unused capacity. 4. Industry. 5. Size. 6. The importance of cost information. 7. Intra-company transitions.
(Banker et al., 2008) (moderation)	1. The USA. 2. 27000 manufacturing business-units.	Survey (questionnaire).	4.6% (19.8%).	Operational performance (improvements in unit manufacturing costs, cycle time and product quality).	**Influential contingency factors:** None. **Uninfluential contingency factors:** World-class manufacturing practices usage.

Table 1: A summary of interaction studies on ABC adoption (continued)

Study and (sub-form of fit)	Sample characteristics	Research strategy	Response (ABC adoption) rates	Outcome variable/s	Findings
(Xiao et al., 2011) (moderation)	1. China. 2. 337 publicly-listed manufacturing and non-manufacturing companies.	Survey (questionnaire).	65% (the mean score of the extent of ABC usage was 3 out of 5).	Company performance (cost efficiency, customer satisfaction, employee morale, job satisfaction and commitment, on-time delivery to customers, innovativeness, continuous improvement and overall performance).	**Influential contingency factors:** None. **Uninfluential contingency factors:** Information/communication technology usage.
(Elhamma, 2012) (moderation)	1. Morocco. 2. Manufacturing and non-manufacturing companies.	Survey (questionnaire).	Not stated (12.9%).	Company performance (improvements in profitability, competitiveness, productivity and overall performance).	**Influential contingency factors:** Size (ABC has a significant impact on company performance in large companies, but not in small or medium-sized companies). **Uninfluential contingency factors:** None.
(Elhamma and Zhang, 2013) (moderation)	1. Morocco. 2. Manufacturing and non-manufacturing companies.	Survey (questionnaire).	Not stated (12.9%).	Company performance (improvements in profitability, competitiveness, productivity and overall performance).	**Influential contingency factors:** None. **Uninfluential contingency factors:** Strategy (ABC has a significant effect on performance regardless of the adopted strategy, i.e., prospector or defender).

Table 1: A summary of interaction studies on ABC adoption (continued)

Study and (sub-form of fit)	Sample characteristics	Research strategy	Response (ABC adoption) rates	Outcome variable/s	Findings
(Krumwiede and Charles, 2014) (moderation)	1. The USA. 2. 1100 manufacturing and non-manufacturing business-units.	Survey (questionnaire).	18.5% (Not stated).	Financial performance (profitability).	**Influential contingency factors:** 1. Strategy (ABC has a significant impact on performance when used in business-units with high levels of customer service strategy, but not in business-units with low levels of customer service strategy). 2. Strategy and information system quality (significant three-way interaction of low price strategy, the level of information systems quality and ABC usage). **Uninfluential contingency factors:** 1. Size. 2. Industry.
(Maiga et al., 2014) (moderation)	1. The USA. 2. 2506 manufacturing business-units.	Survey (questionnaire).	20.67% (52.5%).	Financial performance (the extent of improvement in return on sales, return on assets and turnover on assets).	**Influential contingency factors:** ERP usage (ABC has a significant impact on the financial performance when used in business-units that use ERP systems). **Uninfluential contingency factors:** None.
(Ittner et al., 2002) (matching)	1. The USA. 2. 25361 manufacturing business-units.	Survey (questionnaire).	11% (26%).	Business-unit performance (manufacturing quality, manufacturing cycle time, return on assets, changes in manufacturing costs, changes in first pass quality yield and changes in manufacturing cycle time).	**Influential contingency factors:** The misfit between plant operational characteristics related to PC and the adoption of ABC as an optimal CSD has only a weak negative influence on return on assets. **Uninfluential contingency factors:** None.

Appendix 4-3: A summary of selection studies on CSC

Table 1: A summary of selection studies on CSC

Study	**Sample characteristics**	**Research strategy**	**Response rate**	**CSC measures**	**Influential contingency factors**	**Uninfluential contingency factors**
(Drury and Tayles, 2005)	1. The UK. 2. 621 manufacturing and non-manufacturing business-units.	Survey (questionnaire).	30.1%.	1. A composite score of the number of cost pools and cost drivers. 2. Number of cost pools. 3. Number of cost drivers.	1. PC (product diversity) on all CSC measures. 2. Size on all CSC measures. 3. PC (customisation) on the composite and number of cost drivers CSC measures (**negative**). 4. Industry (financial and service) on the composite and number of cost drivers CSC measures. 5. The importance of cost information in profitability analysis on the number of cost pools CSC measure.	1. Cost structure. 2. Competition.
(Al-Omiri and Drury, 2007)	1. The UK. 2. 1000 manufacturing and non-manufacturing business-units.	Survey (questionnaire).	19.6%.	1. Number of cost pools. 2. Number of cost drivers. 3. Dichotomous variable (ABC adoption versus non-adoption). 4. Dichotomous variable (absorption versus direct costing).	1. Importance of cost information on all CSC measures. 2. Size on all CSC measures. 3. Competition on three CSC measures (except the absorption versus direct costing CSC measure). 4. Industry (financial) on three CSC measures (except the absorption versus direct costing CSC measure). 5. Industry (service) on the ABC adoption CSC measure. 6. Innovative management accounting techniques usage on the ABC adoption CSC measure. 7. JIT production on the ABC adoption CSC measure.	1. PC (product diversity). 2. Cost structure. 3. Information technology quality.

Table 1: A summary of selection studies on CSC (continued)

Study	**Sample characteristics**	**Research strategy**	**Response rate**	**CSC measures**	**Influential contingency factors**	**Uninfluential contingency factors**
(Brierley, 2007)	1. The UK. 2. 673 manufacturing business-units.	Survey (questionnaire).	41.6%.	1. Number of cost pools. 2. Number of cost drivers.	1. Cost structure on the number of cost pools CSC measure. 2. Size on the number of cost pools CSC measure.	1. PC (customisation). 2. Competition. 3. The importance of cost information in selling price decisions.
(Ismail and Mahmoud, 2012)	1. Egypt. 2. 96 manufacturing companies.	Survey (questionnaire).	85%.	A composite score of each of the number of cost pools, the number of cost drivers and a dichotomous variable of ABC adoption versus non-adoption.	1. The importance of cost information.	1. PC (product diversity). 2. Competition. 3. Cost structure. 4. Size. 5. Industry.
(Al-Omiri and Drury, 2013)	1. Saudi Arabia. 2. 1000 manufacturing and non-manufacturing business-units.	Survey (questionnaire).	32%.	1. Number of cost pools. 2. Number of cost drivers. 3. Dichotomous variable (ABC adoption versus non-adoption). 4. Dichotomous variable (absorption versus direct costing).	1. The importance of cost information on all CSC measures. 2. Size on all CSC measures. 3. Industry (financial) on three CSC measures (except the absorption versus direct costing CSC measure). 4. Competition on three CSC measures (except the absorption versus direct costing CSC measure). 5. Cost structure on the ABC adoption CSC measure. 6. PC (product diversity) on the ABC adoption CSC measure. 7. Industry (service) on the number of cost pools CSC measure. 8. Innovative management accounting techniques usage on the ABC adoption CSC measure.	1. TQM usage. 2. JIT production usage. 3. Influence on determining selling price.

Table 1: A summary of selection studies on CSC (continued)

Study	**Sample characteristics**	**Research strategy**	**Response rate**	**CSC measures**	**Influential contingency factors**	**Uninfluential contingency factors**
(Brierley, 2010)	1. The UK. 2. 12 manufacturing business-units.	Cross-sectional field studies (semi-structured interviews).	N/A.	CSC in terms of the assignment of overhead costs.	Parent companies are the sole determinant of CSC. When the business-unit does not have a parent company, or the parent company does not specify the business-unit's costing system: 1. Manufacturing technology (via the level of overhead costs). 2. Competition (moderated by the level of available funds). 3. PC (customisation) (moderated by the level of available funds). 4. The importance of cost information in decision-making (via management's demand for product cost information).	N/A.

Appendix 4-4: A summary of interaction studies on CSC

Table 1: A summary of interaction studies on CSC

Study and (sub-form of fit)	**Sample characteristics**	**Research strategy**	**Response rate**	**CSC measure**	**Outcome variable/s**	**Findings**
(Abernethy et al., 2001) (matching)	1. Australia. 2. Five manufacturing business-units.	Case study (semi-structured interviews).	N/A.	1. Number of cost pools. 2. Nature of cost pools. 3. Type of cost drivers.	Manager satisfaction with the costing system.	**<u>Influential contingency factors:</u>** The misfit between PC (product diversity and customisation) and optimal level of CSC has a negative influence on manager satisfaction with the costing system. **<u>Uninfluential contingency factors:</u>** None.
(Schoute, 2009) (moderation)	1. The Netherlands. 2. 2108 medium-sized manufacturing companies.	Survey (questionnaire).	6.3%.	1. A composite score of the number and nature of cost pools and the number and type of cost drivers. 2. A composite score of the number of cost pools and cost drivers.	1. User satisfaction with the costing system. 2. The extent of cost information usage in decision-making.	**<u>Influential contingency factors:</u>** Purpose of use (at higher (lower) levels of usage for product planning purposes, CSC negatively (positively) affects the extent of cost information usage (not user satisfaction), whereas at higher (lower) levels of usage for cost management purposes, CSC positively (negatively) affects the extent of cost information usage and user satisfaction). **<u>Uninfluential contingency factors:</u>** None.

Appendix 6-1: Interview guide

Interview guide

Introduction:

My name is Abdulrahman Aljabr, a lecturer in management and cost accounting at King Faisal University. This interview is part of my PhD study at the University of Sheffield, UK, which is sponsored by King Faisal University. My research focuses on investigating which factors influence costing system complexity and the nature of relationship between costing system complexity and outcomes related to costing system usefulness in Saudi manufacturing industry. I would like to ask you questions about your business-unit's costing system and the factors that influence costing system complexity (CSC). Also, I would like to ask you questions about your business-unit's production environment, and how it is related to costing system complexity.

I would like to reassure you that any response you provide is confidential and will not be revealed to any third party. In addition, your business-unit and your name will not be revealed from my work. My focus is on identifying the underlying patterns across different business-units in Saudi manufacturing industry and not on a specific business-unit. I appreciate your cooperation and assistance by accepting to be interviewed.

Do you mind if I record this interview?

Part 1: The costing system

Q1. Does your business-unit use a formal costing system for the purpose of decision-making? Does your business-unit follow specific procedures to assign direct and overhead/indirect costs to products?

Probes:

If 'yes', for the purpose of decision-making, how would you classify your business-unit costing system?
Would you classify your business-unit's costing system as direct, variable, absorption, ABC, or others?
Which costs do you include in product costs for the purpose of decision-making? (manufacturing/non-manufacturing, variable/fixed, direct/indirect).

If 'no', how does your business-unit cost its products for the purpose of decision-making?
What are the specific procedures that your business-unit follows in assigning overhead/indirect costs to products?

Q2. Could you please tell me what do you understand by costing system complexity (CSC)?

Probes:

If the interviewee's answer is that costing system complexity is related to the assignment of overhead/indirect costs to products, I will use the following probes:
Would you consider each of the following to be an indicator of CSC?

a. The number of cost centres/cost pools.
b. The number of allocation rates/cost drivers.
c. The type of cost pools (i.e., departmental/functional-based versus activity-based cost centres/cost pools.
d. The type of allocation rates/cost drivers (i.e., unit-level, batch-level, and product-sustaining level).

What other factors are indicators of CSC?

If the interviewee's answer is that CSC is related to something else not related to the assignment of overhead/indirect costs to products, I will use the following probes:
Can you tell me more about it (the definition of CSC provided by the interviewee)?
Although you have defined CSC by (the definition of CSC provided by the interviewee), can I ask your opinion about the complexity involved with the assignment of overhead/indirect costs to products?
Would you consider each of the following to be an indicator of this type of CSC (the assignment of overhead/indirect costs to products)?

a. The number of cost centres/cost pools.
b. The number of allocation rates/cost drivers.
c. The type of cost pools (i.e., departmental/functional-based versus activity-based cost centres/cost pools.
d. The type of allocation rates/cost drivers (i.e., unit-level, batch-level, and product-sustaining level).

What other factors are indicators of this type of CSC (the assignment of overhead/indirect costs to products?
Can I ask you to consider the type of CSC that is related to the assignment of overhead/indirect costs to products when answering the interview's questions.

Part 2: The production environment and its relationship with CSC

There is a high chance that management or cost accountants might not have the enough knowledge to answer Q3, Q6, and Q7. When I come across Q3, I will ask the interviewee if he/she has the enough knowledge about the production process undertaken and manufacturing technologies used in the business-unit.

If the answer is **'yes'**, then I will proceed to ask all the remaining questions.

If the answer is **'no'**, I will ask the interviewee if it is possible to meet the operations or production manager to obtain this information.[183] If **'agreed'**, then the management or cost accountant should be present when the operations or production manager answers Q3, Q6, and Q7. This is because these questions are related to Q4, Q5, Q8, and Q9, which need to be answered by the management or cost accountant. If, however, the meeting with the operations or production manager was not possible, then

1. I will just ask the management or cost accountant to give me a tour around the factory floor or to give me a brochure of the factory production process.
2. I will not skip Q3, Q6, and Q7, but I will try to discuss them in general with the management or cost accountant.

Q3. How would you evaluate the level of complexity of your business-unit's production environment?

<u>Probes:</u>
If 'complex', how is that?

a. What are the dimensions/sub-dimensions that make your business-unit's production environment complex? **(In Table 1 below, I will mark any dimension mentioned by the interviewee and add to it any new dimension not included)**.

[183] When contacting the interviewee to arrange the interview's time and location, I will briefly discuss this point. In particular, I will inform the interviewee that there are some questions that might need to be answered by the operations or production manager, and I will ask if it is possible to speak to the operations or production manager during my visit.

Table 1: PC dimensions/sub-dimensions

PC dimensions/sub-dimensions	
Process related	
Type of production process (e.g., project (job shop), batch, or mass (continuous) production.	
The level of standardisation in the manufacturing process (the use of common manufacturing processes).	
The level of standardisation in the manufacturing process (make-to-order vs. make-to-stock).	
The extent of diversity/similarity in the production processes needed by the business-unit's products (process diversity).	
Process diversity (manual vs. automation).	
The percentage of subcontracting in the manufacturing process.	
Product related	
The level of customisation/standardisation in products.	
Product complexity (i.e., the number of parts, number of unique components, and the number of different processes needed for each product).	
Number of products/ product lines/production orders (i.e., two similar products but with different sizes or dimensions are considered two products).	
Product diversity.	
Volume diversity.	
Size diversity.	
The type of products (mature vs. new products).	
The frequency of introduction of new products/changes in products and production schedule.	
Production-environment related	
The size and sophistication of support departments needed/resources used by the business-unit's products (e.g., the number of staff who schedule machines, perform setup, inspect items, move materials, ship orders, etc.).	
The level of diversity in the amount of support services provided for the business-unit's products (support diversity).	
Other dimensions mentioned by the interviewee	

Following from that, I will ask the interviewee about his/her opinion regarding the PC dimensions/sub-dimensions that have not been mentioned earlier when answering Q3 (unmarked PC dimensions/sub-dimensions in table (1)).

a. In your opinion, would each of these (unmarked PC dimensions/sub-dimensions) indicate the level of complexity of production environment?
b. **If 'no'**, why is that?

If 'not complex', why is that?

a. Can you tell me more about your business-unit's production environment? **(In Table 1, I will mark any dimension related to the description of the production environment provided by the interviewee and add to it any new dimension not included).**
b. In your opinion, why do these dimensions/sub-dimensions not reflect the level of complexity of your business-unit's production environment?

Following from that, I will ask the interviewees about his/her opinion regarding the PC dimensions/sub-dimensions that have not been mentioned earlier when answering Q3 (unmarked PC dimensions/sub-dimensions in Table 1).

c. In your opinion, would each of these (unmarked PC dimensions/ sub-dimensions) indicate the level of complexity of production environment?
d. **If 'no'**, why is that?

Q4. Does PC affect the percentage of both direct and indirect costs in your business-unit's cost structure?

<u>Probes:</u>
If 'yes', how?
If 'no', why?

Q5. Do you think that PC has an impact on costing system complexity?

<u>Probes:</u>
If 'yes', can you explain how?
Does each dimension have an influence on each of the following:

a. Number of cost centres/cost pools.
b. Number of allocation rates/cost drivers.
c. The nature of cost centres/cost pools (departments/functional-based versus activity-based).
d. The type of bases used when calculating the overhead allocation rate/nature of cost drivers (unit, batch, and product-sustaining levels).

If 'no', can you explain why?

Part 3 AMT:

Q6. To what extent does your business-unit use advanced manufacturing technologies (AMT)?

Probes:

If 'used to any extent', can you indicate what type of AMT your business-unit uses?
Does your business-unit use:

a. Product design technologies (e.g., computer-aided design (CAD), computer-aided engineering (CAE), computer-aided process planning (CAPP)).
b. Manufacturing or process technologies (e.g., computer numerical control (CNC), computer-aided manufacturing (CAM), flexible manufacturing systems (FMS)).
c. Logistic/planning technologies (e.g., material requirements planning (MRP), the use of computer and software for factory floor and production control, and manufacturing resources planning (MRP II)).
d. Information exchange technologies (e.g., electronic data interchange (EDI)).

If 'not used', can you tell me whether your business-unit use any of the following technologies:

a. Product design technologies (e.g., Computer-aided Design (CAD), computer-aided engineering (CAE), computer-aided process planning (CAPP)).
b. Manufacturing or process technologies (e.g., computer numerical control (CNC), computer-aided manufacturing (CAM), flexible manufacturing systems (FMS)).
c. Logistic/planning technologies (e.g., material requirements planning (MRP), the use of computer and software for factory floor and production control, and manufacturing resources planning (MRP II)).
d. Information exchange technologies (e.g., electronic data interchange (EDI)).

Q7. If the answer of Q6 is 'yes', can you tell me what are the benefits that your business-unit intends to achieve or intended to achieve from using AMT?

Probes:

For example:

a. Increasing quality.
b. Increasing manufacturing flexibility (i.e., allowing the production of small volumes of different products at mass production costs).
c. Increasing productivity.
d. Increasing functional integration (within functions (e.g., across different manufacturing tasks) and across functions (e.g., between design, engineering and manufacturing).
e. Reducing throughput and lead-time.
f. Reducing work-in process and finished goods inventory levels.
g. High levels of machine utilization.
h. Cost reductions.
i. Reducing floor space.
j. Allowing production of a wide range of products.

Have AMT assisted your business-unit to obtain the intended benefits?

Q8. Do you differentiate between the different levels of costs? i.e., do you measure unit, batch, product, and facility costs?
(**If needed, I will illustrate briefly to the interviewee the meaning of each level of costs**)

- Unit-level costs are the costs of activities performed each time a unit of a product is produced. Examples include: raw material, packaging material, direct wages paid to production workers, and machine operation costs (repair and maintenance, depreciation and energy).

- Batch-level costs are the costs of activities performed each time a group (i.e., batch) of units of a product rather than the individual unit of a product is produced. Examples include: costs related to preparing, setting-up machines for new production runs, purchasing and receiving materials, possessing a customer order, scheduling production, first-item inspection, cleaning, and moving materials.

- Product-sustaining costs are the costs of activities performed to produce a specific product regardless of the number of units or batches produced for the product. Examples include: costs related to registering the product, maintaining and updating product specifications, special testing and tooling for individual products, technical support provided for individual products, making changes to the product's production process and package design, marketing, and research and development.

- Facility-level costs are the costs of activities performed to support the whole factory's manufacturing process, and they are common to all products produced within the factory. Examples include: factory manager and administrative costs, safety inspection, building depreciation, insurance, rent, and all general expenses, such as security and landscaping.

Probes:
If 'yes', can you tell me what are the percentage of each level of costs?
If 'no', would you be able to easily identify the percentage of each level from your records?

Q9. Were there reductions in costs as a result of using AMT?

Probes:
If 'yes', can you specify?
Were there reductions in costs related to:
a. Setup
b. Changing over production from one product to another
c. Scheduling production run costs
d. Inspection, rework, scrap, waste, customer service, and field support costs
e. Direct labour and indirect labour costs
f. Product design costs

If 'no', can you tell me why?

Part 4: The influences on and the outcomes of CSC

Q10. What are the main factors that have imposed an additional need for your business-unit to have a more complex costing system? (I will mark any factor mentioned by the interviewee in the Table 2 below and add to it any new factor not included).

Table 2: Factors influencing CSC

Factors	
Competition. Cost structure. Organisational culture. Production complexity. Business-unit's size. Top management support. The importance of cost information in decision-making. Business-unit's nationality. AMT.	
Other factors mentioned by the interviewee	

Probes:
For each factor, how?

Q11. From your experience, do you think each of the following factors might have an impact on CSC? (Even though some of the following factors might have been already mentioned by the interviewee when answering Q10, I will emphasise on the WHY question).

a. The level of competition that your business-unit faces (i.e., product, materials, and price competition). Why?
b. The cost structure (the percentage of overhead/indirect costs to total costs). Why?
c. The culture of the business-unit in terms of the focus on achievements, details, and the level of control (i.e., loose or tight). Why?
d. The size of your business-unit (the number of employees and the amount of annual sales revenue). Why?
e. The support provided by top management. Why?
f. The importance of cost information in decision-making. Why?
g. The nationality of the business unit (i.e., Wholly-owned Saudi vs. foreign business-unit). Why?
h. Advanced manufacturing technologies (AMT). Why?

Q12. What kinds of objectives or outcomes does your business-unit intend to achieve from using the costing system?

<u>Probes:</u>
How do you evaluate your business-unit's costing system?

Ending the interview:

Would you add anything that you consider important and related to the topic covered in this interview?

Also, I will ask if it is possible to take a tour around the factory floor or to give me a brochure of the factory production process.[184]

Thank you for given me this valuable information. I appreciate your participation. If you would like to add any further information or ask any question, please feel free to call me on 00966506912416 or e-mail me at aaljabr1@sheffield.ac.uk.

[184] It should be noted that the interviewee might prefer to meet outside the workplace (i.e., the factory). In this case, I will ask the interviewee to bring a brochure of the factory production process. Also, in case the interviewee is not able to answer Q3, Q6, and Q7 when meeting outside the workplace, I will ask him/her to if it is possible to arrange a meeting with the operations or production manager at another time. Also, it might be possible to contact the operations or production manager by phone during the interview to ask him/her these questions (Q3, Q6, and Q7).

Appendix 6-2: Template analysis and the template employed

There are different techniques available for analysing qualitative data, and the choice should be based on the research philosophy - i.e., ontological and epistemological positions - (Collis and Hussey, 2014) and the research approach, i.e., deductive and inductive (Saunders et al., 2009).[185] Qualitative data are non-quantified or non-numeric data that can result from different research strategies (Saunders et al., 2009). Thematic analysis is a well-known technique for use in data analysis in qualitative studies (Attride-Stirling, 2001; Braun and Clarke, 2006; Bryman and Bell, 2011; Vaismoradi et al., 2013). Indeed, some researchers consider it the foundation of all qualitative data analysis techniques, as it equips researchers with the many skills that are needed in other qualitative analysis techniques (Braun and Clarke, 2006). Therefore, they encourage researchers to make learning this method a priority.

To analyse the qualitative data obtained during the exploratory stage, this research used template analysis (e.g., Crabtree and Miller, 1999; King, 1998; 2004), which belongs to the general technique of thematic analysis (e.g., Attride-Stirling, 2001; Braun and Clarke, 2006). When using this technique, researchers aim to produce a coding template, i.e., a list of codes, for themes that were identified from the textual data through an intensive reading and rereading of, for example, interview transcripts (King et al., 2002; King, 2004). At the start, researchers construct the coding template based on a preliminary scan of the transcripts, or a priori, i.e., based on the interview guide, or adopt both approaches (Crabtree and Miller, 1999; King et al., 2002; Fereday and Muir-Cochrane, 2008; Cassell, Bishop, Symon, Johnson and Buehring, 2009). Then, researchers continue the process of adding, deleting and

[185] There are two main approaches to conducting research: deductive and inductive (Sekaran, 2000; Saunders et al., 2009; Bryman and Bell, 2011). The deductive approach is concerned with testing an existing theory, whereas the inductive approach aims to build theory. This research adopted the former.

modifying themes while reading and interpreting the transcripts until the template has been refined into its final form (King et al., 2002; King, 2004).[186] In the template, themes can be organised in either a hierarchical or parallel manner (King, 1998; 2004).

Template analysis was used in this research because of its advantages compared to other qualitative data analysis techniques. These advantages include the fact that template analysis can be employed with a wide range of different epistemological positions, is less time consuming and more flexible - i.e., few specific or rigid procedures - and has principles that are easier to understand and allow researchers to manage large datasets (King, 2004). Table 1 shows the template used in the template analysis.

Table 1: Template (list of codes)

1. Business-units' production and costing systems 1.1 Production and the use of formal costing system. 1.2 The treatment of direct costs. 1.3 The treatment of indirect costs. 1.4 The types of costs included in product costs.
2. Costing system complexity (CSC) 2.1 The assignment of indirect costs to products. 2.2 Other definitions. 2.3 CSC indicators. 2.3.1 Cost centres/pools. 2.3.2 Cost rates' bases/drivers. 2.3.3 ABC. 2.3.4 Others. 2.4 CSC benefits and problems.
3. Production complexity (PC) 3.1 Interviewee's evaluation. 3.1.1 Accounting. 3.1.2 Production. 3.2 Reasons. 3.2.1 Accounting. 3.2.2 Production. 3.3 Dimensions/sub-dimensions. 3.3.1 Production type. 3.3.2 Standardisation (common process). 3.3.3 Standardisation (order vs. stock). 3.3.4 Process diversity.

[186] It can prove challenging deciding when the template has been refined and developed to reach its final form. In this regard, King (2004) pointed out that, as a general rule, the template cannot be considered final unless all of the text has been coded, and the researcher has read the text and scrutinised the codes at least twice.

Table 1: Template (list of codes) (continued)

	3.3.5 Process diversity (automation vs. manual). 3.3.6 Subcontracting. 3.3.7 Product customisation. 3.3.8 Product complexity. 3.3.9 Number of products. 3.3.10 Volume diversity. 3.3.11 Size diversity. 3.3.12 Product's type. 3.3.13 Frequency of introducing new products/changes to products and processes. 3.3.14 Support departments' size. 3.3.15 Support diversity. 3.3.16 Others.
4.	**PC Influence on direct and indirect costs**
5.	**PC influence on CSC**
6.	**AMT usage** 6.1 Design. 6.2 Process. 6.3 Planning. 6.4 Information exchange.
7.	**AMT benefits** **7.1** Quality. 7.2 Flexibility. 7.3 Productivity. 7.4 Integration. 7.5 Throughput time. 7.6 WIP and finished inventory. 7.7 Machine utilisation. 7.8 Cost reductions. 7.9 Floor space. 7.10Variety of products.
8.	**COST levels**
9.	**Cost reductions** 9.1 Setup. 9.2 Production change. 9.3 Production scheduling. 9.4 Quality. 9.5 Labour. 9.6 Design. 9.7 Others.
10.	**CSC influences** 10.1 Competition. 10.2 Cost structure. 10.3 Organisational culture. 10.4 Business-unit size. 10.5 Top management support. 10.6 The importance of cost information in decision-making. 10.7 Business-unit nationality. 10.8 AMT. 10.9 Others.

Table 1: Template (list of codes) (continued)

11. Costing systems outcomes and objectives.

Appendix 6-3: English cover letter

Dear Participant,

I am writing to ask your help in a study of product costing systems used by manufacturing companies in Saudi Arabia. The focus of this questionnaire is to determine the factors that influence costing system design and the usefulness of costing systems. This questionnaire is part of my PhD research at The University of Sheffield, UK which is sponsored by King Faisal University, Saudi Arabia.

You have been chosen to participate in this research project as you work in the manufacturing industry or other industries related to manufacturing (e.g., construction, mining, agriculture, pharmaceuticals and biotechnology).

This research will be useful in providing information about the conditions that necessitate the need to have more detailed costing system, and the role that organisational factors play in facilitating increasing the level of details of costing systems. In addition, this research will provide information about the conditions under which increasing the level of details of costing systems would be effective.

By completing this questionnaire, you will be entered into a draw to receive one of five coupons each with a value of 200 SR purchases from Jarir Bookstore. The responses you provide are confidential, and will not be revealed to any third party. I will not record the results of individual questionnaire respondents or the identities of any respondent or his/her business unit in my work.

If you wish, I will send you a summary of the main findings. Please answer the questions from the perspective of the business unit that most clearly defines where you work (e.g., a head office of a divisionalised company, a division of a divisionalised company, a non-divisionalised company, etc.).

Please do not hesitate to contact me if you have any questions. You can call me on 00966506912416, or e-mail me at aaljabr1@sheffield.ac.uk. After you have completed the questionnaire, please return it in the enclosed stamped addressed envelope.

Thank you for your cooperation,

Abdulrahman Aljabr
Lecturer in Management and Cost accounting, King Faisal University
Research student, The University of Sheffield

Appendix 6-4: Final English paper questionnaire

An exploratory study of costing system design in Saudi Arabia

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Saudi Arabia

The University Of Sheffield.

The University of Sheffield
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1

Section A. The usefulness of product cost information in decision making

Q1. To what extent, if at all, does your business unit use product cost information in the following decisions? (Please circle the appropriate number.)

	Do not make this type of decision	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Product pricing decisions.	0	1	2	3	4	5
b. Make or buy decisions.	0	1	2	3	4	5
c. Cost reduction decisions.	0	1	2	3	4	5
d. Product mix decisions.	0	1	2	3	4	5
e. Product output level decisions.	0	1	2	3	4	5
f. Product design decisions.	0	1	2	3	4	5
g. Evaluating new production process decisions.	0	1	2	3	4	5
h. Product introduction decisions.	0	1	2	3	4	5
i. Product discontinuation decisions.	0	1	2	3	4	5

Q2. To what extent do you agree or disagree with the following statements relating to your perception of the usefulness and accuracy of your costing system in calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. The business unit's costing system provides product cost information that is useful when making different decisions.	1	2	3	4	5
b. I rely on product cost information generated by the business unit's costing system to make different decisions.	1	2	3	4	5
c. I am satisfied with the accuracy of the business unit's costing system at assigning indirect costs to products for the purpose of decision making.	1	2	3	4	5

Section B. Your business unit's costing system

Q3. For the purpose of decision making (e.g., pricing, make or buy, or product introduction decisions), does your business unit include each of the following costs in product costs? (Please tick the appropriate answer.)

1. Direct manufacturing costs (e.g., direct material and direct labour costs).	Yes ( )	No ( )
2. Variable indirect/overhead manufacturing costs (e.g., indirect material, indirect labour, machine energy/maintenance, and factory electricity and water costs).	Yes ( )	No ( )
3. Fixed indirect/overhead manufacturing costs (e.g., factory rent, insurance, and managerial salary costs).	Yes ( )	No ( )
4. Non-manufacturing costs (e.g., sales commissions and shipping costs and executives, secretarial, and public relations employee salaries costs).	Yes ( )	No ( )

The following information relates to Q4, Q5, Q6, and Q7.

The assignment of indirect/overhead costs to cost objects is often a two-stage procedure.

- **The first stage** involves the assignment of different overhead costs to cost centres (also known as cost pools), such as production departments, production lines, machines, or activities. This stage can be done using (1) a direct assignment, (2) a cause-and-effect assignment, or (3) an arbitrary assignment.

- **In the second stage,** one or multiple overhead allocation rates are established for each cost centre (cost pool) to assign overhead costs to cost objects (e.g., product X or product Y). The overhead allocation rates can be based on different bases (also known as cost drivers), such as number of units produced, number of labour or machine hours, number of setups or number of purchase orders.

Q4. Which of the following statements describes the procedure that your business unit uses to assign overhead costs to products for the purpose of decision making? (Please circle the appropriate number.)

1. Overhead costs are not assigned to products, and are regarded as period costs that are charged to the profit and loss account. (If you answered 1, please go to question 8 on page 5.)
2. All overhead costs are accumulated in a single cost centre or cost pool to calculate a plant wide or single overhead rate that is used to assign all overhead costs to products regardless of the number of processes each product needs. (If you answered 2, please go to question 8 on page 5.)
3. Overhead costs are assigned to cost centres (e.g., production departments or machines), and then overhead costs are allocated between products based on bases that are related to the production volume (e.g., number of products produced and number of labour hours).
4. Overhead costs are assigned to cost pools (i.e., activities rather than production departments or machines), and then overhead costs are allocated between products based on cost drivers. Some of these cost drivers are related to the production volume (e.g., number of labour hours), whereas others are not (e.g., the time to set up machines for production).
5. Other methods,
   Please specify:

Q5. **For the purpose of decision making, how many different cost centres (cost pools) are used in the entire costing system used by your business unit when calculating product costs of all products?**

Please write the number here:.....................cost centres (cost pools).

Q6. **For the purpose of decision making, how many different bases (cost drivers) are used when allocating overhead costs accumulated in cost centres (cost pools) to cost objects as described on page 3?**

Please write the number here:.....................bases (cost drivers).

The following information is related to Q7: **(Please refer to the paragraph on page 3 if you need further information).**

- **Direct assignment:** overhead costs can be easily attributed to each cost centre (cost pool).
- **Cause-and-effect assignment:** each cost centre (cost pool) is allocated an amount that represents the real consumption of overhead costs.
- **Arbitrary assignment:** each cost centre (cost pool) is allocated an amount that does not represent the real consumption of overhead costs.

Q7. **To what extent do you agree or disagree with the following statements relating to the level of detail of the costing system used by your business unit for calculating product costs for the purpose of decision making? (Please circle the appropriate number.)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. In the first stage, <u>non-manufacturing</u> overhead costs are assigned to each cost centre (cost pool) by using either a direct assignment or a cause-and-effect assignment.	1	2	3	4	5
b. In the first stage, <u>manufacturing</u> overhead costs are assigned to each cost centre (cost pool) by using either a direct assignment or a cause-and-effect assignment.	1	2	3	4	5
c. In the first stage, arbitrary assignments of overhead costs to cost centres (cost pools) are avoided whenever possible.	1	2	3	4	5
d. The number of cost centres (cost pools) is enough to ensure that each cost centre (cost pool) contains only homogeneous production processes.	1	2	3	4	5
e. The number of overhead allocation bases (cost drivers) is enough to ensure that products are allocated with the amount of overhead costs consumed by them.	1	2	3	4	5
f. When assigning overhead costs from cost centres (cost pools) to products, the costing system uses bases (cost drivers) that represent the actual amount of overhead costs consumed.	1	2	3	4	5

Q8. To what extent do you agree or disagree with the following statements relating to top management's attitude to the costing system when calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Top management considers that the costing system is important to the business unit.	1	2	3	4	5
b. Top management provides support to your business unit's costing system.	1	2	3	4	5
c. Top management has provided adequate resources to implement your business unit's costing system.	1	2	3	4	5

Q9. To what extent do you agree or disagree with the following statements relating to top management's knowledge and awareness about the importance of cost information in decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Top management has the enough knowledge about the importance of cost information in decision making.	1	2	3	4	5
b. Top management is aware of the undesirable consequences of making decisions based on inaccurate cost information.	1	2	3	4	5
c. Top management appreciates the accountants' efforts relating to providing detailed cost information when making decisions.	1	2	3	4	5

Q10. Which of the following best describes your business unit's experience with activity-based costing (ABC)? (Please circle the appropriate number.)

1. Currently using ABC.
2. Intending to use ABC.
3. Currently investigating using ABC.
4. Intending to investigate using ABC.
5. Implemented ABC and subsequently decided to abandon it.
6. Investigated using ABC and decided to reject it.
7. Investigated using ABC and decided to reject it. However, the company established a system of activity analysis or cost driver analysis.
8. Rejected ABC, but never considered using it.
9. Never considered using ABC.

Q11. For your business unit, how important or unimportant is product cost information for each of the following decisions? (Please circle the appropriate number.)

	Do not make this type of decision	Very unimportant	Unimportant	Neutral	Important	Very important
a. Product pricing decisions.	0	1	2	3	4	5
b. Make or buy decisions.	0	1	2	3	4	5
c. Cost reduction decisions.	0	1	2	3	4	5
d. Product mix decisions.	0	1	2	3	4	5
e. Product output level decisions.	0	1	2	3	4	5
f. Product design decisions.	0	1	2	3	4	5
g. Evaluating new production process decisions.	0	1	2	3	4	5
h. Product introduction decisions.	0	1	2	3	4	5
i. Product discontinuation decisions.	0	1	2	3	4	5

Section C. Your business unit's environment and production process

Q12. What is the level of intensity or weakness of each of the following types of competition? (Please circle the appropriate number.)

	Very weak	Weak	Moderate	Intense	Very intense
a. The current level of competition for the major products of your business unit.	1	2	3	4	5
b. The level of price competition for your business unit's major products.	1	2	3	4	5
c. The level of competition for purchasing raw materials for your business unit's major products.	1	2	3	4	5

Q13. Does each of the following describe the type of production of your business unit? (Please tick the appropriate answer.)

1. Mass production.	Yes ( )	No ( )
2. Batch production.	Yes ( )	No ( )
3. Single product or project production.	Yes ( )	No ( )

Q14. Which of the following best describes the percentage of the customised and standardised products produced by your business unit? (Please circle the appropriate number.)

1. At least 95% of products are standardised.
2. Approximately 75% of products are standardised, and 25% of products are customised.
3. Approximately 50% of products are standardised and 50% of products are customised.
4. Approximately 75% of products are customised, and 25% of products are standardised.
5. At least 95% of products are customised.

Q15. To what extent do each of the following statements apply or do not apply to your business unit's products and production environment? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Most products are complex to produce because they contain large number of components.	1	2	3	4	5
b. Most products are complex to produce because they need to pass through large number of production stages/departments.	1	2	3	4	5
c. A large number of different products are produced.	1	2	3	4	5
d. Most products are produced in significantly different sizes.	1	2	3	4	5
e. There are major differences in product volumes or batch sizes.	1	2	3	4	5
f. The manufacturing process is not standardised because changes to the production process need to be made if some factors (e.g., the type of material or machine) have been changed.	1	2	3	4	5
g. The production processes for most products take a long time.	1	2	3	4	5
h. Most products require different processes to design, manufacture and distribute them.	1	2	3	4	5
i. For some or all products, the manufacturing process is partially manual and partially automated.	1	2	3	4	5
j. There are frequent new product introductions.	1	2	3	4	5
k. There are frequent changes in products and production processes.	1	2	3	4	5
l. Each product line requires different levels of support department costs (e.g., engineering, purchasing and marketing costs)	1	2	3	4	5

Q16. **To what extent, if at all, does your business unit use the following types of advanced manufacturing technologies? (Please circle the appropriate number.) (If your answers are 1 (Not at all) for all choices, please go to question 18 on page 9.)**

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Product design technologies: These technologies are used in designing the product (e.g., Computer Aided Design (CAD) and Computer Aided Engineering (CAE)).	1	2	3	4	5
b. Process technologies: These technologies are used on the shop floor, and provide information related to the manufacturing process (e.g., Computer Aided Manufacturing (CAM) and Flexible Manufacturing Systems (FMS)).	1	2	3	4	5
c. Logistic/planning technologies: These technologies are used to control the material flow from the stage of obtaining raw material to the stage of delivering finished products (e.g., Material Requirement Planning systems (MRP).	1	2	3	4	5
d. Information exchange technologies: These technologies are used to facilitate storing and exchanging information among process, product and logistic technologies (e.g., Electronic Data Interchange (EDI)).	1	2	3	4	5

Q17. **To what extent, if at all, have the technologies in question 16 used by your business unit assisted in reducing the following costs? (Please circle the appropriate number.)**

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Setup costs.	1	2	3	4	5
b. Costs of changing over production from one product to another.	1	2	3	4	5
c. Scheduling production runs costs.	1	2	3	4	5
d. First time inspection costs.	1	2	3	4	5
e. Moving material costs.	1	2	3	4	5
f. Other batch-related costs (e.g., preparation, cleaning, laboratory testing, and computer and production management costs).	1	2	3	4	5
g. Product design costs.	1	2	3	4	5

Q18. **To what extent do you agree or disagree that the manufacturing technologies used by your business unit can perform the following functions? (Please circle the appropriate number.)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. The ability to switch production from one product to another easily without incurring significant costs and taking much time.	1	2	3	4	5
b. The ability to perform various types of operations without requiring prohibitive efforts when switching from one operation to another.	1	2	3	4	5
c. The ability to produce products in different ways.	1	2	3	4	5
d. The ability to respond easily to changes in production volume.	1	2	3	4	5
e. The ability to produce different products in low volumes without incurring significant costs (i.e., economies of scope).	1	2	3	4	5
f. The ability to add and remove new products from the product mix.	1	2	3	4	5
g. The ability to make design changes to existing products.	1	2	3	4	5
h. The ability to produce a wide range of different products without investing in new major capital equipment.	1	2	3	4	5

Section D. Your business unit

Q19. **Below is a list of different values that may be used to reflect and describe the nature of your business unit's work environment. To what extent, if at all, is each of the following valued in your business unit? (Please circle the appropriate number.)**

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Being competitive.	1	2	3	4	5
b. Focus on achievements.	1	2	3	4	5
c. Having high expectations for performance.	1	2	3	4	5
d. Focus on action.	1	2	3	4	5
e. Focus on results.	1	2	3	4	5
f. Paying attention to detail.	1	2	3	4	5
g. Being precise.	1	2	3	4	5
h. Being careful.	1	2	3	4	5

Q20. **Below is a list of different practices that may be used to reflect and describe the nature of your business unit's work environment. To what extent, if at all, does each item represent a current practice of your business unit? (Please circle the appropriate number.)**

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Employee expectations are specified in detail.	1	2	3	4	5
b. Desired results are defined explicitly.	1	2	3	4	5
c. Work rules and/or specific work polices are used widely.	1	2	3	4	5
d. Direct supervision of employee activities takes place frequently.	1	2	3	4	5
e. Frequent monitoring of employee performance takes place.	1	2	3	4	5
f. Performance measures are precise and timely.	1	2	3	4	5
g. Performance reviews are detailed, comprehensive and frequent.	1	2	3	4	5
h. There is a strong link between the penalties imposed or rewards provided and the performance measures used.	1	2	3	4	5

Q21. **What is the percentage of each of the following costs in your business unit's total costs? (Please insert the appropriate percentage.)**

	%
Direct manufacturing costs.	( )
Indirect/overhead manufacturing costs.	( )
Non-manufacturing costs.	( )
Total costs.	**100%**

Q22. **Is your company a wholly Saudi-owned company? (Please circle the appropriate number.)**

1. Yes.
2. No.

Q23. What is the approximate amount of your business unit's sales revenue in the last financial year? (Please circle the appropriate number.)

1. Less than 10 million riyals.
2. 10 to 30 million riyals.
3. More than 30 to 75 million riyals.
4. More than 75 to 100 million riyals.
5. More than 100 to 150 million riyals.
6. More than 150 to 200 million riyals.
7. More than 200 to 300 million riyals.
8. More than 300 to 500 million riyals.
9. More than 500 million riyals.

Q24. What is the approximate number of employees of your business unit?

Please record the approximate number here: .... employees.

Q25. Which of the following best describes your business unit? (Please circle the appropriate number.)

1. A head office of a divisionalised company.
2. A division of a divisionalised company.
3. A branch of a division of a divisionalised company.
4. An autonomous company.
5. Others,
   Please specify: ....

Q26. What is the industrial sector of your business unit?

....

Q27. What is your role/position within the business unit where you work?

....

Thank you for taking the time to complete this questionnaire. I am grateful for your assistance in providing this information. If you would you like to add any comments about the questionnaire or your costing system, please use the space below.

1 - Would you like to participate in a follow up interview about your costing system? (If so, please tick your response.)
Yes ( ) No ( )

2 - Would you like to receive a summary of the study's results? (If so, please tick your response.)
Yes ( ) No ( )

3 – Do you accept receiving following up questions about your answers to the questionnaire? (If so, please tick your response.)
Yes ( ) No ( )

4 - Can you please provide me with your contact information? This information is needed for three purposes:

1. To contact you in case you agreed to be interviewed.
2. To contact you if further information is needed about your answers to the questionnaire.
3. To send you a summary of the study's results if you have requested them.

Name: ....
E-mail address: ....
Phone Number: ....

Thank you for your cooperation in completing this questionnaire. Please do not hesitate to contact me if you have any questions. You can call me (Abdulrahman Aljabr) on 00966506912416, or e-mail me at aaljabr1@sheffield.ac.uk. After you have completed the questionnaire, please return it in the enclosed stamped addressed envelope.

Appendix 6-5: Extracts from the final English online questionnaire

An exploratory study of costing system design in Saudi Arabia

Welcome

Welcome to the questionnaire: An exploratory study of costing system design in Saudi Arabia

The focus of this questionnaire is to investigate the factors that influence costing system design and the usefulness of costing systems in Saudi manufacturing industry. This research aims to provide information about the conditions that necessitate the need to have more detailed costing systems, and the role that organisational factors play in facilitating increasing the level of detail of costing systems. In addition, this research will provide information about the conditions under which increasing the level of detail of costing systems could be effective.

I would be very grateful if you participate in this research by completing this questionnaire. The responses you provide are confidential, and will not be revealed to any third party. I will not record the results of individual questionnaire respondents or the identities of any respondent in my work. Please do not hesitate to contact me if you have any questions. You can call me on 00966506912416, or e-mail me at aaljabr1@sheffield.ac.uk.

Thank you for your cooperation,
Abdulrahman Aljabr
Lecturer in Management and Cost Accounting, King Faisal University
Research student, The University of Sheffield

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An exploratory study of costing system design in Saudi Arabia

Section B: Your business unit's costing system

Q3 of 27

For the purpose of decision making (e.g., pricing, make or buy, or product introduction decisions), does your business unit include each of the following costs in product costs? (Please tick the appropriate choice.)

	Yes	No
Direct manufacturing costs (e.g., direct material and direct labour costs).	○	○
Variable indirect/overhead manufacturing costs (e.g., indirect material, indirect labour, machine energy/maintenance, and factory electricity and water costs).	○	○
Fixed indirect/overhead manufacturing costs (e.g., factory rent, insurance, and managerial salary costs).	○	○
Non-manufacturing costs (e.g., sales commissions and shipping costs and executives, secretarial, and public relations employee salaries costs).	○	○

An exploratory study of costing system design in Saudi Arabia

Q5 of 27

For the purpose of decision making, how many different cost centres (cost pools) are used in the entire costing system used by your business unit when calculating product costs of all products? (Please write the number of cost centres (cost pools) in the box below.)

Q6 of 27

For the purpose of decision making, how many different bases (cost drivers) are used when allocating overhead costs accumulated in cost centres (cost pools) to cost objects as described on the previous page? (Please write the number of bases (cost drivers) in the box below.)

Q11 of 27

For your business unit, how important or unimportant is product cost information for each of the following decisions? (Please tick the appropriate choice.)

	Do not make this type of decision	Very unimportant	Unimportant	Neutral	Important	Very important
Product pricing decisions.	○	○	○	○	○	○
Make or buy decisions.	○	○	○	○	○	○
Cost reduction decisions.	○	○	○	○	○	○
Product mix decisions.	○	○	○	○	○	○
Product output level decisions.	○	○	○	○	○	○
Product design decisions.	○	○	○	○	○	○
Evaluating new production process decisions.	○	○	○	○	○	○
Product introduction decisions.	○	○	○	○	○	○
Product discontinuation decisions.	○	○	○	○	○	○

Save and Continue Later | Previous Page | Next Page

An exploratory study of costing system design in Saudi Arabia

Section C. Your business unit's environment and production process

Q12 of 27

What is the level of intensity or weakness of each of the following types of competition? (Please tick the appropriate choice.)

	Very weak	Weak	Moderate	Intense	Very intense
The current level of competition for the major products of your business unit.	○	○	○	○	○
The level of price competition for your business unit's major products.	○	○	○	○	○
The level of competition for purchasing raw materials for your business unit's major products.	○	○	○	○	○

Q13 of 27

Does each of the following describe the type of production of your business unit? (Please tick the appropriate choice.)

	Yes	No
Mass production.	○	○
Batch production.	○	○
Single product or project production.	○	○

Save and Continue Later Previous Page Next Page

Q21 of 27

What is the percentage of each of the following costs in your business unit's total costs? (Please insert the appropriate percentage in the boxes below.)

Direct manufacturing costs. [ ]

Indirect/overhead manufacturing costs. [ ]

Non-manufacturing costs. [ ]

Total costs **100%**

Q22 of 27

Is your company a wholly Saudi-owned company? (Please tick the appropriate choice.)

- Yes.
- No.

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4 - Can you please provide me with your contact information? This information is needed for four purposes:

1. To prevent reminder e-mails to be sent to your e-mail.
2. To contact you in case you agreed to be interviewed.
3. To contact you if further information is needed about your answers to the questionnaire.
4. To send you a summary of the study's results if you have requested them.

Name [ ]

Email address [ ]

Phone number [ ]

Company's name [ ]

Thank you for your cooperation in completing this questionnaire. Please do not hesitate to contact me if you have any questions. You can call me (Abdulrahman Aljabr) on 00966506912416, or e-mail me at aaljabr1@sheffield.ac.uk.

Save and Continue Later | Previous Page | Finish questionnaire

You have finished completing this questionnaire.

Thank you for your time.

Appendix 6-6: Full list of the design-related guidelines followed in preparing the questionnaire

Table 1: Guidelines followed for the visual presentation of the questions and questionnaire pages and screens

General guidelines for the visual presentation of the questionnaire questions:

5. Using darker and larger print for the questions stems and lighter and smaller print for the answer choices and spaces.
6. Making the answer choices to appear as one subgroup of the larger question group through spacing and indenting.
7. Standardising all answer spaces and options, i.e., making them look alike.
8. Using visual design proprieties, e.g., bolding, to emphasise information that is important to respondents.
9. Ensuring the legibility of the text through using appropriate font, font size and line length.
10. Locating the instructions in the places where they will be used.
11. Placing optional and occasionally needed instructions between parentheses.

General guidelines for the visual presentation of open-ended questions:

1. Providing answer boxes according to the number of answers needed.
2. Ensuring that the size of the answer space is sufficient for the response task.
3. Using labels that identify the answer needed next to the answers spaces.

General guidelines for the visual presentation of close-ended questions:

1. Aligning the response options vertically in one column or horizontally in one row and keeping equal distance between the answer choices.
2. Using different shapes for the answer spaces - e.g., circles and squares - to assist respondents to distinguish between single and multiple-answer questions (**Online questionnaire**).

General guidelines for the visual presentation of the questionnaire pages and screens:

1. Making more spaces between questions than between the questions and answers.
2. Maintaining a consistent visual presentation of the questions throughout the questionnaire and using vertical alignment to organise the beginning of questions and answer options.
3. Grouping related information in regions.
4. Using consistent beginnings of questions and sections throughout the questionnaire, e.g., reverse print.
5. Numbering questions from the beginning to the end and avoiding restating numbers in each section.
6. Using visual design proprieties, e.g., bolding, consistently throughout the questionnaire to emphasise information that is important to respondents.
7. Avoiding visual clutter and increasing the proportion of blank space.
8. Avoiding presenting questions side by side on one page.
9. Minimising the complexity of grids and matrices by, for example, horizontally highlighting every other row in the grid or matrix and hiding the gridlines.

Table 2: Guidelines followed for the design of the online questionnaire

3. Ensuring that the questions are presented in a similar way across different devices and operating systems.
4. Presenting multiple questions per page, i.e., screen, for long questionnaires.
5. Creating interesting and informative welcome and closing screens that display certain information.
6. Making the screen format more focused on respondents rather than the sponsor.
7. Using a consistent page layout across the screens and a visual emphasis for important information.
8. Allowing respondents to go back to previous questions and pages.
9. Avoiding asking respondents to provide answers to some questions in order for respondents to be allowed to proceed to the following question or screen.
10. Avoiding including a graph that indicates the progress of completing the questionnaire and including the question number instead.
11. Avoiding including audios or videos in the questionnaire.
12. Allowing respondents to save their responses to the questionnaire and complete it later.

Table 3: Guidelines followed for the design of the paper questionnaire

3. Constructing the questionnaire in a booklet format.
4. Creating interesting and informative front and back cover pages.

Table 4: Design-related guidelines followed when applying the mixed-mode questionnaire:

3. Using the same question, answer format and wording across questionnaire modes.
4. Using similar visual formats across the modes.
5. Avoiding using features available only in the online questionnaire, e.g., embedded links to definitions or additional information, when they are likely to cause measurement differences.

Appendix 6-7: Full list of the forming/ordering question-related guidelines followed in preparing the questionnaire

Table 1: Guidelines followed for forming the questions

The guidelines followed in relation to question formation:

1. Choosing appropriate and using a variety of question formats.
2. Attempting to ask questions that are applicable to respondents.
3. Asking one question at a time.
4. Ensuring that the questions are accurate.
5. Using simple and familiar words and terms.
6. Using specific and concrete words to specify the concepts clearly.
7. Presenting the question in the shortest possible way without affecting clarity.
8. Using complete sentences to ask the questions.
9. Avoiding double-negative questions.
10. Organising the question in a way that makes it easier for respondents to comprehend the answer task.

The guidelines followed in relation to open-ended question formation:

1. Specifying in the question stem the type of response desired.
2. Using as few descriptive open-ended questions as possible, and, when used, a motivation phrase should be added.

The guidelines followed in relation to closed-ended question formation:

1. Stating both the positive and negative sides in the question stem, e.g., agree/disagree, when using bipolar ordinal scales, i.e., those that measure graduation along two opposite dimensions, such as agree/disagree. Adding “if at all” to the question stem when using unipolar ordinal scales, i.e., those that measure graduation along one dimension where the zero point represents one end of the scale, e.g., very successful to not at all successful.
2. Providing a list of all reasonable possible answers for each question.
3. Providing a list of answers that are mutually exclusive.
4. Using forced-choice questions rather than check-all-that-apply questions.
5. Avoiding mixing unipolar and bipolar scales in one question.
6. Limiting the bipolar and unipolar ordinal scales length to five points and ensuring that the ordinal scales are presented in the same direction in the entire questionnaire.
7. Asking the questions in a way that matches the response scale.
8. Keeping an equal distance between the points of the ordinal scale.

Table 2: Guidelines followed for ordering questions

3. Grouping related questions together in one section.
4. Using starting questions that are important to all or most respondents.
5. Placing sensitive and objectionable questions near the end of the questionnaire.
6. Asking filter questions before follow-up questions.

Appendix 6-8: Information about questions used for constructs not included in the research model

Table 1: Information about questions used for constructs not included in the research model

Question number	Objective of question	Sources
Q3	To identify the types of costs included in product costs.	The researcher.
Q4	To identify the method used for assigning overhead costs to products.	The researcher.
Q13	To identify the production type.	Adopted from Malmi (1999).
Q22	To identify whether the respondent works in a wholly Saudi-owned business-unit or not.	The researcher.
Q25	To identify how respondents define their business-unit's position.	Adapted from Brierley (2007; 2008c).
Q26	To identify the business-unit's manufacturing sector.	The researcher.
Q27	To identify the respondent role within the business-unit.	The researcher.
Q10	To identify the experience with ABC.	Adopted from Brierley (2011).
Q16	To identify the extent of AMT usage.	Adapted from Swamidass and Kotha (1998) and Kotha and Swamidass (2000).
Q17	To identify the extent to which AMT has assisted in reducing batch- and product-level costs.	The researcher.
Q18	To identify the level of production flexibility.	Adapted from Kaplan (1986b), Gupta and Somers (1996), Boyer, Leong, Ward and Krajewski (1997) and Swamidass and Kotha (1998).

Appendix 6-9: Full list of the pre-testing-related guidelines followed in pre-testing the questionnaire

Table 1: Guidelines followed for testing questions and questionnaires

1. Obtaining feedback on the questionnaire draft from experts, i.e., experts review.
2. Conducting cognitive and retrospective interviews of the complete questionnaire.
3. Pilot-testing the questionnaire **(Online questionnaire)**.
4. Conducting testing in the mode/s that will be used in the final questionnaire.

Table 2: Guidelines followed for quality control and testing the online questionnaire

1. Testing the online questionnaire through expert review, cognitive interviews and pilot-testing.
2. Testing the online questionnaire using different devices and operating systems, and testing the database to ensure that the data are collected and coded correctly.
3. Providing contact information in case respondents have enquiries.
4. Developing procedures to ensure data security, e.g., storing identifying information separately from the questionnaire responses.

Table 3: Guidelines followed for quality control and testing the paper questionnaire

1. Testing the paper questionnaire through expert reviews and cognitive interviews.
2. Providing contact information in case respondents have enquiries.

Appendix 6-10: Arabic cover letter

The University Of Sheffield.

أخي/أختي العزيز/ه

السلام عليكم ورحمة الله وبركاته

إنني أكتب لك هذا الخطاب سائلا مساعدتك في بحثي المتعلق بأنظمة التكاليف المستخدمة من قبل الشركات العاملة في القطاع الصناعي بالمملكة العربية السعودية. إن هدف هذا الإستبيان هو التعرف على العوامل التي تؤثر على تفصيل أنظمة التكاليف المطبقة في القطاع الصناعي السعودي ومدى منفعة هذه الأنظمة. هذا الإستبيان هو جزء من بحث الدكتوراة الذي أجريه في جامعة شيفلد البريطانية، والذي تقوم بدعمه جامعة الملك فيصل بالمملكة العربية السعودية.

لقد تم إختيارك للمشاركة في هذا البحث لإنك تعمل في القطاع الصناعي أو قطاعات أخرى متعلقة بالصناعة (كقطاع المقاولات، وقطاع التعدين، وقطاع الزراعة، وقطاع الأدوية والمواد الحيوية). إن هذا البحث سوف يكون مفيد من خلال تقديم معلومات عن الحالات التي تُوجب على المنشآت زيادة تفصيل نظام التكاليف المطبق لديهم، وعن دور بعض العوامل الخاصة بالمنشأة في تسهيل عملية زيادة تفصيل النظام. إضافة إلى ذلك، يسعى هذا البحث إلى تزويد معلومات عن الحالات التي يكون عندها زيادة تفصيل أنظمة التكاليف أمرا نافعا ومفيدا للمنشآت.

بإكمالك لهذا الإستبيان، سوف يدخل إسمك السحب للفوز بكوبون من خمس كوبونات مشتريات بقمة 200 ريال لكل كوبون من مكتبة جرير. الأجوبة التي سوف تقوم بتقديمها ستكون سرية ولن يفصح عنها إلى أي طرف ثالث. لن أقوم بالإفصاح عن أجوبة أي استبيان بعينه أو عن هوية أي مشارك أو عن هوية منشأته عند كتابة نتائج هذا البحث.

سوف أقوم بإرسال ملخص نتائج الدراسة إليك إذا رغبت بذلك. من فضلك أجب على الإستبيان من وجهة نظر المنشأة التي تعمل بها (مثلا، المكتب الرئيسي لمجموعة شركات، شركة تابعة لمجموعة شركات، شركة مستقلة، إلخ).

من فضلك لا تتردد بالتواصل معي في حال وجود أي سؤال. يمكنك التواصل معي على رقم: 0506912416، أو التواصل معي من خلال البريد الإلكتروني: aaljabr1@sheffield.ac.uk .

بعد إكمالك الإستبيان، أرجو إرساله في الظرف المرفق.

أشكرك على تعاونك،

عبدالرحمن الجبر

محاضر محاسبة إدارية وتكاليف، جامعة الملك فيصل

باحث، جامعة شيفلد البريطانية

Appendix 6-11: Final Arabic paper questionnaire

دراسة إستكشافية لأنظمة التكاليف المطبقة في المملكة العربية السعودية

جامعة الملك فيصل
كلية إدارة الأعمال
ص.ب.:6128
الهفوف, 31982
المملكة العربية السعودية

The University of Sheffield
Management School
Conduit Road
Sheffield S10 1FL
United Kingdom

قسم أ: منفعة معلومات تكاليف المنتجات في اتخاذ القرارات

س1. إلى أي مدى تقوم منشأتكم باستخدام معلومات تكاليف المنتجات عند اتخاذ القرارات التالية؟ (من فضلك ضع دائرة على الرقم المناسب.)

	لا نقوم باتخاذ هذا القرار	لا نستخدمها عند اتخاذ هذا القرار	إلى مدى بسيط جدا	إلى مدى معقول	إلى مدى كبير	إلى مدى كبير جدا
أ. قرارات تسعير المنتجات.	0	1	2	3	4	5
ب. قرارات الشراء أو الصنع.	0	1	2	3	4	5
ت. قرارات تخفيض التكاليف.	0	1	2	3	4	5
ث. قرارات مزيج المنتجات.	0	1	2	3	4	5
ج. قرارات تحديد كمية إنتاج المنتجات.	0	1	2	3	4	5
ح. قرارات تصميم المنتجات.	0	1	2	3	4	5
خ. قرارات تقييم طرق الإنتاج الجديدة.	0	1	2	3	4	5
د. قرارات تقديم منتجات جديدة.	0	1	2	3	4	5
ذ. قرارات توقف إنتاج بعض المنتجات.	0	1	2	3	4	5

س2. إلى أي مدى توافق أو لا توافق على العبارات التالية المتعلقة برأيك عن دقة ومنفعة نظام التكاليف المطبق لديكم بالمنشأة في حساب تكاليف المنتجات لأغراض اتخاذ القرارات؟ (من فضلك ضع دائرة على الرقم المناسب.)

	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
أ. نظام التكاليف المطبق لدينا بالمنشأة يقوم بتوفير معلومات تكاليف مفيدة عند اتخاذ قرارات مختلفة.	1	2	3	4	5
ب. أنا أعتمد على معلومات تكاليف المنتجات الصادرة من نظام التكاليف المطبق لدينا بالمنشأة عند اتخاذ قرارات مختلفة.	1	2	3	4	5
ت. أنا راضي عن دقة نظام التكاليف المطبق لدينا بالمنشأة من ناحية توزيع التكاليف غير المباشرة على المنتجات لأغراض اتخاذ القرارات.	1	2	3	4	5

قسم ب: نظام التكاليف المطبق لديكم بالمنشأة

س3. لأغراض اتخاذ القرارات (مثلا: قرارات التسعير، الشراء أو الصنع، أو قرارات تقديم منتجات جديدة)، هل تدخل كل تكلفة من التكاليف التالية في تحديد تكلفة المنتج؟ (من فضلك أشر على الخيار المناسب.)

1. التكاليف الصناعية المباشرة (مثلا، تكاليف المواد والعمالة المباشرة).	نعم ( )	لا ( )
2. التكاليف الصناعية غير المباشرة المتغيرة (مثلا، مواد غير مباشرة، عمالة غير مباشرة، وقود وصيانة الآلات، تكاليف مياه وكهرباء المصنع).	نعم ( )	لا ( )
3. التكاليف الصناعية غير المباشرة الثابتة (مثلا، إيجار المصنع، التأمين، راتب مدير المصنع).	نعم ( )	لا ( )
4. التكاليف غير الصناعية (مثلا، عمولات رجال البيع ومصاريف الشحن و رواتب الرؤساء والسكرتارية وموظفي العلاقات العامة).	نعم ( )	لا ( )

المعلومات التالية تخص س4، س5، س6، وس7.

يتم معالجة التكاليف غير المباشرة بتحميلها على المنتجات وفق مرحلتين أساسيتين.

- **المرحلة الأولى** تتضمن تحميل أنواع مختلفة من التكاليف غير المباشرة على مراكز التكلفة (تعرف أيضا بمجمعات التكلفة) ، مثل المراكز الإنتاجية، خطوط الإنتاج، الآلات، أو الأنشطة. يتم التحميل في هذه المرحلة بأحد الأساليب التالية: (1) التحميل المباشر، (2) التحميل الإرتباطي، أو (3) التحميل العشوائي.

- **في المرحلة الثانية** يتم تحديد معدل تحميل أو عدة معدلات تحميل لكل مركز أو مجمع تكلفة لتحميل التكاليف غير المباشرة على المنتجات. يحسب معدل أو معدلات التحميل بناء على أسس تحميل مختلفة (تعرف أيضا بمسببات التكلفة) مثل عدد الوحدات المنتجة، عدد ساعات العمالة المباشرة، عدد ساعات تشغيل الآلات، عدد مرات إعداد وتجهيز الآلات، أو عدد طلبات الشراء.

س4. ماهي العبارة التي توضح العملية المتبعة من قبل منشأتكم فيما يخص تحميل التكاليف غير المباشرة على المنتجات لأغراض اتخاذ القرارات؟ (من فضلك ضع دائرة على الرقم المناسب.)

1. التكاليف غير المباشرة لا تحمل على المنتجات، وتعتبر تكاليف فترة تعالج في حساب الأرباح والخسائر. (إذا اخترت الإجابة رقم 1، فضلا إذهب لسؤال 8 في صفحة 5.)
2. يتم تجميع كل التكاليف غير المباشرة في مركز تكلفة أو مجمع تكلفة واحد من أجل حساب معدل تحميل واحد لتحميل هذه التكاليف غير المباشرة على المنتجات بغض النظر عن عدد العمليات الإنتاجية اللازمة لتصنيع كل منتج. (إذا اخترت الإجابة رقم 2، فضلا إذهب لسؤال 8 في صفحة 5.)
3. التكاليف غير المباشرة تحمل على مراكز التكلفة (بعبارة أخرى، المراكز الإنتاجية أو الآلات)، ومن ثم يتم توزيع هذه التكاليف غير المباشرة على المنتجات بناءاً على أسس تحميل مرتبطة فقط بحجم الإنتاج (مثلا: عدد الوحدات المنتجة، و عدد ساعات العمالة المباشرة).
4. التكاليف غير المباشرة تحمل على مجمعات تكلفة (بعبارة أخرى، على الأنشطة وليس على المراكز الإنتاجية أو الآلات)، ومن ثم يتم توزيع هذه التكاليف غير المباشرة على المنتجات باستخدام بما يعرف بمسببات التكلفة بحيث أن يكون بعض من هذه المسببات مرتبط بحجم الإنتاج (مثلا: عدد ساعات العمالة المباشرة) والبعض الآخر غير مرتبط بحجم الإنتاج (مثلا: الوقت المستغرق لإعداد وتجهيز الآلات للإنتاج).
5. طرق أخرى،
من فضلك حدد:

س5. لأغراض إتخاذ القرارات، ما هو العدد الإجمالي لمراكز التكلفة (مجمعات التكلفة) المستخدمة من قبل نظام التكاليف المطبق لديكم بالمنشأة عند حساب تكاليف جميع المنتجات؟

من فضلك اكتب العدد هنا: ___________ مراكز تكلفة (مجمعات تكلفة).

س6. لأغراض اتخاذ القرارات، ما هو عدد أسس التحميل (مسببات التكلفة) المستخدمة لتحميل التكاليف غير المباشرة المجمعة في مراكز التكلفة (مجمعات التكلفة) على المنتجات كما سبق توضيحه في صفحة 3 ؟

من فضلك اكتب العدد هنا: ___________ أسس التحميل (مسببات التكلفة).

المعلومات التالية تخص س7. (من فضلك راجع الشرح الموجود في صفحة 3 إذا رغبت في الحصول على معلومات إضافية.)

. **التحميل المباشر:** والذي يتم عنده تحميل التكاليف غير المباشرة على مراكز التكلفة (مجمعات التكلفة) بشكل بسيط وواضح لإرتباط التكاليف غير المباشرة بشكل مباشر بمراكز التكلفة (مجمعات التكلفة).

. **التحميل الإرتباطي:** والذي يتم عنده تحميل كل مركز تكلفة (مجمع تكلفة) بنصيب معين من التكاليف غير المباشرة، ويعكس هذا النصيب المحمل القيمة الحقيقية المستخدمة من التكاليف غير المباشرة.

. **التحميل العشوائي:** والذي يتم عنده تحميل كل مركز تكلفة (مجمع تكلفة) بنصيب معين من التكاليف غير المباشرة، والذي لا يعكس القيمة الحقيقية المستخدمة من التكاليف غير المباشرة.

س7. إلى أي مدى توافق أو لا توافق على العبارات التالية المتعلقة بدرجة تفصيل نظام التكاليف المستخدم من قبل منشأتكم في حساب تكاليف المنتجات لأغراض اتخاذ القرارات؟ (من فضلك ضع دائرة على الرقم المناسب.)

	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
أ. في المرحلة الأولى، يتم تحميل التكاليف غير الصناعية غير المباشرة على مراكز التكلفة (مجمعات التكلفة) باستخدام طريقة التحميل المباشر أو التحميل الإرتباطي.	1	2	3	4	5
ب. في المرحلة الأولى، يتم تحميل التكاليف الصناعية غير المباشرة على مراكز التكلفة (مجمعات التكلفة) باستخدام طريقة التحميل المباشر أو التحميل الإرتباطي.	1	2	3	4	5
ت. في المرحلة الأولى، يتم تجنب -بقدر الإمكان- تحميل التكاليف غير المباشرة على مراكز التكلفة (مجمعات التكلفة) بشكل عشوائي.	1	2	3	4	5
ث. يوجد عدد كافي من مراكز التكلفة (مجمعات التكلفة)، والذي يضمن احتواء كل مركز تكلفة (مجمع تكلفة) على عمليات إنتاجية متشابهة.	1	2	3	4	5
ج. يوجد عدد كافي من أسس التحميل (مسببات التكلفة)، والذي يضمن تحميل كل منتج بالمقدار الحقيقي المستخدم من التكاليف غير المباشرة.	1	2	3	4	5
ح. عند توزيع التكاليف غير المباشرة المجمعة في كل مركز تكلفة (مجمع تكلفة) على المنتجات، يتم إستخدام أسس تحميل (مسببات تكلفة)، والتي تعبر عن القيمة الحقيقية المستخدمة من التكاليف غير المباشرة.	1	2	3	4	5

س8. إلى أي مدى توافق أو لا توافق على العبارات التالية المتعلقة بموقف الإدارة العليا من نظام التكاليف فيما يتعلق بحساب تكاليف المنتجات لأغراض اتخاذ القرارات؟ (من فضلك ضع دائرة على الرقم المناسب.)

	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
أ. الإدارة العليا تعتبر أن نظام التكاليف مهم للمنشأة.	1	2	3	4	5
ب. الإدارة العليا توفر دعم لنظام التكاليف المطبق لديكم بالمنشأة.	1	2	3	4	5
ت. الإدارة العليا توفر الموارد اللازمة لتطبيق نظام التكاليف المستخدم في منشأتكم.	1	2	3	4	5

س9. إلى أي مدى توافق أو لا توافق على العبارات التالية المتعلقة بإدراك ومعرفة الإدارة العليا بأهمية معلومات التكاليف في اتخاذ القرارات؟ (من فضلك ضع دائرة على الرقم المناسب.)

	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
أ. الإدارة العليا لديها المعرفة الكافية بأهمية معلومات التكاليف في اتخاذ القرارات.	1	2	3	4	5
ب. الإدارة العليا لديها الوعي التام بالنتائج الغير مرغوب بها عند اتخاذ قرارات بناء على معلومات تكاليف غير دقيقة.	1	2	3	4	5
ت. الإدارة العليا تقدر جهود المحاسب عند قيامه بتوفير معلومات تكاليف تفصيلية عند اتخاذ القرارات.	1	2	3	4	5

س10. ماهي العبارة التي تعبر عن موقف منشأتكم من استخدام نظام التكاليف على أساس الأنشطة (ABC)؟ (من فضلك ضع دائرة على الرقم المناسب.)

أ. نظام (ABC) مستخدم حاليا.

ب. ننوي استخدام نظام (ABC).

ت. نبحث حاليا استخدام نظام (ABC).

ث. ننوي بحث استخدام نظام (ABC).

ج. بدأنا بتطبيق نظام (ABC) ولكن قررنا تركه.

ح. بحثنا إمكانية استخدام نظام (ABC) ولكن قررنا رفض استخدامه.

خ. بحثنا إمكانية استخدام نظام (ABC) ولكن قررنا رفض استخدامه. ولكن قامت الشركة بإنشاء نظام لتحليل الأنشطة أو لتحليل مسببات التكلفة.

د. رفضنا استخدام نظام (ABC) بدون أي بحث عن مدى إمكانية استخدامه.

ذ. لم يتم، على الإطلاق، بحث إمكانية استخدام نظام (ABC).

س11 من وجهة نظر منشأتكم، ما هي درجة أهمية أو عدم أهمية معلومات تكاليف المنتجات في اتخاذ كل قرار من القرارات التالية؟ (من فضلك ضع دائرة على الرقم المناسب.)

	لا نقوم باتخاذ هذا القرار	ليست مهمة على الإطلاق	ليست مهمة	محايد	مهمة	مهمة جدا
أ. قرارات تسعير المنتجات.	0	1	2	3	4	5
ب. قرارات الشراء أو الصنع.	0	1	2	3	4	5
ت. قرارات تخفيض التكاليف.	0	1	2	3	4	5
ث. قرارات مزيج المنتجات.	0	1	2	3	4	5
ج. قرارات تحديد كمية إنتاج المنتجات.	0	1	2	3	4	5
ح. قرارات تصميم المنتجات.	0	1	2	3	4	5
خ. قرارات تقييم طرق الإنتاج الجديدة.	0	1	2	3	4	5
د. قرارات تقديم منتجات جديدة.	0	1	2	3	4	5
ذ. قرارات توقف إنتاج بعض المنتجات.	0	1	2	3	4	5

قسم ج: البيئة التي تعمل بها منشأتكم وعملياتها الإنتاجية

س12. ما هو مستوى شدة أو ضعف كل نوع من أنواع المنافسة التالية؟ (من فضلك ضع دائرة على الرقم المناسب.)

	ضعيف جدا	ضعيف	متوسط	شديد	شديد جدا
أ. مستوى المنافسة الحالي للمنتجات الرئيسية لمنشأتكم.	1	2	3	4	5
ب. مستوى المنافسة في أسعار المنتجات الرئيسية لمنشأتكم.	1	2	3	4	5
ت. مستوى المنافسة في شراء المواد الأولية للمنتجات الرئيسية لمنشأتكم.	1	2	3	4	5

س13. هل يمثل كل مما يلي عن نمط الإنتاج المتبع في منشأتكم؟ (من فضلك أشر على الخيار المناسب.)

1. إنتاج مستمر	نعم ( )	لا ( )
2. إنتاج الدفعات	نعم ( )	لا ( )
3. إنتاج بحسب الطلب	نعم ( )	لا ( )

س14. ماهي العبارة المناسبة التي تعبر عن النسبة المئوية لكل من (1) المنتجات المنتجة حسب الطلب، و (2) المنتجات القياسية المنتجة من قبل منشأتكم؟ (من فضلك ضع دائرة على الرقم المناسب.)

1. بحد أدنى, 95% من المنتجات المنتجة هي منتجات قياسية.
2. حوالي 75% من المنتجات المنتجة هي منتجات قياسية و25% من المنتجات المنتجة هي منتجات منتجة حسب الطلب.
3. حوالي 50% من المنتجات المنتجة هي منتجات قياسية و50% من المنتجات المنتجة هي منتجات منتجة حسب الطلب.
4. حوالي 75% من المنتجات المنتجة هي منتجات منتجة حسب الطلب و25% من المنتجات المنتجة هي منتجات قياسية.
5. بحد أدنى, 95% من المنتجات المنتجة هي منتجات منتجة حسب الطلب.

س15. إلى أي مدى تنطبق أو لا تنطبق كل عبارة من العبارات التالية على المنتجات المصنعة والعمليات الإنتاجية المستخدمة من قبل منشأتكم؟ (من فضلك ضع دائرة على الرقم المناسب.)

	لا تنطبق أبداً	إلى مدى بسيط جدا	إلى مدى معقول	إلى مدى كبير	إلى مدى كبير جدا
أ. أغلبية المنتجات تكون صعبة في التصنيع لاحتوائها على عدد كبير من القطع.	1	2	3	4	5
ب. أغلبية المنتجات تكون صعبة في التصنيع لاحتياجها للمرور على عدد كبير من المراحل/الأقسام الإنتاجية.	1	2	3	4	5
ت. يتم تصنيع عدد كبير من المنتجات المختلفة.	1	2	3	4	5
ث. أغلبية المنتجات تنتج بأحجام مختلفة كليا.	1	2	3	4	5
ج. توجد اختلافات كبيرة في كميات الإنتاج للمنتجات وفي كميات الدفعات الإنتاجية.	1	2	3	4	5
ح. العمليات الإنتاجية للمنتجات ليست ثابتة لإنه يستلزم إجراء بعض التغييرات عليها في حال تغيرت عوامل أخرى كنوع المادة الخام أو الآلات مثلا.	1	2	3	4	5
خ. العمليات الإنتاجية لأغلبية المنتجات تستغرق وقت طويل.	1	2	3	4	5
د. أغلبية المنتجات تحتاج إلى عمليات تصميم، تصنيع، وتوزيع مختلفة.	1	2	3	4	5
ذ. لبعض أو لكل المنتجات، جزء من العملية الإنتاجية يكون يدوي وجزء آخر يكون آلي.	1	2	3	4	5
ر. يتم تقديم منتجات جديدة بشكل متكرر.	1	2	3	4	5
ز. يتم إجراء تغييرات على المنتجات أو العمليات الإنتاجية بشكل متكرر.	1	2	3	4	5
س. يحتاج كل خط إنتاجي إلى نصيب مختلف من تكاليف الأقسام الخدمية (مثلا: تكاليف الهندسة، المشتريات، والتسويق)	1	2	3	4	5

س16. إلى أي مدى تقوم منشأتكم باستخدام الأنواع التالية من تقنيات التصنيع المتقدمة (AMT)؟ (من فضلك ضع دائرة على الرقم المناسب.) (إذا كان جوابك ب 1 لكل الأنواع، فضلا اذهب لسؤال 18 في صفحة 9.)

	لا نستخدمها أبدا	إلى مدى بسيط جدا	إلى مدى معقول	إلى مدى كبير	إلى مدى كبير جدا
أ. <u>تقنيات تصميم المنتجات:</u> تستخدم هذه التقنيات لتصميم المنتجات (مثلا: التصميم بمساعدة الحاسب (CAD) والهندسة بمساعدة الحاسب (CAE)).	1	2	3	4	5
ب. <u>تقنيات العمليات:</u> تستخدم هذه التقنيات في أرض المصنع وتقوم بتقديم معلومات متعلقة بالعملية الإنتاجية (مثلا: التصنيع بمساعدة الحاسب (CAM) ونظم التصنيع المرنة (FMS)).	1	2	3	4	5
ت. <u>التقنيات اللوجستية وتقنيات التخطيط:</u> تستخدم هذه التقنيات لمتابعة حركة المواد من مرحلة الحصول على المواد الأولية إلى مرحلة توصيل المنتج النهائي (مثلا: نظم تخطيط متطلبات المواد (MRP)).	1	2	3	4	5
ث. <u>تقنيات تبادل المعلومات:</u> تستخدم هذه التقنيات لتسهيل حفظ وتبادل المعلومات بين تقنيات العمليات، المنتج، والتقنيات اللوجستية (مثلا: تبادل المعلومات الإلكتروني (EDI)).	1	2	3	4	5

س17. إلى أي مدى قامت التقنيات المشار إليها في سؤال 16 والمستخدمة من قبل منشأتكم بالمساعدة في تخفيض التكاليف التالية؟ (من فضلك ضع دائرة على الرقم المناسب.)

	لم تقم بأي تخفيض	إلى مدى بسيط جدا	إلى مدى معقول	إلى مدى كبير	إلى مدى كبير جدا
أ. تكاليف إعداد وتجهيز الآلات للتصنيع.	1	2	3	4	5
ب. التكاليف المرتبطة بإنتقال/تحول الإنتاج من منتج إلى منتج آخر.	1	2	3	4	5
ت. التكاليف المرتبطة بجدولة دفعات الإنتاج.	1	2	3	4	5
ث. تكاليف فحص الدفعات الإنتاجية.	1	2	3	4	5
ج. تكاليف نقل المواد للدفعات الإنتاجية.	1	2	3	4	5
ح. التكاليف الأخرى والتي تكون مرتبطة بالدفعات الإنتاجية (مثلا: تكاليف الإعداد، تكاليف التنظيف، تكاليف فحص المختبرات، والتكاليف المرتبطة بإدارة الإنتاج).	1	2	3	4	5
خ. تكاليف تصميم المنتجات.	1	2	3	4	5

س18. إلى أي مدى توافق أو لا توافق على أن تقنيات الإنتاج المستخدمة من قبل منشأتكم تستطيع القيام بالوظائف التالية؟ (من فضلك ضع دائرة على الرقم المناسب.)

	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
أ. المقدرة على إنتقال/تحول الإنتاج من منتج إلى منتج آخر بسهولة ومن غير الحاجة لوقت طويل أو التسبب في دفع تكاليف عالية.	1	2	3	4	5
ب. المقدرة على تنفيذ عدة عمليات مختلفة من غير الحاجة إلى بذل جهود كبيرة عند الإنتقال/التحول من عملية إلى أخرى.	1	2	3	4	5
ت. المقدرة على إنتاج المنتجات بطرق مختلفة.	1	2	3	4	5
ث. المقدرة على الاستجابة إلى التغيرات في كميات الإنتاج بسهولة.	1	2	3	4	5
ج. المقدرة على إنتاج منتجات متعددة بكميات قليله بدون التسبب في دفع تكاليف عالية (اقتصاديات المجال).	1	2	3	4	5
ح. المقدرة على إضافة أو حذف منتجات جديدة إلى مزيج المنتجات.	1	2	3	4	5
خ. المقدرة على إحداث تغييرات على تصميم المنتجات التي تصنع حاليا.	1	2	3	4	5
د. المقدرة على تصنيع مدى واسع من منتجات مختلفة من دون الحاجة إلى الاستثمار في معدات رئيسية جديدة.	1	2	3	4	5

قسم د: المنشأة التي تعمل بها

س19. القائمة التالية توضح مجموعة من القيم التي من الممكن أن تكون مطبقة لديكم في المنشأة والتي تعكس وتصف طبيعة بيئة العمل في المنشآت. إلى أي مدى تقوم منشأتكم بتقدير كل قيمة من القيم التالية؟ (من فضلك ضع دائرة على الرقم المناسب.)

	ليست مقدرة تماما	إلى مدى بسيط جدا	إلى مدى معقول	إلى مدى كبير	إلى مدى كبير جدا
أ. أن تكون منافسا.	1	2	3	4	5
ب. التركيز على الإنجازات.	1	2	3	4	5
ت. امتلاك توقعات عالية للأداء.	1	2	3	4	5
ث. التركيز على الأداء.	1	2	3	4	5
ج. التركيز على النتائج.	1	2	3	4	5
ح. الاهتمام بالتفاصيل.	1	2	3	4	5
خ. أن تكون دقيقا.	1	2	3	4	5
د. أن تكون حذرا.	1	2	3	4	5

س20. القائمة التالية توضح مجموعة من الممارسات التي من الممكن أن تكون مطبقة لديكم في المنشأة والتي تعكس وتصف طبيعة بيئة العمل في المنشآت. إلى أي مدى يمثل كل عنصر من العناصر التالية، ممارسة حالية لمنشأتكم؟ (من فضلك ضع دائرة على الرقم المناسب.)

	لا تمثل ممارسة إطلاقا	إلى مدى بسيط جدا	إلى مدى معقول	إلى مدى كبير	إلى مدى كبير جدا
أ. تطلعات الموظفين محددة بشكل تفصيلي.	1	2	3	4	5
ب. النتائج المرجو تحقيقها محددة بشكل واضح.	1	2	3	4	5
ت. قواعد وسياسات العمل مستخدمة بشكل كبير.	1	2	3	4	5
ث. يتم الإشراف المباشر على أنشطة الموظفين بشكل معتاد.	1	2	3	4	5
ج. يتم الرقابة على أداء الموظف بشكل معتاد.	1	2	3	4	5
ح. مقاييس الأداء دقيقة ووقتية.	1	2	3	4	5
خ. مراجعة الأداء تكون بشكل تفصيلي، شامل، ومعتاد.	1	2	3	4	5
د. وجود ارتباط شديد ما بين مقاييس الأداء المستخدمة وكل من المكافآت المقدمة والعقوبات المفروضة.	1	2	3	4	5

س21. ماهي النسبة المئوية لكل تكلفة من التكاليف التالية من إجمالي تكاليف منشأتكم؟ (من فضلك اكتب النسب المئوية.)

	%
التكاليف الصناعية المباشرة.	( )
التكاليف الصناعية غير المباشرة.	( )
التكاليف غير الصناعية.	( )
إجمالي التكاليف.	**100%**

س22. هل منشأتكم مملوكة بالكامل من قبل سعوديين؟ (من فضلك ضع دائرة على الرقم المناسب.)

1. نعم.
2. لا.

س23. ما هي القيمة التقريبية لمبيعات منشأتكم في السنة المالية الماضية؟ (من فضلك ضع دائرة على الرقم المناسب.)

1. أقل من 10 مليون ريال.
2. من 10 إلى 30 مليون ريال.
3. أكثر من 30 إلى 75 مليون ريال.
4. أكثر من 75 إلى 100 مليون ريال.
5. أكثر من 100 إلى 150 مليون ريال.
6. أكثر من 150 إلى 200 مليون ريال.
7. أكثر من 200 إلى 300 مليون ريال.
8. أكثر من 300 إلى 500 مليون ريال.
9. أكثر من 500 مليون ريال.

س24. ما هو العدد التقريبي لموظفي وعمال منشأتكم؟

من فضلك اكتب العدد التقريبي هنا: ------------ موظف وعامل.

س25 أي مما يلي يصف منشأتك؟ (من فضلك ضع دائرة على الرقم المناسب.)

1. المكتب الرئيسي لمجموعة شركات.
2. شركة من ضمن مجموعة شركات.
3. فرع لشركة تابعة لمجموعة شركات.
4. شركة مستقلة.
5. أخرى،

من فضلك حدد: ---

س26. ما هو القطاع الصناعي التي تعمل به منشأتك؟

س27. ما هو منصبك الوظيفي في المنشأة التي تعمل بها؟

أشكرك على بذل الوقت لتعبئة هذا الاستبيان. أنا ممتن لك جدا على تقديمك هذه المعلومات القيمة. إذا رغبت بإضافة أي تعليق متعلق بالاستبيان أو نظام التكاليف المعمول به في منشأتكم، من فضلك استخدم الفراغ المتاح بالأسفل.

1-هل ترغب بالمشاركة في مقابلة حول نظام التكاليف المطبق لدى منشأتكم؟ (من فضلك أشر على رغبتك.)

نعم ( ) لا ( )

2-هل ترغب في الحصول على ملخص نتائج هذه الدراسة؟ (من فضلك أشر على رغبتك.)

نعم ( ) لا ( )

3-هل توافق على إستلام أسئلة لاحقا والتي ستكون متعلقة بأجوبتك على هذا الإستبيان؟ (من فضلك أشر على رغبتك.)

نعم ( ) لا ( )

4-هل من الممكن بأن تقوم بتزويدي بمعلومات الاتصال الخاصة بك؟ هناك حاجة لمعلومات الاتصال الخاصة بك لثلاثة أسباب:

1. ليتسنى لي الاتصال بك في حال موافقتك على إجراء المقابلة.
2. ليتسنى لي الاتصال بك في حال الحاجة لمعلومات إضافية متعلقة بأجوبتك على الاستبيان.
3. ليتسنى لي إرسال ملخص لنتائج هذه الدراسة في حال طلبك لها.

الاسم: --

البريد الإلكتروني: --

رقم الهاتف: --

أشكرك على تعاونك باستكمال هذا الاستبيان.

من فضلك لا تتردد بالتواصل معي في حال وجود أي سؤال. يمكنك التواصل معي (عبدالرحمن الجبر) على رقم: 0506912416، أو التواصل معي من خلال البريد الإلكتروني: aaljabr1@sheffield.ac.uk . بعد انتهائك من تعبئة الاستبيان، أرجو إرساله في الظرف المرفق.

Appendix 6-12: Extracts from the final Arabic online questionnaire

دراسة إستكشافية لأنظمة التكاليف المطبقة في المملكة العربية السعودية

أهلا وسهلا

السلام عليكم ورحمة الله وبركاته

أهلا وسهلا بك إلى إستبيان: دراسة إستكشافية لأنظمة التكاليف المطبقة في المملكة العربية السعودية

إن هدف هذا الإستبيان هو التعرف على العوامل التي تؤثر على تفصيل أنظمة التكاليف المطبقة في القطاع الصناعي السعودي ومدى منفعة هذه الأنظمة. إن هذا البحث يهدف إلى تقديم معلومات عن الحالات التي تُوجب على المنشآت زيادة تفصيل نظام التكاليف المطبق لديهم، وعن دور بعض العوامل الخاصة بالمنشأة في تسهيل عملية زيادة تفصيل النظام. كما يهدف هذا البحث أيضا إلى تزويد معلومات عن الحالات التي يكون عندها زيادة تفصيل أنظمة التكاليف أمرا نافعا ومفيدا للمنشآت.

سوف أكون ممتن لك جدا، إذا قمت بالمشاركة في هذا البحث من خلال إستكمالك لهذا الإستبيان. إن جميع الأجوبة التي سوف تقوم بتقديمها ستكون سرية، ولن يتم الإفصاح عنها إلى أي طرف ثالث. لن أقوم بالإفصاح عن أجوبة أي استبيان بعينه، أو عن هوية أي مشارك، أو عن هوية منشأته عند كتابة نتائج هذا البحث. من فضلك، لا تتردد بالتواصل معي في حال وجود أي سؤال لديك. يمكنك التواصل معي على رقم: 0506912416، أو التواصل معي من خلال البريد الإلكتروني: aaljabr1@sheffield.ac.uk .

أشكرك على تعاونك،
عبدالرحمن الجبر
محاضر في المحاسبة الإدارية والتكاليف، جامعة الملك فيصل
باحث، جامعة شيفلد البريطانية

الصفحة التالية | الحفظ ثم الإستمرار لاحقا

دراسة إستكشافية لأنظمة التكاليف المطبقة في المملكة العربية السعودية

قسم ب: نظام التكاليف المطبق لديكم بالمنشأة

س3 من 27

لأغراض اتخاذ القرارات (مثلا: قرارات التسعير، الشراء أو الصنع، أو قرارات تقديم منتجات جديدة)، هل تدخل كل تكلفة من التكاليف التالية في تحديد تكلفة المنتج؟ (من فضلك أشر على الخيار المناسب.)

	نعم	لا
التكاليف الصناعية المباشرة (مثلا، تكاليف المواد والعمالة المباشرة).	○	○
التكاليف الصناعية غير المباشرة المتغيرة (مثلا، مواد غير مباشرة، عمالة غير مباشرة، وقود وصيانة الآلات، تكاليف مياه وكهرباء المصنع).	○	○
التكاليف الصناعية غير المباشرة الثابتة (مثلا، إيجار المصنع، التأمين، راتب مدير المصنع).	○	○
التكاليف غير الصناعية (مثلا، عمولات رجال البيع ومصاريف الشحن و رواتب الرؤساء والسكرتارية وموظفي العلاقات العامة).	○	○

دراسة إستكشافية لأنظمة التكاليف المطبقة في المملكة العربية السعودية

س5 من 27

لأغراض إتخاذ القرارات، ما هو العدد الإجمالي لمراكز التكلفة (مجمعات التكلفة) المستخدمة من قبل نظام التكاليف المطبق لديكم بالمنشأة عند حساب تكاليف جميع المنتجات؟ (من فضلك إكتب عدد مراكز التكلفة (مجمعات التكلفة) في الفراغ أدناه.)

س6 من 27

لأغراض اتخاذ القرارات، ما هو عدد أسس التحميل (مسببات التكلفة) المستخدمة لتحميل التكاليف غير المباشرة المجمعة في مراكز التكلفة (مجمعات التكلفة) على المنتجات كما سبق توضيحه في الصفحة السابقة؟ (من فضلك اكتب عدد أسس التحميل (مسببات التكلفة) في الفراغ أدناه.)

س11 من 27

من وجهة نظر منشأتكم، ما هي درجة أهمية أو عدم أهمية معلومات تكاليف المنتجات في اتخاذ كل قرار من القرارات التالية؟ (من فضلك أشر على الخيار المناسب.)

	لا نقوم باتخاذ هذا القرار	ليست مهمة على الإطلاق	ليست مهمة	محايد	مهمة	مهمة جدا
قرارات تسعير المنتجات.	○	○	○	○	○	○
قرارات الشراء أو الصنع.	○	○	○	○	○	○
قرارات تخفيض التكاليف.	○	○	○	○	○	○
قرارات مزيج المنتجات.	○	○	○	○	○	○
قرارات تحديد كمية إنتاج المنتجات.	○	○	○	○	○	○
قرارات تصميم المنتجات.	○	○	○	○	○	○
قرارات تقييم طرق الإنتاج الجديدة.	○	○	○	○	○	○
قرارات تقديم منتجات جديدة.	○	○	○	○	○	○
قرارات توقف إنتاج بعض المنتجات.	○	○	○	○	○	○

الحفظ ثم الإستمرار لاحقا | الصفحة السابقة | الصفحة التالية

دراسة إستكشافية لأنظمة التكاليف المطبقة في المملكة العربية السعودية

قسم ج: البيئة التي تعمل بها منشأتكم وعملياتها الإنتاجية

س12 من 27

ما هو مستوى شدة أو ضعف كل نوع من أنواع المنافسة التالية؟ (من فضلك أشر على الخيار المناسب.)

	ضعيف جدا	ضعيف	متوسط	شديد	شديد جدا
مستوى المنافسة الحالي للمنتجات الرئيسية لمنشأتكم.	○	○	○	○	○
مستوى المنافسة في أسعار المنتجات الرئيسية لمنشأتكم.	○	○	○	○	○
مستوى المنافسة في شراء المواد الأولية للمنتجات الرئيسية لمنشأتكم.	○	○	○	○	○

س13 من 27

هل يمثل كل مما يلي عن نمط الإنتاج المتبع في منشأتكم؟ (من فضلك أشر على الخيار المناسب.)

	نعم	لا
إنتاج مستمر	○	○
إنتاج الدفعات	○	○
إنتاج بحسب الطلب	○	○

الحفظ ثم الإستمرار لاحقا | الصفحة السابقة | الصفحة التالية

س21 من 27

ماهي النسبة المئوية لكل تكلفة من التكاليف التالية من إجمالي تكاليف منشأتكم؟ (من فضلك اكتب النسب المئوية في الفراغات أدناه.)

التكاليف الصناعية المباشرة. [ ]

التكاليف الصناعية غير المباشرة. [ ]

التكاليف غير الصناعية. [ ]

إجمالي التكاليف **100%**

س22 من 27

هل منشأتكم مملوكة بالكامل من قبل سعوديين؟ (من فضلك أشرعلى الخيارالمناسب.)

- نعم
- لا

الصفحة التالية | الصفحة السابقة | الحفظ ثم الإستمرار لاحقا

4- هل من الممكن بأن تقوم بتزويدي بمعلومات الاتصال الخاصة بك؟ هناك حاجة لمعلومات الاتصال الخاصة بك لأربعة أسباب:

1. لعدم إرسال رسائل تذكيرية إلى بريدك الإلكتروني.
2. ليتسنى لي الاتصال بك في حال موافقتك على إجراء المقابلة.
3. ليتسنى لي الاتصال بك في حال الحاجة لمعلومات إضافية متعلقة بأجوبتك على الاستبيان.
4. ليتسنى لي إرسال ملخص لنتائج هذه الدراسة في حال طلبك لها.

الإسم [ ]

البريد الإلكتروني [ ]

رقم الهاتف [ ]

إسم الشركة [ ]

أشكرك على تعاونك باستكمال هذا الاستبيان. من فضلك لا تتردد بالتواصل معي في حال وجود أي سؤال. يمكنك التواصل معي (عبدالرحمن الجبر) على رقم: 0506912416، أو التواصل معي من خلال البريد الإلكتروني: aaljabr1@sheffield.ac.uk .

إنهاء الإستبيان | الصفحة السابقة | الحفظ ثم الإستمرار لاحقا

لقد إستكملت هذا الإستبيان

نشكرك على وقتك الذى قضيته معنا لإجابة هذا الإستبيان

Appendix 6-13: Initial draft of the English paper questionnaire tested in the first pre-testing stage of the questionnaire pre-testing process

An exploratory study of costing system complexity in Saudi Arabia

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Section A. The usefulness of product cost information in decision making

Q1. To what extent, if at all, does your business unit use product cost information in the following decisions? (Please circle the appropriate number.)

	Do not make this type of decision	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Product pricing decisions.	0	1	2	3	4	5
b. Make or buy decisions.	0	1	2	3	4	5
c. Cost reduction decisions.	0	1	2	3	4	5
d. Product mix decisions.	0	1	2	3	4	5
e. Product output level decisions.	0	1	2	3	4	5
f. Product design decisions.	0	1	2	3	4	5
g. Evaluating new production process decisions.	0	1	2	3	4	5
h. Product introduction decisions.	0	1	2	3	4	5
i. Product discontinuation decisions.	0	1	2	3	4	5

Q2. To what extent do you agree or disagree with the following statements relating to your perception of the usefulness and accuracy of your costing system in calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. My costing system provides product cost information that is useful when making different decisions.	1	2	3	4	5
b. I rely on product cost information generated by my costing system to make different decisions.	1	2	3	4	5
c. I am satisfied with the accuracy of my costing system at assigning indirect costs to products for the purpose of decision making.	1	2	3	4	5

Section B. Your business unit's costing system

Q3. For the purpose of decision making, which costs does your business unit include in product costs? (Please circle all applicable numbers.)

1. Direct manufacturing costs only (e.g., direct material and direct labour costs).
2. Variable indirect/overhead manufacturing costs (e.g., indirect material, indirect labour, machine energy/maintenance, and factory electricity and water costs).
3. Fixed indirect/overhead manufacturing costs (e.g., factory rent, insurance, and managerial salary costs).
4. Direct non-manufacturing costs (e.g., sales commissions and shipping costs).
5. Indirect non-manufacturing costs (e.g., executives, secretarial, and public relations employee salaries).

The following information relates to Q4, Q5, Q6, and Q7.

The assignment of indirect/overhead costs to cost objects is often a two-step procedure. The first step involves the assignment of different overhead costs to cost centres (also known as cost pools), such as production departments, machines, or activities using different bases (also known as first-step bases or resource drivers), such as production volume, area, or the number of employees. In the second step, one or multiple overhead allocation rates are established for each cost centre/cost pool to assign overhead costs to cost objects (e.g., product X or product Y). The overhead allocation rates can be based on different bases (also known as second-step bases or cost drivers), such as number of units produced, number of labour or machine hours, number of setups or number of purchase orders.

Q4. Which of the following statements describes the procedure that your business unit uses to assign overhead costs to products for the purpose of decision making? (Please circle the appropriate number.)

1. Overhead costs are not assigned to products, and are regarded as period costs that are charged to the profit and loss account. (If you answered 1, please go to question 9 on page 4)
2. All overhead costs are accumulated in a single cost centre or cost pool to calculate a plant wide or single overhead rate that is used to assign all overhead costs to products regardless of the number of processes each product needs. (If you answered 2, please go to question 9 on page 4)
3. Overhead costs are assigned to cost centres (i.e., production departments or machines), and, then, overhead costs are allocated between products using overhead allocation rates that are established based on the second-step bases.
4. Overhead costs are assigned to activity cost pools, and, then, overhead costs are allocated between products using overhead allocation rates that are established based on cost drivers.

Q5. How many different cost centres/cost pools are used in the costing system used by your business unit when calculating product costs for the purpose of decision making?

Please write the number here: __________ cost centres/cost pools.

Q6. For the purpose of decision making, how many different *first-step* bases/resource drivers are used when assigning overhead costs to cost centres/cost pools as described above?

Please write the number here: __________ *first-step* bases/resource drivers.

Q7. For the purpose of decision making, how many different *second-step* bases/cost drivers are used when allocating overhead costs accumulated in cost centres/cost pools to cost objects as described above?

Please write the number here: .... *second-step* bases/cost drivers.

Q8. To what extent do you agree or disagree with the following statements relating to the level of details of the costing system used by your business unit when calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Non-manufacturing costs are assigned to cost centres/cost pools using different first-step bases/resource drivers that captures the consumption of these resources by cost centres/cost pools.	1	2	3	4	5
b. The number of cost centres/cost pools is enough to ensure that each cost centre/cost pool contains only homogeneous production processes.	1	2	3	4	5
c. Resources expenses (i.e., overhead costs) are directly assigned to each cost centre/cost pool or assigned by using cause-and-effect first-step bases/resource drivers.	1	2	3	4	5
d. The resource costs accumulated within each cost centre/cost pool are allocated between products using multiple rates each of which has different second-step base/cost driver.	1	2	3	4	5
e. The resource costs accumulated within each cost centre/cost pool are allocated between products using bases that are proportional to the actual quantity of resources consumed.	1	2	3	4	5

Q9. To what extent do you agree or disagree with the following statements relating to top management's attitude to the costing system when calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Top management provides support to your business unit's costing system.	1	2	3	4	5
b. Top management considers that the costing system is important to the business unit.	1	2	3	4	5
c. Top management has provided adequate resources to implement your business unit's costing system.	1	2	3	4	5

Q10. **Which of the following best describes your business unit's experience with activity-based costing (ABC)? (Please circle the appropriate number.)**

1. Currently using ABC.
2. Intending to use ABC.
3. Currently investigating using ABC.
4. Intending to investigate using ABC.
5. Rejected ABC, but established a system of activity analysis or cost driver analysis.
6. Implemented ABC and subsequently decided to abandon it.
7. Investigated using ABC and decided to reject it.
8. Rejected ABC, but never considered using it.
9. Never considered using ABC.

Q11. **How important or unimportant is product cost information for each of the following decisions? (Please circle the appropriate number.)**

	Do not make this type of decision	Very unimportant	Unimportant	Neutral	Important	Very important
a. Product pricing decisions.	0	1	2	3	4	5
b. Make or buy decisions.	0	1	2	3	4	5
c. Cost reduction decisions.	0	1	2	3	4	5
d. Product mix decisions.	0	1	2	3	4	5
e. Product output level decisions.	0	1	2	3	4	5
f. Product design decisions.	0	1	2	3	4	5
g. Evaluating new production process decisions.	0	1	2	3	4	5
h. Product introduction decisions.	0	1	2	3	4	5
i. Product discontinuation decisions.	0	1	2	3	4	5

Q12. **To what extent do you agree or disagree with the following statements relating to top management's knowledge and awareness about the importance of cost information in decision making? (Please circle the appropriate number.)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Top management has the enough knowledge about the importance of cost information in decision making.	1	2	3	4	5
b. Top management is aware of the undesirable consequences of making decisions based on inaccurate cost information.	1	2	3	4	5
c. Top management appreciates the accountants' efforts relating to providing detailed cost information when making decisions.	1	2	3	4	5

Section C. Your business unit's environment and production process

Q13. **What is the level of intensity or weakness of each of the following types of competition? (Please circle the appropriate number.)**

	Very weak	Weak	Moderate	Intense	Very intense
a. The current level of competition for the major products of your business unit.	1	2	3	4	5
b. The level of competition for purchasing raw materials for your business unit's major products.	1	2	3	4	5
c. The level of price competition for your business unit's major products.	1	2	3	4	5

Q14. **Which of the following best describes the percentage of the customised and standardised products produced by your business unit? (Please circle the appropriate number.)**

1. At least 95% of products are standardised.
2. Approximately 75% of products are standardised, and 25% of products are customised.
3. Approximately 50% of products are standardised and 50% of products are customised.
4. Approximately 75% of products are customised, and 25% of products are standardised.
5. At least 95% of products are customised.

Q15. Which of the following best describes the type of production of your business unit? (Please circle the appropriate number(s).)

1. Single product or project production.
2. Batch production.
3. Mass production.

Q16. To what extent do you agree or disagree with the following statements relating to products produced and production process used in your business unit? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Some products are complex to produce because they contain large number of components.	1	2	3	4	5
b. Some products are complex to produce because they need to pass through large number of production stages/departments.	1	2	3	4	5
c. A large number of different products are produced.	1	2	3	4	5
d. Some products are produced in significantly different sizes.	1	2	3	4	5
e. There are major differences in product volumes or batch sizes.	1	2	3	4	5
f. The manufacturing process is not standardised because changes to the production process need to be made if some factors (e.g., the type of material) have been changed.	1	2	3	4	5
g. The production processes for some products take a long time.	1	2	3	4	5
h. Most products require different processes to design, manufacture and distribute them.	1	2	3	4	5
i. For some or all products, the manufacturing process is partially manual and partially automated.	1	2	3	4	5
j. There are frequent new product introductions.	1	2	3	4	5
k. There are frequent changes in products and production processes.	1	2	3	4	5
l. Each product line requires different level of support department costs (e.g., engineering, purchasing and marketing costs)	1	2	3	4	5

Q17. **To what extent, if at all, does your business unit use the following types of advanced manufacturing technologies? (Please circle the appropriate number.) (If your answers are 1 (Not at all) for all choices, please go to question 20 on page 9.)**

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Product design technologies: These technologies are used in designing the product (e.g., Computer Aided Design (CAD) and Computer Aided Engineering (CAE)).	1	2	3	4	5
b. Process technologies: These technologies are used on the shop floor, and provide information related to the manufacturing process (e.g., Computer Aided Manufacturing (CAM) and Flexible Manufacturing Systems (FMS)).	1	2	3	4	5
c. Logistic/planning technologies: These technologies are used to control the material flow from the stage of obtaining raw material to the stage of delivering finished products (e.g., Material Requirement Planning systems (MRP).	1	2	3	4	5
d. Information exchange technologies: These technologies are used to facilitate storing and exchanging information among process, product and logistic technologies (e.g., Electronic Data Interchange (EDI)).	1	2	3	4	5

Q18. **To what extent, if at all, have the technologies used by your business unit assisted in reducing the following costs? (Please circle the appropriate number.)**

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Setup costs.	1	2	3	4	5
b. Costs of changing over production from one product to another.	1	2	3	4	5
c. Scheduling production runs costs.	1	2	3	4	5
d. First time inspection costs.	1	2	3	4	5
e. Moving material costs.	1	2	3	4	5
f. Other batch-related costs (e.g., preparation, cleaning, laboratory testing, and computer and production management costs).	1	2	3	4	5
g. Product design costs.	1	2	3	4	5

Q19. **To what extent do you agree or disagree that the manufacturing technologies used by your business unit can perform the following functions? (Please circle the appropriate number.)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. The ability to switch production from one product to another easily without incurring significant costs and taking much time.	1	2	3	4	5
b. The ability to respond easily to changes in production volume.	1	2	3	4	5
c. The ability to produce different products in low volumes without incurring significant costs (i.e., economies of scope).	1	2	3	4	5
d. The ability to add and remove new products from the product mix.	1	2	3	4	5
e. The ability to make design changes to existing products.	1	2	3	4	5
f. The ability to produce a wide range of different products without investing in new major capital equipment.	1	2	3	4	5

Section D. Your business unit

Q20. **Below is a list of different values that may be used to reflect and describe the nature of your business unit's work environment. To what extent, if at all, each of the following is valued in your business unit? (Please circle the appropriate number.)**

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Being competitive.	1	2	3	4	5
b. Focus on achievements.	1	2	3	4	5
c. Having high expectations for performance.	1	2	3	4	5
d. Focus on action.	1	2	3	4	5
e. Focus on results.	1	2	3	4	5
f. Paying attention to detail.	1	2	3	4	5
g. Being precise.	1	2	3	4	5
h. Being careful.	1	2	3	4	5

Q21. Below is a list of different practices that may be used to reflect and describe the nature of your business unit's work environment. To what extent, if at all, does each item represent a current practice of your business unit? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Employee expectations are specified in detail.	1	2	3	4	5
b. Desired results are defined explicitly.	1	2	3	4	5
c. Work rules and/or specific work polices are used widely.	1	2	3	4	5
d. Direct supervision of employee activities takes place frequently.	1	2	3	4	5
e. Frequent monitoring of employee performance takes place.	1	2	3	4	5
f. Performance measures are precise and timely.	1	2	3	4	5
g. Performance reviews are detailed, comprehensive and frequent.	1	2	3	4	5
h. There is a strong link between the penalties imposed or rewards provided and the performance measures used.	1	2	3	4	5

Q22. What is the percentage of each of the following costs in your business unit's total costs? (Please insert the appropriate percentage.)

	%
Direct material costs.	( )
Direct labour costs.	( )
Variable manufacturing overhead costs.	( )
Fixed manufacturing overhead costs.	( )
Direct non-manufacturing costs.	( )
Indirect non-manufacturing costs.	( )
Total costs.	**100%**

Q23. Is your company a wholly Saudi-owned company? (Please circle the appropriate number.)

1. Yes.
2. No.

Q24. What is the approximate amount of your business unit's sales revenue in the last financial year?

Please record the approximate amount here: SR ……………

Q25. What is the approximate number of employees of your business unit?

Please record the approximate number here: …………… employees.

Q26. When answering the questionnaire, how have you defined your operating unit? That is the place that identifies where you work (e.g., a head office of a divisionalised company, a division of a divisionlised company, a non-divisionlised company, etc).

Please specify:……………………………………………………………

Q27. What is the industrial sector of your business unit?

……………………………………………………………

Q28. What is your role/position within the business unit where you work?

……………………………………………………………

Thank you for taking the time to complete this questionnaire. I am greatful for your assistance in providing this information. If you would you like to add any comments about the questionnaire or your costing system, please use the space below.

1 - Would you like to participate in a follow up interview about your costing system? (If so, please tick your response.)

Yes ( ) No ( )

2 - Would you like to receive a summary of the study's results? (If so, please tick your response.)

Yes ( ) No ( )

3 - Can you please provide me with your contact information? This information is needed for two purposes:

1. To contact you in case you agreed to be interviewed.
2. To contact you if further information is needed about your answers to the questionnaire.

Name: ....

E-mail address: ....

Phone Number: ....

Thank you for your cooperation in completing this questionnaire. Please do not hesitate to contact me if you have any questions. You can call me (Abdulrahman Aljabr) on 00966506912416, or e-mail me at aaljabr1@sheffield.ac.uk. After you have completed the questionnaire, please return it in the enclosed stamped addressed envelope.

Appendix 6-14: The two versions of the English paper questionnaire examined in the second pre-testing stage of the questionnaire pre-testing process

Version 1:

An exploratory study of costing system design in Saudi Arabia

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Section A. The usefulness of product cost information in decision making

Q1. To what extent, if at all, does your business unit use product cost information in the following decisions? (Please circle the appropriate number.)

	Do not make this type of decision	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Product pricing decisions.	0	1	2	3	4	5
b. Make or buy decisions.	0	1	2	3	4	5
c. Cost reduction decisions.	0	1	2	3	4	5
d. Product mix decisions.	0	1	2	3	4	5
e. Product output level decisions.	0	1	2	3	4	5
f. Product design decisions.	0	1	2	3	4	5
g. Evaluating new production process decisions.	0	1	2	3	4	5
h. Product introduction decisions.	0	1	2	3	4	5
i. Product discontinuation decisions.	0	1	2	3	4	5

Q2. To what extent do you agree or disagree with the following statements relating to your perception of the usefulness and accuracy of your costing system in calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. The business unit's costing system provides product cost information that is useful when making different decisions.	1	2	3	4	5
b. I rely on product cost information generated by the business unit's costing system to make different decisions.	1	2	3	4	5
c. I am satisfied with the accuracy of the business unit's costing system at assigning indirect costs to products for the purpose of decision making.	1	2	3	4	5

Section B. Your business unit's costing system

Q3. For the purpose of decision making (e.g., pricing, make or buy, or product introduction decisions), which costs does your business unit include in product costs? (Please circle all applicable numbers.)

1. Direct manufacturing costs (e.g., direct material and direct labour costs).
2. Variable indirect/overhead manufacturing costs (e.g., indirect material, indirect labour, machine energy/maintenance, and factory electricity and water costs).
3. Fixed indirect/overhead manufacturing costs (e.g., factory rent, insurance, and managerial salary costs).
4. Non-manufacturing costs (e.g., sales commissions and shipping costs and executives, secretarial, and public relations employee salaries costs).

The following information relates to Q4, Q5, Q6, and Q7.

The assignment of indirect/overhead costs to cost objects is often a two-stage procedure.

- The first stage involves the assignment of different overhead costs to cost centres (also known as cost pools), such as production departments, machines, or activities. This stage can be done using (1) a direct assignment where overhead costs can be easily attributed to each cost centre (cost pool), (2) a cause-and-effect assignment where each cost centre (cost pool) is allocated an amount that represents the real consumption of overhead costs, or (3) an arbitrarily assignment where each cost centre (cost pool) is allocated an amount that does not represent the real consumption of overhead costs.

- In the second stage, one or multiple overhead allocation rates are established for each cost centre (cost pool) to assign overhead costs to cost objects (e.g., product X or product Y). The overhead allocation rates can be based on different bases (also known as cost drivers), such as number of units produced, number of labour or machine hours, number of setups or number of purchase orders.

Q4. Which of the following statements describes the procedure that your business unit uses to assign overhead costs to products for the purpose of decision making? (Please circle the appropriate number.)

1. Overhead costs are not assigned to products, and are regarded as period costs that are charged to the profit and loss account. (If you answered 1, please go to question 8 on page 4.)
2. All overhead costs are accumulated in a single cost centre or cost pool to calculate a plant wide or single overhead rate that is used to assign all overhead costs to products regardless of the number of processes each product needs. (If you answered 2, please go to question 8 on page 4.)
3. Overhead costs are assigned to cost centres (e.g., production departments or machines), and then overhead costs are allocated between products based on bases that are related to the production volume (e.g., number of products produced and number of labour hours).
4. Overhead costs are assigned to cost pools (i.e., activities rather than production departments or machines), and then overhead costs are allocated between products based on cost drivers. Some of these cost drivers are related to the production volume (e.g., number of labour hours), whereas others are not (e.g., the time to set up machines for production).

Q5. For the purpose of decision making, how many different cost centres (cost pools) are used in the entire costing system used by your business unit when calculating product costs of all products?

Please write the number here:.................... cost centres (cost pools).

Q6. For the purpose of decision making, how many different bases (cost drivers) are used when allocating overhead costs accumulated in cost centres (cost pools) to cost objects as described on page 3?

Please write the number here:...............bases (cost drivers).

Q7. To what extent do you agree or disagree with the following statements relating to the level of detail of the costing system used by your business unit when calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. In the first stage, non-manufacturing overhead costs are assigned to each cost centre (cost pool) by using either a direct assignment or a cause-and-effect assignment.	1	2	3	4	5
b. In the first stage, manufacturing overhead costs are assigned to each cost centre (cost pool) by using either a direct assignment or a cause-and-effect assignment.	1	2	3	4	5
c. In the first stage, arbitrarily assignments of overhead costs to cost centres (cost pools) are avoided whenever possible.	1	2	3	4	5
d. The number of cost centres (cost pools) is enough to ensure that each cost centre (cost pool) contains only homogeneous production processes.	1	2	3	4	5
e. When assigning overhead costs from cost centres (cost pools) to products, the costing system uses multiple overhead rates that are established using different bases (cost drivers).	1	2	3	4	5
f. When assigning overhead costs from cost centres (cost pools) to products, the costing system uses bases (cost drivers) that represent the actual quantity of resources consumed.	1	2	3	4	5

Q8. To what extent do you agree or disagree with the following statements relating to top management's attitude to the costing system when calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Top management considers that the costing system is important to the business unit.	1	2	3	4	5
b. Top management provides support to your business unit's costing system.	1	2	3	4	5
c. Top management has provided adequate resources to implement your business unit's costing system.	1	2	3	4	5

Q9. Which of the following best describes your business unit's experience with activity-based costing (ABC)? (Please circle the appropriate number.)

1. Currently using ABC.
2. Intending to use ABC.
3. Currently investigating using ABC.
4. Intending to investigate using ABC.
5. Implemented ABC and subsequently decided to abandon it.
6. Investigated using ABC and decided to reject it.
7. Investigated using ABC and decided to reject it. However, the company established a system of activity analysis or cost driver analysis.
8. Rejected ABC, but never considered using it.
9. Never considered using ABC.

Q10. For your business unit, how important or unimportant is product cost information for each of the following decisions? (Please circle the appropriate number.)

	Do not make this type of decision	Very unimportant	Unimportant	Neutral	Important	Very important
a. Product pricing decisions.	0	1	2	3	4	5
b. Make or buy decisions.	0	1	2	3	4	5
c. Cost reduction decisions.	0	1	2	3	4	5
d. Product mix decisions.	0	1	2	3	4	5
e. Product output level decisions.	0	1	2	3	4	5
f. Product design decisions.	0	1	2	3	4	5
g. Evaluating new production process decisions.	0	1	2	3	4	5
h. Product introduction decisions.	0	1	2	3	4	5
i. Product discontinuation decisions.	0	1	2	3	4	5

Q11. **To what extent do you agree or disagree with the following statements relating to top management's knowledge and awareness about the importance of cost information in decision making? (Please circle the appropriate number.)**

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Top management has the enough knowledge about the importance of cost information in decision making.	1	2	3	4	5
b. Top management is aware of the undesirable consequences of making decisions based on inaccurate cost information.	1	2	3	4	5
c. Top management appreciates the accountants' efforts relating to providing detailed cost information when making decisions.	1	2	3	4	5

Section C. Your business unit's environment and production process

Q12. **What is the level of intensity or weakness of each of the following types of competition? (Please circle the appropriate number.)**

	Very weak	Weak	Moderate	Intense	Very intense
a. The current level of competition for the major products of your business unit.	1	2	3	4	5
b. The level of price competition for your business unit's major products.	1	2	3	4	5
c. The level of competition for purchasing raw materials for your business unit's major products.	1	2	3	4	5

Q13. **Which of the following best describes the type of production of your business unit? (Please circle the appropriate number(s).)**

1. Single product or project production.
2. Batch production.
3. Mass production.

Q14. Which of the following best describes the percentage of the customised and standardised products produced by your business unit? (Please circle the appropriate number.)

1. At least 95% of products are standardised.
2. Approximately 75% of products are standardised, and 25% of products are customised.
3. Approximately 50% of products are standardised and 50% of products are customised.
4. Approximately 75% of products are customised, and 25% of products are standardised.
5. At least 95% of products are customised.

Q15. To what extent do each of the following statements apply or do not apply to your business unit's products and production environment? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Most products are complex to produce because they contain large number of components.	1	2	3	4	5
b. Most products are complex to produce because they need to pass through large number of production stages/departments.	1	2	3	4	5
c. A large number of different products are produced.	1	2	3	4	5
d. Most products are produced in significantly different sizes.	1	2	3	4	5
e. There are major differences in product volumes or batch sizes.	1	2	3	4	5
f. The manufacturing process is not standardised because changes to the production process need to be made if some factors (e.g., the type of material or machine) have been changed.	1	2	3	4	5
g. The production processes for most products take a long time.	1	2	3	4	5
h. Most products require different processes to design, manufacture and distribute them.	1	2	3	4	5
i. For some or all products, the manufacturing process is partially manual and partially automated.	1	2	3	4	5
j. There are frequent new product introductions.	1	2	3	4	5
k. There are frequent changes in products and production processes.	1	2	3	4	5
l. Each product line requires different levels of support department costs (e.g., engineering, purchasing and marketing costs)	1	2	3	4	5

Q16. To what extent, if at all, does your business unit use the following types of advanced manufacturing technologies? (Please circle the appropriate number.) (If your answers are 1 (Not at all) for all choices, please go to question 18 on page 9.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Product design technologies: These technologies are used in designing the product (e.g., Computer Aided Design (CAD) and Computer Aided Engineering (CAE)).	1	2	3	4	5
b. Process technologies: These technologies are used on the shop floor, and provide information related to the manufacturing process (e.g., Computer Aided Manufacturing (CAM) and Flexible Manufacturing Systems (FMS)).	1	2	3	4	5
c. Logistic/planning technologies: These technologies are used to control the material flow from the stage of obtaining raw material to the stage of delivering finished products (e.g., Material Requirement Planning systems (MRP).	1	2	3	4	5
d. Information exchange technologies: These technologies are used to facilitate storing and exchanging information among process, product and logistic technologies (e.g., Electronic Data Interchange (EDI)).	1	2	3	4	5

Q17. To what extent, if at all, have the technologies in question 16 used by your business unit assisted in reducing the following costs? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Setup costs.	1	2	3	4	5
b. Costs of changing over production from one product to another.	1	2	3	4	5
c. Scheduling production runs costs.	1	2	3	4	5
d. First time inspection costs.	1	2	3	4	5
e. Moving material costs.	1	2	3	4	5
f. Other batch-related costs (e.g., preparation, cleaning, laboratory testing, and computer and production management costs).	1	2	3	4	5
g. Product design costs.	1	2	3	4	5

Q18. To what extent do you agree or disagree that the manufacturing technologies used by your business unit can perform the following functions? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. The ability to switch production from one product to another easily without incurring significant costs and taking much time.	1	2	3	4	5
b. The ability to perform various types of operations without requiring prohibitive efforts when switching from one operation to another.	1	2	3	4	5
c. The ability to produce products in different ways.	1	2	3	4	5
d. The ability to respond easily to changes in production volume.	1	2	3	4	5
e. The ability to produce different products in low volumes without incurring significant costs (i.e., economies of scope).	1	2	3	4	5
f. The ability to add and remove new products from the product mix.	1	2	3	4	5
g. The ability to make design changes to existing products.	1	2	3	4	5
h. The ability to produce a wide range of different products without investing in new major capital equipment.	1	2	3	4	5

Section D. Your business unit

Q19. Below is a list of different values that may be used to reflect and describe the nature of your business unit's work environment. To what extent, if at all, each of the following is valued in your business unit? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Being competitive.	1	2	3	4	5
b. Focus on achievements.	1	2	3	4	5
c. Having high expectations for performance.	1	2	3	4	5
d. Focus on action.	1	2	3	4	5
e. Focus on results.	1	2	3	4	5
f. Paying attention to detail.	1	2	3	4	5
g. Being precise.	1	2	3	4	5
h. Being careful.	1	2	3	4	5

Q20. **Below is a list of different practices that may be used to reflect and describe the nature of your business unit's work environment. To what extent, if at all, does each item represent a current practice of your business unit? (Please circle the appropriate number.)**

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Employee expectations are specified in detail.	1	2	3	4	5
b. Desired results are defined explicitly.	1	2	3	4	5
c. Work rules and/or specific work polices are used widely.	1	2	3	4	5
d. Direct supervision of employee activities takes place frequently.	1	2	3	4	5
e. Frequent monitoring of employee performance takes place.	1	2	3	4	5
f. Performance measures are precise and timely.	1	2	3	4	5
g. Performance reviews are detailed, comprehensive and frequent.	1	2	3	4	5
h. There is a strong link between the penalties imposed or rewards provided and the performance measures used.	1	2	3	4	5

Q21. **What is the percentage of each of the following costs in your business unit's total costs? (Please insert the appropriate percentage.)**

	%
Direct manufacturing costs.	( )
Indirect manufacturing costs.	( )
Non-manufacturing costs.	( )
Total costs.	100%

Q22. **Is your company a wholly Saudi-owned company? (Please circle the appropriate number.)**

1. Yes.
2. No.

Q23. What is the approximate amount of your business unit's sales revenue in the last financial year? (Please circle the appropriate number.)

1. Less than 10 million riyals.
2. 10 to 30 million riyals.
3. More than 30 to 75 million riyals.
4. More than 75 to 100 million riyals.
5. More than 100 to 150 million riyals.
6. More than 150 to 200 million riyals.
7. More than 200 to 300 million riyals.
8. More than 300 to 500 million riyals.
9. More than 500 million riyals.

Q24. What is the approximate number of employees of your business unit?

Please record the approximate number here: ....employees.

Q25. Which of the following best describes your business unit? (Please circle the appropriate number.)

1. A head office of a divisionalised company.
2. A division of a divisionalised company.
3. A branch of a division of a divisionalised company.
4. An autonomous company.
5. Others,
   Please specify: ....

Q26. What is the industrial sector of your business unit?

....

Q27. What is your role/position within the business unit where you work?

....

Thank you for taking the time to complete this questionnaire. I am grateful for your assistance in providing this information. If you would you like to add any comments about the questionnaire or your costing system, please use the space below.

1 - Would you like to participate in a follow up interview about your costing system? (If so, please tick your response.)
Yes ( ) No ( )

2 - Would you like to receive a summary of the study's results? (If so, please tick your response.)
Yes ( ) No ( )

3 – Do you accept receiving following up questions about your answers to the questionnaire? (If so, please tick your response.)
Yes ( ) No ( )

4 - Can you please provide me with your contact information? This information is needed for three purposes:

1. To contact you in case you agreed to be interviewed.
2. To contact you if further information is needed about your answers to the questionnaire.
3. To send you a summary of the study's results if you have requested them.

Name: ....
E-mail address: ....
Phone Number: ....

Thank you for your cooperation in completing this questionnaire. Please do not hesitate to contact me if you have any questions. You can call me (Abdulrahman Aljabr) on 00966506912416, or e-mail me at aaljabr1@sheffield.ac.uk. After you have completed the questionnaire, please return it in the enclosed stamped addressed envelope.

Version 2:

An exploratory study of costing system design in Saudi Arabia

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The University of Sheffield
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Section A. The usefulness of product cost information in decision making

Q1. To what extent, if at all, does your business unit use product cost information in the following decisions? (Please circle the appropriate number.)

	Do not make this type of decision	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Product pricing decisions.	0	1	2	3	4	5
b. Make or buy decisions.	0	1	2	3	4	5
c. Cost reduction decisions.	0	1	2	3	4	5
d. Product mix decisions.	0	1	2	3	4	5
e. Product output level decisions.	0	1	2	3	4	5
f. Product design decisions.	0	1	2	3	4	5
g. Evaluating new production process decisions.	0	1	2	3	4	5
h. Product introduction decisions.	0	1	2	3	4	5
i. Product discontinuation decisions.	0	1	2	3	4	5

Q2. To what extent do you agree or disagree with the following statements relating to your perception of the usefulness and accuracy of your costing system in calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. The business unit's costing system provides product cost information that is useful when making different decisions.	1	2	3	4	5
b. I rely on product cost information generated by the business unit's costing system to make different decisions.	1	2	3	4	5
c. I am satisfied with the accuracy of the business unit's costing system at assigning indirect costs to products for the purpose of decision making.	1	2	3	4	5

Section B. Your business unit's costing system

Q3 For the purpose of decision making (e.g., pricing, make or buy, or product introduction decisions), which costs does your business unit include in product costs? (Please circle all applicable numbers.)

1. Direct manufacturing costs (e.g., direct material and direct labour costs).
2. Variable indirect/overhead manufacturing costs (e.g., indirect material, indirect labour, machine energy/maintenance, and factory electricity and water costs).
3. Fixed indirect/overhead manufacturing costs (e.g., factory rent, insurance, and managerial salary costs).
4. Non-manufacturing costs (e.g., sales commissions and shipping costs and executives, secretarial, and public relations employee salaries costs).

The following information relates to Q4, Q5, Q6, Q7, and Q8.

The assignment of indirect/overhead costs to cost objects is often a two-stage procedure.

- The first stage involves the assignment of different overhead costs to cost centres (also known as cost pools), such as production departments, machines, or activities using different bases (also known as *first-stage bases* or resource drivers), such as production volume, area, or number of employees.

- In the second stage, one or multiple overhead allocation rates are established for each cost centre (cost pool) to assign overhead costs to cost objects (e.g., product X or product Y). The overhead allocation rates can be based on different bases (also known as *second-stage bases* or cost drivers), such as number of units produced, number of labour or machine hours, number of setups or number of purchase orders.

Q4 Which of the following statements describes the procedure that your business unit uses to assign overhead costs to products for the purpose of decision making? (Please circle the appropriate number.)

1. Overhead costs are not assigned to products, and are regarded as period costs that are charged to the profit and loss account. (If you answered 1, please go to question 9 on page 4.)
2. All overhead costs are accumulated in a single cost centre or cost pool to calculate a plant wide or single overhead rate that is used to assign all overhead costs to products regardless of the number of processes each product needs. (If you answered 2, please go to question 9 on page 4.)
3. Overhead costs are assigned to cost centres (e.g., production departments or machines), and then overhead costs are allocated between products based on *second-stage bases* that are related to the production volume (e.g., number of products produced and number of labour hours).
4. Overhead costs are assigned to cost pools (i.e., activities rather than production departments or machines), and then overhead costs are allocated between products based on cost drivers. Some of these cost drivers are related to the production volume (e.g., number of labour hours), whereas others are not (e.g., the time to set up machines for production).

Q5 For the purpose of decision making, how many different cost centres (cost pools) are used in the entire costing system used by your business unit when calculating product costs of all products?

Please write the number here: .... cost centres (cost pools).

Q6 For the purpose of decision making, how many different *first-stage bases* (resource drivers), such as area, or production volume are used when assigning overhead costs to cost centres (cost pools) as described above?

Please write the number here: .... *first-stage bases* (resource drivers).

Q7. For the purpose of decision making, how many different *second-stage bases* (cost drivers), such as the number of labour or machine hours, or the time to set up machines are used when allocating overhead costs accumulated in cost centres (cost pools) to cost objects as described on page 3?

Please write the number here:.....__________.......*second-stage bases* (cost drivers).

Q8. To what extent do you agree or disagree with the following statements relating to the level of detail of the costing system used by your business unit when calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Non-manufacturing overhead costs are directly assigned to cost centres (cost pools) or assigned by using *first-stage bases* (resource drivers) that represent the consumption of these costs by cost centres (cost pools).	1	2	3	4	5
b. Manufacturing overhead costs are directly assigned to cost centres (cost pools) or assigned by using *first-stage bases* (resource drivers) that represent the consumption of these costs by cost centres (cost pools).	1	2	3	4	5
c. The number of cost centres (cost pools) is enough to ensure that each cost centre (cost pool) contains only homogeneous production processes.	1	2	3	4	5
d. When assigning overhead costs from cost centres (cost pools) to products, the costing system uses multiple overhead rates that are established using different *second-stage bases* (cost drivers).	1	2	3	4	5
e. When assigning overhead costs from cost centres (cost pools) to products, the costing system uses *second-stage bases* (cost drivers) that represent the actual quantity of resources consumed.	1	2	3	4	5

Q9. To what extent do you agree or disagree with the following statements relating to top management's attitude to the costing system when calculating product costs for the purpose of decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Top management considers that the costing system is important to the business unit.	1	2	3	4	5
b. Top management provides support to your business unit's costing system.	1	2	3	4	5
c. Top management has provided adequate resources to implement your business unit's costing system.	1	2	3	4	5

Q10. Which of the following best describes your business unit's experience with activity-based costing (ABC)? (Please circle the appropriate number.)

1. Currently using ABC.
2. Intending to use ABC.
3. Currently investigating using ABC.
4. Intending to investigate using ABC.
5. Implemented ABC and subsequently decided to abandon it.
6. Investigated using ABC and decided to reject it.
7. Investigated using ABC and decided to reject it. However, the company established a system of activity analysis or cost driver analysis.
8. Rejected ABC, but never considered using it.
9. Never considered using ABC.

Q11. For your business unit, how important or unimportant is product cost information for each of the following decisions? (Please circle the appropriate number.)

	Do not make this type of decision	Very unimportant	Unimportant	Neutral	Important	Very important
a. Product pricing decisions.	0	1	2	3	4	5
b. Make or buy decisions.	0	1	2	3	4	5
c. Cost reduction decisions.	0	1	2	3	4	5
d. Product mix decisions.	0	1	2	3	4	5
e. Product output level decisions.	0	1	2	3	4	5
f. Product design decisions.	0	1	2	3	4	5
g. Evaluating new production process decisions.	0	1	2	3	4	5
h. Product introduction decisions.	0	1	2	3	4	5
i. Product discontinuation decisions.	0	1	2	3	4	5

Q12. To what extent do you agree or disagree with the following statements relating to top management's knowledge and awareness about the importance of cost information in decision making? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. Top management has the enough knowledge about the importance of cost information in decision making.	1	2	3	4	5
b. Top management is aware of the undesirable consequences of making decisions based on inaccurate cost information.	1	2	3	4	5
c. Top management appreciates the accountants' efforts relating to providing detailed cost information when making decisions.	1	2	3	4	5

Section C. Your business unit's environment and production process

Q13. What is the level of intensity or weakness of each of the following types of competition? (Please circle the appropriate number.)

	Very weak	Weak	Moderate	Intense	Very intense
a. The current level of competition for the major products of your business unit.	1	2	3	4	5
b. The level of price competition for your business unit's major products.	1	2	3	4	5
c. The level of competition for purchasing raw materials for your business unit's major products.	1	2	3	4	5

Q14. Which of the following best describes the type of production of your business unit? (Please circle the appropriate number(s).)

1. Single product or project production.
2. Batch production.
3. Mass production.

Q15. Which of the following best describes the percentage of the customised and standardised products produced by your business unit? (Please circle the appropriate number.)

1. At least 95% of products are standardised.
2. Approximately 75% of products are standardised, and 25% of products are customised.
3. Approximately 50% of products are standardised and 50% of products are customised.
4. Approximately 75% of products are customised, and 25% of products are standardised.
5. At least 95% of products are customised.

Q16. To what extent do each of the following statements apply or do not apply to your business unit's products and production environment? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Most products are complex to produce because they contain large number of components.	1	2	3	4	5
b. Most products are complex to produce because they need to pass through large number of production stages/departments.	1	2	3	4	5
c. A large number of different products are produced.	1	2	3	4	5
d. Most products are produced in significantly different sizes.	1	2	3	4	5
e. There are major differences in product volumes or batch sizes.	1	2	3	4	5
f. The manufacturing process is not standardised because changes to the production process need to be made if some factors (e.g., the type of material or machine) have been changed.	1	2	3	4	5
g. The production processes for most products take a long time.	1	2	3	4	5
h. Most products require different processes to design, manufacture and distribute them.	1	2	3	4	5
i. For some or all products, the manufacturing process is partially manual and partially automated.	1	2	3	4	5
j. There are frequent new product introductions.	1	2	3	4	5
k. There are frequent changes in products and production processes.	1	2	3	4	5
l. Each product line requires different levels of support department costs (e.g., engineering, purchasing and marketing costs)	1	2	3	4	5

Q17. To what extent, if at all, does your business unit use the following types of advanced manufacturing technologies? (Please circle the appropriate number.) (If your answers are 1 (Not at all) for all choices, please go to question 19 on page 9.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. <u>Product design technologies:</u> These technologies are used in designing the product (e.g., Computer Aided Design (CAD) and Computer Aided Engineering (CAE)).	1	2	3	4	5
b. <u>Process technologies:</u> These technologies are used on the shop floor, and provide information related to the manufacturing process (e.g., Computer Aided Manufacturing (CAM) and Flexible Manufacturing Systems (FMS)).	1	2	3	4	5
c. <u>Logistic/planning technologies:</u> These technologies are used to control the material flow from the stage of obtaining raw material to the stage of delivering finished products (e.g., Material Requirement Planning systems (MRP).	1	2	3	4	5
d. <u>Information exchange technologies:</u> These technologies are used to facilitate storing and exchanging information among process, product and logistic technologies (e.g., Electronic Data Interchange (EDI)).	1	2	3	4	5

Q18. To what extent, if at all, have the technologies in question 17 used by your business unit assisted in reducing the following costs? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Setup costs.	1	2	3	4	5
b. Costs of changing over production from one product to another.	1	2	3	4	5
c. Scheduling production runs costs.	1	2	3	4	5
d. First time inspection costs.	1	2	3	4	5
e. Moving material costs.	1	2	3	4	5
f. Other batch-related costs (e.g., preparation, cleaning, laboratory testing, and computer and production management costs).	1	2	3	4	5
g. Product design costs.	1	2	3	4	5

Q19. To what extent do you agree or disagree that the manufacturing technologies used by your business unit can perform the following functions? (Please circle the appropriate number.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. The ability to switch production from one product to another easily without incurring significant costs and taking much time.	1	2	3	4	5
b. The ability to perform various types of operations without requiring prohibitive efforts when switching from one operation to another.	1	2	3	4	5
c. The ability to produce products in different ways.	1	2	3	4	5
d. The ability to respond easily to changes in production volume.	1	2	3	4	5
e. The ability to produce different products in low volumes without incurring significant costs (i.e., economies of scope).	1	2	3	4	5
f. The ability to add and remove new products from the product mix.	1	2	3	4	5
g. The ability to make design changes to existing products.	1	2	3	4	5
h. The ability to produce a wide range of different products without investing in new major capital equipment.	1	2	3	4	5

Section D. Your business unit

Q20. Below is a list of different values that may be used to reflect and describe the nature of your business unit's work environment. To what extent, if at all, each of the following is valued in your business unit? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Being competitive.	1	2	3	4	5
b. Focus on achievements.	1	2	3	4	5
c. Having high expectations for performance.	1	2	3	4	5
d. Focus on action.	1	2	3	4	5
e. Focus on results.	1	2	3	4	5
f. Paying attention to detail.	1	2	3	4	5
g. Being precise.	1	2	3	4	5
h. Being careful.	1	2	3	4	5

Q21. Below is a list of different practices that may be used to reflect and describe the nature of your business unit's work environment. To what extent, if at all, does each item represent a current practice of your business unit? (Please circle the appropriate number.)

	Not at all	To a little extent	To some extent	To a considerable extent	To a very great extent
a. Employee expectations are specified in detail.	1	2	3	4	5
b. Desired results are defined explicitly.	1	2	3	4	5
c. Work rules and/or specific work polices are used widely.	1	2	3	4	5
d. Direct supervision of employee activities takes place frequently.	1	2	3	4	5
e. Frequent monitoring of employee performance takes place.	1	2	3	4	5
f. Performance measures are precise and timely.	1	2	3	4	5
g. Performance reviews are detailed, comprehensive and frequent.	1	2	3	4	5
h. There is a strong link between the penalties imposed or rewards provided and the performance measures used.	1	2	3	4	5

Q22. What is the percentage of each of the following costs in your business unit's total costs? (Please insert the appropriate percentage.)

	%
Direct manufacturing costs.	( )
Indirect manufacturing costs.	( )
Non-manufacturing costs.	( )
Total costs.	100%

Q23. Is your company a wholly Saudi-owned company? (Please circle the appropriate number.)

1. Yes.
2. No.

Q24. What is the approximate amount of your business unit's sales revenue in the last financial year? (Please circle the appropriate number.)

1. Less than 10 million riyals.
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3. More than 30 to 75 million riyals.
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7. More than 200 to 300 million riyals.
8. More than 300 to 500 million riyals.
9. More than 500 million riyals.

Q25. What is the approximate number of employees of your business unit?

Please record the approximate number here: .... employees.

Q26. Which of the following best describes your business unit? (Please circle the appropriate number.)

1. A head office of a divisionalised company.
2. A division of a divisionalised company.
3. A branch of a division of a divisionalised company.
4. An autonomous company.
5. Others,
   Please specify: ....

Q27. What is the industrial sector of your business unit?

....

Q28. What is your role/position within the business unit where you work?

....

Thank you for taking the time to complete this questionnaire. I am grateful for your assistance in providing this information. If you would you like to add any comments about the questionnaire or your costing system, please use the space below.

1 - Would you like to participate in a follow up interview about your costing system? (If so, please tick your response.)

Yes ( ) No ( )

2 - Would you like to receive a summary of the study's results? (If so, please tick your response.)

Yes ( ) No ( )

3 – Do you accept receiving following up questions about your answers to the questionnaire? (If so, please tick your response.)

Yes ( ) No ( )

4 - Can you please provide me with your contact information? This information is needed for three purposes:

1. To contact you in case you agreed to be interviewed.
2. To contact you if further information is needed about your answers to the questionnaire.
3. To send you a summary of the study's results if you have requested them.

Name: ______________________________

E-mail address: ______________________________

Phone Number: ______________________________

Thank you for your cooperation in completing this questionnaire. Please do not hesitate to contact me if you have any questions. You can call me (Abdulrahman Aljabr) on 00966506912416, or e-mail me at aaljabr1@sheffield.ac.uk. After you have completed the questionnaire, please return it in the enclosed stamped addressed envelope.

Appendix 6-15: Full list of the administration-related guidelines followed in administrating the questionnaire

Table 1: Guidelines followed for using multiple modes of questionnaire in the mixed-mode questionnaire:

1. Offering the mail questionnaire after the web questionnaire if the different modes of questionnaire were offered sequentially.
2. Using a sponsor who has established connections with the sample members.
3. Reducing questionnaire costs by using the more expansive questionnaire mode in a later stage of the implementation process.

Table 2: The followed general administration-related guidelines

5. Using multiple contacts and varying the message between them; recommended four contacts.
6. Being precise in the timing of making contacts; recommended time interval of 1 week, 2 weeks and 10 days between the four contacts.
7. Sending a token appreciation with the survey request
8. Keeping the e-mail contact as short as possible **(Online questionnaire).**
9. Taking care about sender name and address and the subject line text for the e-mail communication **(Online questionnaire)**.
10. Designing a cover letter with care - i.e., including the most important information, such as the research purpose, a request to complete the questionnaire, information about confidentiality and instructions on returning the questionnaire to convince respondents to complete it - and sending it with the questionnaire **(Paper questionnaire)**.

Appendix 6-16: The English E-mail including the links to the online questionnaires

Dear (*potential respondent name*),

As I explained in my visit/call, I am conducting a research project related to costing system design and its usefulness in the Saudi manufacturing industry. This questionnaire is part of my PhD research at The University of Sheffield in the UK, which is sponsored by King Faisal University, Saudi Arabia as indicated by the attached letter from King Faisal University.

I hope that providing you with a link to the questionnaire makes it easy for you to respond. To complete the English copy of the online questionnaire, simply click on this link:

http://www.smartsurvey.co.uk/s/EnglishSurvey/

Alternatively, you can access the Arabic copy of the online questionnaire by clicking on this link:

http://www.smartsurvey.co.uk/s/ArabicSurvey/

Also, I attach English and Arabic copies of a paper version of the questionnaire along with the cover letters in case you prefer to complete a paper version of the questionnaire. After you have completed the paper version of the questionnaire, please email it back to: aaljabr1@sheffield.ac.uk.

This research is important because it aims to provide information about the conditions that necessitate the need to have more detailed costing systems, and the role that organisational factors play in facilitating increasing the level of detail of costing systems. In addition, this research aims to provide information about the conditions under which increasing the level of detail of costing systems could be effective.

By completing this questionnaire, you will be entered into a draw to receive one of five coupons each with a value of 200 SR purchases from Jarir Bookstore. In addition, if you wish, I will send you a summary of the main findings. The responses you provide are confidential, and will not be revealed to any third party. I will not record the results of individual questionnaire respondents or the identities of any respondent or his/her business-unit in my work.

I truly appreciate your participation. Please do not hesitate to contact me if you have any questions. You can call me on 00966506912416, or e-mail me at aaljabr1@sheffield.ac.uk.

Thank you for your help,
Abdulrahman Aljabr
Lecturer in Management and Cost Accounting, King Faisal University
Researcher, The University of Sheffield

Appendix 6-17: The Arabic e-mail including the links to the online questionnaires

الأخ/ت الفاضل/ه (إسم الشخص)،

كما وضحت مسبقا في زيارتي/مكالمتي، أنا أجري بحث متعلق بدرجة تفصيل و منفعة أنظمة التكاليف المطبقة في القطاع الصناعي في المملكة العربية السعودية. هذا الإستبيان هو جزء من بحث الدكتوراة الذي أجريه في جامعة شيفلد البريطانية، والذي تقوم بدعمه جامعة الملك فيصل بالمملكة العربية السعودية كما هو موضح بالخطاب المرفق من جامعة الملك فيصل.

أتمنى أن يكون إرفاق الرابط الإلكتروني للإستبيان مساهما في تسهيل عملية الإجابة عليه. إذا أحببت أن تقوم بإكمال الإستبيان الإلكتروني، يمكنك الضغط على الرابط:
الإستبيان باللغة العربية: http://www.s.smartsurvey.co.uk/ArabicSurvey/
الإستبيان باللغة الإنجليزية: http://www.s.smartsurvey.co.uk/EnglishSurvey/

بالإضافة إلى ذلك، لقد قمت بإرفاق نسخة ورقية للإستبيان والخطاب التوضيحي له باللغتين العربية والإنجليزية في حال رغبت بإستكمال النسخة الورقية من الإستبيان. بعد إكمالك النسخة الورقية من الإستبيان، آمل إعادة إرسالها بواسطة البريد الإلكتروني إلى: aaljabr1@Sheffield.ac.uk .

إن هذا البحث سوف يكون مفيد من خلال تقديم معلومات عن الحالات التي تُوجب على المنشآت زيادة تفصيل نظام التكاليف المطبق لديهم، وعن دور بعض العوامل الخاصة بالمنشأة في تسهيل عملية زيادة تفصيل النظام. إضافة إلى ذلك، يسعى هذا البحث إلى تزويد معلومات عن الحالات التي يكون عندها زيادة تفصيل أنظمة التكاليف أمرا نافعا ومفيدا للمنشآت.

بإكمالك لهذا الإستبيان، سوف يدخل إسمك السحب للفوز بكوبون من خمس كوبونات مشتريات بقمة 200 ريال لكل كوبون من مكتبة جرير. أيضا، سوف أقوم بإرسال ملخص نتائج الدراسة إليك إذا رغبت بذلك. الأجوبة التي سوف تقوم بتقديمها ستكون سرية ولن يفصح عنها إلى أي طرف ثالث. لن أقوم بالإفصاح عن أجوبة أي استبيان بعينه أو عن هوية أي مشارك أو عن هوية منشأته عند كتابة نتائج هذا البحث.

إني أتتطلع لمشاركتكم في هذا البحث. أرجو إعلامي في حال رغبت بمعلومات إضافية. يمكنك التواصل معي بواسطة البريد الإلكتروني على: aaljabr1@Sheffield.ac.uk أو عن طريق الإتصال على رقم: ٠٠٩٦٦٥٠٦٩١٢٤١٦

تحياتي وتقديري،
عبدالرحمن الجبر
محاضر محاسبة إدارية وتكاليف، جامعة الملك فيصل
باحث، جامعة شيفلد البريطانية

Appendix 6-18: King Faisal University's letter

KINGDOM OF SAUDI ARABIA
Ministry of Higher Education
KING FAISAL UNIVERSITY
(037)

المملكة العربية السعودية
وزارة التعليم العالي
جامعة الملك فيصل
(٠٣٧)

الموضوع:...

إلى من يهمه الأمر:

نفيدكم بأن الأستاذ/ عبدالرحمن بن علي الجبر احد مبتعثي قسم المحاسبة بكلية إدارة الأعمال إلى جامعة شيفلد ببريطانيا للحصول على درجة الدكتوراه في المحاسبة، والتي تتطلب تقديم بحث متميز في مجال المحاسبة.

عليه نأمل من سعادتكم مساعدة المذكور في الحصول على معلومات من شركتكم الموقرة لمساعدة الباحث في إتمام البحث والذي يندرج تحت عنوان "دراسة استكشافيه لأنظمة التكاليف المطبقة في المملكة العربية السعودية"، علماً بأن المعلومات سوف تستخدم لأغراض البحث العلمي فقط وأن المعلومات ستعامل بسرية ولن تتم الاشارة إلى أسماء الأشخاص المشاركين في الاستبيان.

ولكم مني خالص الشكر والتقدير،،

رئيس قسم المحاسبة

د. ثامر بن سعد البراك

الرقم: التاريخ: المرفقات:

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Kingdom of Saudi Arabia P.O.Box 400 Al-Hassa - 31982 Tel: 035800000 Fax: 035816980

المملكة العربية السعودية ص.ب ٤٠٠ الأحساء - ٣١٩٨٢ الهاتف: ٠٣٥٨٠٠٠٠٠ فاكس: ٠٣٥٨١٦٩٨٠

مطابع جامعة الملك فيصل 2450

Appendix 6-19: The administration of the mixed-mode questionnaire to the modified sample

Table 1: Details of the administration of the mixed-mode questionnaire to the modified sample

	MODON	RCJY
Initial contact	**Step 1:** 1.Visits to business-units. During the visit, the contact information of the potential respondent was gathered. In addition, potential respondents were asked whether they preferred a paper questionnaire to be given to them during the visit. 2.Phone calls to business-units when the potential respondent, e.g., cost accountant, could not be reached by the researcher. During the phone call, the contact information of the potential respondent was gathered. **Step 2:** On the same day as the visit and phone call, the researcher sent an e-mail that included:[187] 1.The web addresses, i.e., links, of the English and Arabic online questionnaires. 2.Attachments of the English and Arabic paper questionnaires and cover letters, and the King Faisal University's letter.	**Step 1:** Phone calls. During the phone call, the contact information of the potential respondent was gathered. **Step 2:** On the same day as the phone call, the researcher sent an e-mail that included: 1.The web addresses, i.e., links, of the English and Arabic online questionnaires. 2.Attachments of the English and Arabic paper questionnaires and cover letters, and the King Faisal University's letter.

[187] All of the respondents were emailed, including those who preferred to receive the paper questionnaire during the visit.

Table 1: Details of the administration of the mixed-mode questionnaire to the modified sample (continued)

	MODON	RCJY
Second contact (first reminder) to non-respondents	E-mail that included the same web links and attachments as the first e-mail that was sent as part of the initial contact.	E-mail that included the same web links and attachments as the first e-mail that was sent as part of the initial contact.
Third contact (second reminder) to non-respondents	Phone call.	Phone call.
Fourth contact (third reminder) to non-respondents	E-mail that included the same web links and attachments as the first e-mail - part of the initial contact - and second e-mail, i.e., second contact.	E-mail that included the same web links and attachments as the first e-mail - part of the initial contact - and second e-mail, i.e., second contact.

Appendix 6-20: Non-response bias results

Table 1: Results of the independent-samples t-test (n = 200)

Construct	**Mean difference**	**t**	**df**	**Significance**
COMP	-1.07	-1.09	198	0.278
CostStructure-MANUFACTURING[a]	-0.02	-0.80	198	0.427
CostStructure-COMBINED	-1.48	-0.64	198	0.525
CultureOutcome	-1.36	-1.47	198	0.143
CultureDetail	-1.14	-1.37	193	0.171
CultureControl	-0.08	-0.72	198	0.470
PC	0.09	0.92	198	0.360
SizeRevenue[a]	-0.07	-0.18	198	0.860
SizeEmployees	0.08	0.51	198	0.614
TMS	-0.26	-2.39	198	**0.018**
TMKA	-0.22	-2.10	198	**0.037**
CSC-CostPools[a]	0.10	0.58	198	0.563
CSC-CostDrivers[a]	0.10	1.47	198	0.144
CSC-COMPOSITE	0.30	0.61	198	0.542
CSC-DEVELOPED[b]	0.04	0.41	150	0.684
USEFULNESS	-0.02	-0.18	198	0.859
USAGE	-0.10	-0.94	198	0.351

a. To treat the univariate outliers issue, the transformed scales for these constructs were used. Further details about the treatment of the issue relating to outliers are provided in Section 7.2.3.

b. The independent-samples t-test involving CSC-DEVELOPED was conducted for 152 cases for whom Q7 regarding CSC-DEVELOPED was applicable (see Sections 6.3.2.1.2.1, 7.2.4 and 7.4.2.2).

Table 2: Results of the Mann-Whitney test (n = 200)

Construct	**Mann-Whitney U**	**Wilcoxon W**	**Z**	**Asymp. Sig. (2-tailed)**
COMP	4179	11439	-1.57	0.116
CostStructure-MANUFACTURING[a]	4547	11807	-0.63	0.527
CostStructure-COMBINED	4726	11986	-0.19	0.852
CultureOutcome	4512	11772	-0.72	0.470
CultureDetail	4394	11654	-1.03	0.302
CultureControl	4581	11841	-0.55	0.583
PC	4464	7704	-0.84	0.402
SizeRevenue	4731	11991	-0.17	0.862
SizeEmployees[a]	4552	7792	-0.62	0.536
TMS	4006	11266	-2.02	**0.044**
TMKA	4158	11418	-1.64	0.101
CSC-CostPools[a]	4580	7820	-0.55	0.581
CSC-CostDrivers[a]	4163	7403	-1.67	0.094
CSC-COMPOSITE	4517	7757	-0.71	0.477
CSC-DEVELOPED[b]	2568	4279	-0.60	0.546
USEFULNESS	4747	7987	-0.14	0.892
USAGE	4651	11911	-0.37	0.709

a. To treat the univariate outliers issue, the transformed scales for these constructs were used. Further details about the treatment of the issue relating to outliers are provided in Section 7.2.3.
b. The Mann-Whitney test involving CSC-DEVELOPED was conducted for 152 cases for whom Q7 regarding CSC-DEVELOPED was applicable (see Sections 6.3.2.1.2.1, 7.2.4 and 7.4.2.2).

Table 3: Results of the Chi-square test for independence[a] (n = 200)

Variable	Pearson Chi-Square	Continuity Correction	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)[b]
Overhead assignment method[c]	5.34		3	0.149	
ABC usage[d]		0.00	1	0.961	0.811[d]
Nationality (wholly Saudi-owned business-unit)[e]		0.50	1	0.482	
Production type[f]	4.83		3	0.184	

a. When the two variables involved in the Chi-square test for independence are not dichotomous, the significance value of the Pearson Chi-Square value is used to examine whether there are significant differences between the two groups (Pallant, 2013). However, when the two variables involved in the Chi-square test for independence are dichotomous, the significance value of the Continuity Correction value is used instead (ibid). Relating to this, the Chi-square test for independence assumes that the minimum expected cell count is 10 when the variables involved in the test are dichotomous (ibid). If this assumption is violated, the results of the Fisher's Exact Probability Test should be used instead of the significance value of the Continuity Correction value (ibid). The two tests relating to ABC usage and Nationality involve dichotomous variables.

b. Significance value for the Fisher's Exact Probability Test.

c. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.40.
When the two variables involved in the Chi-square test for independence are not dichotomous, the Chi-square test for independence assumes that the minimum expected cell count is five rather than 10 (Pallant, 2013). However, having one cell with a number of cases that is lower than the minimum expected count of five is not considered a violation to this assumption as long as more than 80% of the cells have an expected count of at least five (ibid). The Chi-square test for independence for the variable overhead assignment method includes 92.5% of cells with an expected count of at least five, indicating no violation to the test’s assumption.

d. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.60.
Given that the Chi-square test for independence for ABC usage involves dichotomous variables, and that the results reported in d shows that there is one cell that has an expected count that is lower than 10 (7.60), the results of the Fisher's Exact Probability Test should be used.

e. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 26.80.

f. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.60.

Appendix 8-1: The results of the first stage of applying PRA along with RSM (i.e., the confirmatory approach)

Table 1: Quadratic polynomial regression models that did not meet the first criterion (i.e., significant R^2)

Contingency factor	CSC measure	Outcome measure	R^2	Adjusted R^2	F-ratio	Significance
CostStructure-MANUFACTURING	CSC-CostPools	USAGE	0.04	0.01	1.52	0.185
CostStructure-COMBINED	CSC-CostPools	USAGE	0.05	0.02	1.86	0.104
CostStructure-MANUFACTURING	CSC-CostDrivers	USEFULNESS	0.05	0.03	2.02	0.077
PC	CSC-CostDrivers	USEFULNESS	0.05	0.02	1.98	0.084
CostStructure-MANUFACTURING	CSC-CostDrivers	USAGE	0.05	0.02	2.00	0.081
CostStructure-MANUFACTURING	CSC-COMPOSITE	USAGE	0.05	0.02	1.94	0.089

Table 2: Quadratic polynomial regression models that did not meet the second criterion (CSC-CostPools as the CSC measure)

			Coefficients				
Contingency factor	**CSC measure**	**Outcome measure**	**CSC**	**contingency**	**$(CSC)^2$**	**(CSC)(contingency)**	**$(contingency)^2$**
COMP	CSC-CostPools	USEFULNESS	0.57*	-0.51	-1.01	0.56	2.98***
CostStructure-MANUFACTURING	CSC-CostPools	USEFULNESS	0.67**	0.51	-1.75**	0.54	0.49
CostStructure-COMBINED	CSC-CostPools	USEFULNESS	0.96**	0.38	-1.55*	1.64	0.41
CultureOutcome	CSC-CostPools	USEFULNESS	0.76**	0.66*	-1.67**	-1.59	0.98
CultureDetail	CSC-CostPools	USEFULNESS	0.79**	0.61**	-1.63**	-1.53	0.41
CultureControl	CSC-CostPools	USEFULNESS	0.69***	0.40	-1.41*	-2.50**	1.89**
PC	CSC-CostPools	USEFULNESS	0.68**	0.03	-1.45*	1.13	1.65
SizeRevenue	CSC-CostPools	USEFULNESS	0.73*	0.10	-0.53	-2.12**	0.50
SizeEmployees	CSC-CostPools	USEFULNESS	0.47	0.31	-1.47	-0.36	-0.75
TMS	CSC-CostPools	USEFULNESS	0.30	1.68***	-1.31*	0.09	-0.70
TMKA	CSC-CostPools	USEFULNESS	0.19	3.18***	-0.92	0.97	-3.42***
COMP	CSC-CostPools	USAGE	0.72*	0.24	-1.12	-2.20	0.94
CultureOutcome	CSC-CostPools	USAGE	0.45	0.72	-1.26	-1.76	1.08
CultureDetail	CSC-CostPools	USAGE	0.30	1.55***	-1.14	-0.95	-1.51**
CultureControl	CSC-CostPools	USAGE	0.30	0.83***	-1.30	-1.41	0.20
PC	CSC-CostPools	USAGE	-0.35	-0.49	-1.85**	-4.59***	-1.15
SizeRevenue	CSC-CostPools	USAGE	0.60	-0.05	-0.06	-1.75	-0.16
SizeEmployees	CSC-CostPools	USAGE	0.12	0.42	-0.69	-1.06	-0.91
TMS	CSC-CostPools	USAGE	0.59	0.64	-0.59	-2.06	0.89
TMKA	CSC-CostPools	USAGE	0.91**	2.36***	-0.85	-2.75**	-1.35

*** p < 0.10, ** p < 0.05, *** p < 0.01.**

Table 3: Quadratic polynomial regression models that did not meet the second criterion (CSC-CostDrivers as the CSC measure)

			Coefficients				
Contingency factor	**CSC measure**	**Outcome measure**	**CSC**	**contingency**	**$(CSC)^2$**	**(CSC)(contingency)**	**$(contingency)^2$**
COMP	CSC-CostDrivers	USEFULNESS	0.78**	-0.67	-0.15	-1.13	3.10***
CostStructure-COMBINED	CSC-CostDrivers	USEFULNESS	1.25***	0.25	-0.09	3.92**	-0.02
CultureOutcome	CSC-CostDrivers	USEFULNESS	0.81**	1.13***	-0.44	-1.78	0.13
CultureDetail	CSC-CostDrivers	USEFULNESS	0.75***	0.78***	-0.24	-1.54	0.17
CultureControl	CSC-CostDrivers	USEFULNESS	0.67***	0.57**	-0.52	-2.17*	1.81**
SizeRevenue	CSC-CostDrivers	USEFULNESS	0.40	0.35**	0.30	-1.38*	0.35
SizeEmployees	CSC-CostDrivers	USEFULNESS	0.32	0.49*	-0.13	-0.23	-1.10
TMS	CSC-CostDrivers	USEFULNESS	0.09	1.84***	-0.40	0.29	-0.82
TMKA	CSC-CostDrivers	USEFULNESS	0.41	3.15***	-0.38	-0.01	-3.52***
COMP	CSC-CostDrivers	USAGE	0.82*	0.54	-0.95	-0.94	0.80
CostStructure-COMBINED	CSC-CostDrivers	USAGE	1.42***	-0.04	-0.99	4.23**	-1.12
CultureOutcome	CSC-CostDrivers	USAGE	0.49	1.12***	-1.14	0.03	0.69
CultureDetail	CSC-CostDrivers	USAGE	0.59*	1.74***	-0.97	-0.14	-1.73**
CultureControl	CSC-CostDrivers	USAGE	0.44	1.11***	-1.49*	0.63	-0.18
PC	CSC-CostDrivers	USAGE	0.45	0.13	-1.14	-1.90	0.58
SizeRevenue	CSC-CostDrivers	USAGE	0.64**	0.12	-0.54	-1.13	-0.40
SizeEmployees	CSC-CostDrivers	USAGE	0.42	0.55*	-1.22	0.96	-1.68
TMS	CSC-CostDrivers	USAGE	-0.03	1.36***	-1.30	1.23	-0.04
TMKA	CSC-CostDrivers	USAGE	0.76	2.9***	-1.21	-1.09	-1.82

*** p < 0.10, ** p < 0.05, *** p < 0.01.**

Table 4: Quadratic polynomial regression models that did not meet the second criterion (CSC-COMPOSITE as the CSC measure)

			Coefficients				
Contingency factor	**CSC measure**	**Outcome measure**	**CSC**	**contingency**	**$(CSC)^2$**	**(CSC)(contingency)**	**$(contingency)^2$**
COMP	CSC-COMPOSITE	USEFULNESS	0.63**	-0.68	-1.14	-0.15	3.15***
CostStructure-MANUFACTURING	CSC-COMPOSITE	USEFULNESS	0.68***	0.61	-1.67**	1.43	0.50
CostStructure-COMBINED	CSC-COMPOSITE	USEFULNESS	1.11***	0.50	-1.35*	2.47*	0.62
CultureOutcome	CSC-COMPOSITE	USEFULNESS	0.77***	0.74**	-1.59**	-1.51	0.94
CultureDetail	CSC-COMPOSITE	USEFULNESS	0.82***	0.66**	-1.54**	-1.56*	0.38
CultureControl	CSC-COMPOSITE	USEFULNESS	0.71***	0.44*	-1.29*	-2.42**	2.00**
PC	CSC-COMPOSITE	USEFULNESS	0.67**	-0.01	-1.38*	0.93	1.63
SizeRevenue	CSC-COMPOSITE	USEFULNESS	0.65**	0.15	-0.55	-2.07**	0.51
SizeEmployees	CSC-COMPOSITE	USEFULNESS	0.47*	0.31	-1.40	-0.43	-0.81
TMS	CSC-COMPOSITE	USEFULNESS	0.20	1.76***	-0.81	0.20	-0.84
TMKA	CSC-COMPOSITE	USEFULNESS	0.27	3.10***	-0.77	0.62	-3.42***
COMP	CSC-COMPOSITE	USAGE	0.80**	0.27	-0.72	-1.24	1.50
CostStructure-COMBINED	CSC-COMPOSITE	USAGE	0.89**	0.25	-1.00	2.53*	-0.28
CultureOutcome	CSC-COMPOSITE	USAGE	0.46	0.87**	-1.27	-1.12	0.95
CultureDetail	CSC-COMPOSITE	USAGE	0.41	1.62***	-1.09	-0.63	-1.54**
CultureControl	CSC-COMPOSITE	USAGE	0.34	0.96***	-1.46*	-0.62	0.11
PC	CSC-COMPOSITE	USAGE	0.02	-0.18	-1.51*	-3.14**	-0.03
SizeRevenue	CSC-COMPOSITE	USAGE	0.57*	-0.01	-0.42	-1.56	-0.19
SizeEmployees	CSC-COMPOSITE	USAGE	0.17	0.48	-1.09	-0.13	-1.32
TMS	CSC-COMPOSITE	USAGE	0.36	0.88*	-0.85	-0.95	0.67
TMKA	CSC-COMPOSITE	USAGE	0.76*	2.51***	-0.97	-1.95*	-1.37

*** p < 0.10, ** p < 0.05, *** p < 0.01.**

Table 5: Quadratic polynomial regression models that did not meet the second criterion (CSC-DEVELOPED as the CSC measure)

Contingency factor	**CSC measure**	**Outcome measure**	**Coefficients** **CSC**	**contingency**	**$(CSC)^2$**	**(CSC)(contingency)**	**$(contingency)^2$**
COMP	CSC-DEVELOPED	USEFULNESS	1.29***	-0.38	0.70	-2.03	2.71*
CostStructure-MANUFACTURING	CSC-DEVELOPED	USEFULNESS	1.06***	0.28	0.11	3.98**	1.12
CostStructure-COMBINED	CSC-DEVELOPED	USEFULNESS	1.60***	0.20	0.29	3.30**	0.42
CultureOutcome	CSC-DEVELOPED	USEFULNESS	0.72**	0.81**	0.22	-0.41	0.36
CultureDetail	CSC-DEVELOPED	USEFULNESS	0.96***	0.13	0.21	-1.12	1.61**
CultureControl	CSC-DEVELOPED	USEFULNESS	0.92***	0.67**	0.20	-0.86	0.05
PC	CSC-DEVELOPED	USEFULNESS	1.11***	-0.07	0.58	2.49*	2.28*
SizeRevenue	CSC-DEVELOPED	USEFULNESS	0.86***	0.27*	0.48	-0.45	0.49
SizeEmployees	CSC-DEVELOPED	USEFULNESS	0.88***	0.46*	0.38	-1.34	-0.82
TMS	CSC-DEVELOPED	USEFULNESS	1.16***	1.08**	0.09	-1.57	0.34
TMKA	CSC-DEVELOPED	USEFULNESS	1.22***	3.05***	0.76	-2.11	-3.10*
COMP	CSC-DEVELOPED	USAGE	1.18***	1.09	1.24	-1.52	-0.55
CostStructure-MANUFACTURING	CSC-DEVELOPED	USAGE	0.94***	-0.05	0.82	-0.08	0.12
CostStructure-COMBINED	CSC-DEVELOPED	USAGE	1.00**	0.09	0.83	0.31	-0.07
CultureOutcome	CSC-DEVELOPED	USAGE	0.77*	0.15	0.53	-0.27	1.84*
CultureDetail	CSC-DEVELOPED	USAGE	0.82**	1.64***	0.27	0.30	-1.96*
CultureControl	CSC-DEVELOPED	USAGE	0.79**	0.58*	0.42	-0.03	0.40
PC	CSC-DEVELOPED	USAGE	0.95***	-0.49	0.81	0.13	-1.36
SizeRevenue	CSC-DEVELOPED	USAGE	0.95***	0.11	0.93	-0.44	-0.46
SizeEmployees	CSC-DEVELOPED	USAGE	1.03***	-0.05	0.36	0.49	0.45
TMS	CSC-DEVELOPED	USAGE	-0.20	2.21***	-0.05	3.04**	-2.29**
TMKA	CSC-DEVELOPED	USAGE	-0.08	3.46***	0.10	2.51	-3.58**

*** $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.**

Appendix 8-2: Quadratic polynomial regression models with no significant R^2 differences between the linear and quadratic models

Table 1: Quadratic polynomial regression models with no significant R^2 differences between the linear and quadratic models (CSC-CostPools as the CSC measure)

Contingency factor	**CSC measure**	**Outcome measure**	**R^2 Change**	**F Change**	**Sig. F Change**
CostStructure-MANUFACTURING	CSC-CostPools	USEFULNESS	0.02	1.77	0.154
CostStructure-COMBINED	CSC-CostPools	USEFULNESS	0.03	2.19	0.091
CultureDetail	CSC-CostPools	USEFULNESS	0.03	2.57	0.056
PC	CSC-CostPools	USEFULNESS	0.03	1.96	0.121
SizeEmployees	CSC-CostPools	USEFULNESS	0.03	2.11	0.100
TMS	CSC-CostPools	USEFULNESS	0.01	1.26	0.289
COMP	CSC-CostPools	USAGE	0.02	1.07	0.364
CostStructure-MANUFACTURING	CSC-CostPools	USAGE	0.02	1.06	0.368
CostStructure-COMBINED	CSC-CostPools	USAGE	0.02	1.62	0.186
CultureOutcome	CSC-CostPools	USAGE	0.02	1.69	0.171
CultureDetail	CSC-CostPools	USAGE	0.03	2.40	0.069
CultureControl	CSC-CostPools	USAGE	0.02	1.23	0.300
SizeRevenue	CSC-CostPools	USAGE	0.03	2.05	0.108
SizeEmployees	CSC-CostPools	USAGE	0.02	1.55	0.204
TMS	CSC-CostPools	USAGE	0.02	1.17	0.321
TMKA	CSC-CostPools	USAGE	0.03	2.30	0.079

Table 2: Quadratic polynomial regression models with no significant R^2 differences between the linear and quadratic models (CSC-CostDrivers as the CSC measure)

Contingency factor	**CSC measure**	**Outcome measure**	**R^2 Change**	**F Change**	**Sig. F Change**
CostStructure-MANUFACTURING	CSC-CostDrivers	USEFULNESS	0.02	1.21	0.308
CostStructure-COMBINED	CSC-CostDrivers	USEFULNESS	0.03	2.17	0.093
CultureOutcome	CSC-CostDrivers	USEFULNESS	0.01	0.98	0.402
CultureDetail	CSC-CostDrivers	USEFULNESS	0.01	0.86	0.463
CultureControl	CSC-CostDrivers	USEFULNESS	0.04	2.60	0.053
PC	CSC-CostDrivers	USEFULNESS	0.01	0.66	0.577
SizeRevenue	CSC-CostDrivers	USEFULNESS	0.02	1.04	0.377
SizeEmployees	CSC-CostDrivers	USEFULNESS	0.01	0.66	0.579
TMS	CSC-CostDrivers	USEFULNESS	0.01	0.50	0.685
COMP	CSC-CostDrivers	USAGE	0.01	0.69	0.559
CostStructure-MANUFACTURING	CSC-CostDrivers	USAGE	0.02	1.04	0.375
CultureOutcome	CSC-CostDrivers	USAGE	0.01	0.89	0.449
CultureDetail	CSC-CostDrivers	USAGE	0.03	2.26	0.083
CultureControl	CSC-CostDrivers	USAGE	0.02	1.13	0.338
PC	CSC-CostDrivers	USAGE	0.02	1.32	0.271
SizeRevenue	CSC-CostDrivers	USAGE	0.02	1.54	0.205
SizeEmployees	CSC-CostDrivers	USAGE	0.02	1.35	0.259
TMS	CSC-CostDrivers	USAGE	0.01	0.96	0.411
TMKA	CSC-CostDrivers	USAGE	0.02	1.83	0.142

Table 3: Quadratic polynomial regression models with no significant R^2 differences between the linear and quadratic models (CSC-COMPOSITE as the CSC measure)

Contingency factor	**CSC measure**	**Outcome measure**	**R^2 Change**	**F Change**	**Sig. F Change**
CostStructure-MANUFACTURING	CSC-COMPOSITE	USEFULNESS	0.03	2.38	0.071
PC	CSC-COMPOSITE	USEFULNESS	0.03	1.98	0.119
SizeEmployees	CSC-COMPOSITE	USEFULNESS	0.03	2.16	0.094
TMS	CSC-COMPOSITE	USEFULNESS	0.01	0.92	0.434
COMP	CSC-COMPOSITE	USAGE	0.01	0.66	0.579
CostStructure-MANUFACTURING	CSC-COMPOSITE	USAGE	0.02	1.29	0.278
CostStructure-COMBINED	CSC-COMPOSITE	USAGE	0.03	2.18	0.092
CultureOutcome	CSC-COMPOSITE	USAGE	0.02	1.49	0.218
CultureDetail	CSC-COMPOSITE	USAGE	0.03	2.38	0.071
CultureControl	CSC-COMPOSITE	USAGE	0.02	1.36	0.255
PC	CSC-COMPOSITE	USAGE	0.04	2.61	0.053
SizeRevenue	CSC-COMPOSITE	USAGE	0.03	2.25	0.084
SizeEmployees	CSC-COMPOSITE	USAGE	0.02	1.50	0.217
TMS	CSC-COMPOSITE	USAGE	0.01	0.76	0.518
TMKA	CSC-COMPOSITE	USAGE	0.02	1.94	0.124

Table 4: Quadratic polynomial regression models with no significant R^2 differences between the linear and quadratic models (CSC-DEVELOPED as the CSC measure)

Contingency factor	**CSC measure**	**Outcome measure**	**R^2 Change**	**F Change**	**Sig. F Change**
COMP	CSC-DEVELOPED	USEFULNESS	0.03	1.51	0.213
CostStructure-MANUFACTURING	CSC-DEVELOPED	USEFULNESS	0.03	1.65	0.181
CostStructure-COMBINED	CSC-DEVELOPED	USEFULNESS	0.03	1.62	0.189
CultureOutcome	CSC-DEVELOPED	USEFULNESS	0.00	0.11	0.957
CultureDetail	CSC-DEVELOPED	USEFULNESS	0.04	2.39	0.072
CultureControl	CSC-DEVELOPED	USEFULNESS	0.00	0.26	0.856
PC	CSC-DEVELOPED	USEFULNESS	0.04	2.10	0.103
SizeRevenue	CSC-DEVELOPED	USEFULNESS	0.01	0.51	0.677
SizeEmployees	CSC-DEVELOPED	USEFULNESS	0.02	0.85	0.471
TMS	CSC-DEVELOPED	USEFULNESS	0.01	0.71	0.547
TMKA	CSC-DEVELOPED	USEFULNESS	0.04	2.60	0.055
COMP	CSC-DEVELOPED	USAGE	0.01	0.78	0.508
CostStructure-MANUFACTURING	CSC-DEVELOPED	USAGE	0.01	0.27	0.845
CostStructure-COMBINED	CSC-DEVELOPED	USAGE	0.01	0.29	0.830
CultureOutcome	CSC-DEVELOPED	USAGE	0.02	1.27	0.288
CultureDetail	CSC-DEVELOPED	USAGE	0.02	1.18	0.322
CultureControl	CSC-DEVELOPED	USAGE	0.00	0.13	0.942
PC	CSC-DEVELOPED	USAGE	0.01	0.63	0.600
SizeRevenue	CSC-DEVELOPED	USAGE	0.01	0.58	0.627
SizeEmployees	CSC-DEVELOPED	USAGE	0.00	0.21	0.893
TMS	CSC-DEVELOPED	USAGE	0.04	2.63	0.053
TMKA	CSC-DEVELOPED	USAGE	0.03	2.15	0.097

Appendix 8-3: The results of the moderation versions of the two quadratic models related to cost structure (CostStructure-COMBINED) (quadratic models with insignificant R^2 differences)

Table 1 displays the results of the moderation version of the quadratic model involving CostStructure-COMBINED as the contingency factor, CSC-CostDrivers as the CSC measure and USEFULNESS as the outcome measure. As presented in Table 1 (Panel A), the moderation model is significant (F-value = 3.99, $p < 0.01$, adjusted $R^2 = 0.04$), and the interaction term, (CSC-CostDrivers)(CostStructure-COMBINED), has a significant positive effect on USEFULNESS (b3 = 0.14, $p < .05$), thereby supporting the moderation role of CostStructure-COMBINED on the relationship between CSC-CostDrivers and USEFULNESS. As provided in Table 1 (Panel B), the results of the simple-slope tests reveal that the relationship between CSC-CostDrivers and USEFULNESS is negative and insignificant at the 10th percentile/very low value of CostStructure-COMBINED (effect = -0.05, $p > 0.05$), positive and insignificant at the 25th percentile/low (effect = 0.01, $p > 0.05$) and 50th percentile/moderate (effect = 0.08, $p > 0.05$) values of CostStructure-COMBINED and positive and significant at the 75th percentile/high (effect = 0.18, $p < 0.01$) and 90th percentile/very high (effect = 0.29, $p < 0.01$) values of CostStructure-COMBINED.[188] This

[188] This trend of relationship was also confirmed by the findings of the Johnson-Neyman technique, which provided that the relationship between CSC-CostDrivers and USEFULNESS is negative and insignificant at very low values of CostStructure-COMBINED (-1 and below), positive and insignificant at low and moderate values of CostStructure-COMBINED (-0.72 to -0.44) and positive and significant at high and very high values of CostStructure-COMBINED (-0.18 and above). Based on the values of the various CostStructure-COMBINED levels shown in Table 1 (Panel B), the values (-1 and below) provided by the results of the Johnson-Neyman technique represent very low CostStructure-COMBINED values, given that the highest value (-1) is lower than the 25th percentile, i.e., low, CostStructure-COMBINED value of -0.75. The values (-0.72 to -0.44) provided by the results of the Johnson-Neyman technique represent low and moderate CostStructure-COMBINED values. This is because, first, the lowest value (-0.72) representing a low CostStructure-COMBINED value is: (a) higher than the 10th percentile, i.e., very low, CostStructure-COMBINED value of -1.20; (b) higher than the highest value (-1) of the CostStructure-COMBINED values that were considered very low values by the Johnson-Neyman technique (-1 and below); (c) approximately equal to the 25th percentile, i.e., low, CostStructure-COMBINED value of -0.75; and (d) lower than the 50th percentile, i.e., moderate, CostStructure-COMBINED value of -0.24. Second, the highest value (-0.44) representing a moderate CostStructure-COMBINED value is: (a) higher than the 25th percentile, i.e., low, CostStructure-COMBINED value of -0.75; (b) higher than -0.72 that was considered a low CostStructure-Combined value by the Johnson-

finding is visualised in Figure 1, which exhibits the weak negative relationship between CSC-CostDrivers and USEFULNESS at very low levels of CostStructure-COMBINED, the weak positive one between the two constructs at low and moderate levels of CostStructure-COMBINED and the strong positive one between the two constructs at high and very high levels of CostStructure-COMBINED.

Overall, the results show that CostStructure-COMBINED has an influence on the optimal CSC-CostDrivers from the perspective of the moderation sub-form of fit. In particular, the results of the simple-slope tests (Table 1, Panel B) and Figure 1 indicate that the moderation effect of CostStructure-COMBINED is non-monotonic, in that, at very low levels of CostStructure-COMBINED, the relationship between CSC-CostDrivers and USEFULNESS is negative, whereas, at the remaining levels of CostStructure-COMBINED, the relationship between the two constructs is positive. In addition, the moderation effect of CostStructure-COMBINED accords with that of CostStructure-MANUFACTURING (see Section 8.4.1.1) in signifying the importance of increasing CSC at higher values of the contingency factor. Nevertheless, it weakly conforms with it in signalling the importance of increasing CSC at moderate values of the contingency factor.[189]

Neyman technique; and (c) lower than the 75th percentile, i.e., high, CostStructure-COMBINED value of 0.39. The values (-0.18 and above) provided by the results of the Johnson-Neyman technique represent high and very high CostStructure-COMBINED values, given that the lowest value (-0.18) is: (a) higher than the 50th percentile, i.e., moderate, CostStructure-COMBINED value of -0.24; (b) higher than -0.44 that was considered a moderate CostStructure-Combined value by the Johnson-Neyman technique; and (c) lower than the 90th percentile value, i.e., very high, CostStructure-COMBINED value of 1.22.

[189] The moderation effect of CostStructure-COMBINED on the relationship between CSC-CostDrivers and USEFULNESS only provides weak support for the importance of increasing CSC at moderate values of the contingency factor, as the positive relationship between CSC and the outcome measure at the 50th percentile value, i.e., moderate, of the contingency factor was found to be significant at the 10% significance level (see Table 1).

Table 1: The results of the moderation effect of CostStructure-COMBINED on the relationship between CSC-CostDrivers and USEFULNESS

Moderation model: USEFULNESS= $b_0 + b_1$ CSC-CostDrivers + b_2 CostStructure-COMBINED + b_3 (CSC-CostDrivers)(CostStructure-COMBINED)

Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.11	0.05		87.98	0.000	
CSC-CostDrivers (b_1)	0.12	0.05	0.18	2.52	0.012	1.02
CostStructure-COMBINED (b_2)	-0.01	0.05	-0.01	-0.14	0.888	1.01
(CSC-CostDrivers)(CostStructure-COMBINED) (b_3)	0.14	0.06	0.18	2.56	**0.011**	1.02
F-value	3.99					
Sig.	**0.009**					
Adjusted R^2	0.04					

Panel B:

CostStructure-COMBINED value	**Effect**	**SE**	**t-value**	**Sig.**
10th percentile (-1.20)	-0.05	0.08	-0.68	0.500
25th percentile (-0.75)	0.01	0.06	0.19	0.848
50th percentile (-0.24)	0.08	0.05	1.78	0.077
75th percentile (0.39)	0.18	0.05	3.25	**0.001**
90th percentile (1.22)	0.29	0.09	3.38	**0.001**

Figure 1: The moderation effect of CostStructure-COMBINED on the relationship between CSC-CostDrivers and USEFULNESS

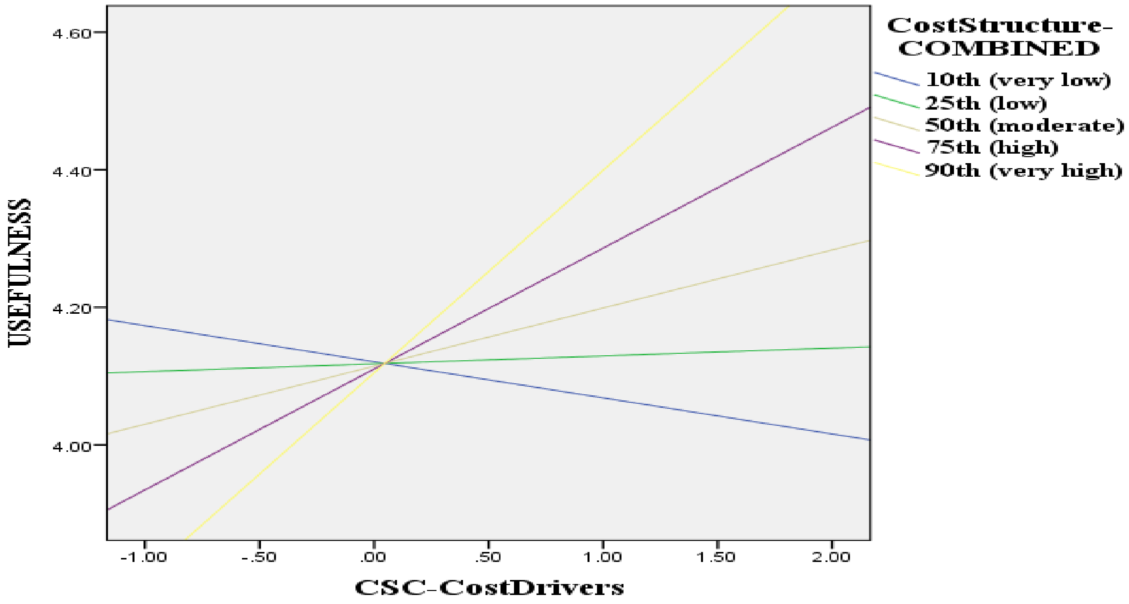


Table 2 summarises the results of the moderation version of the quadratic model involving CostStructure-COMBINED as the contingency factor, CSC-DEVELOPED as the CSC measure and USEFULNESS as the outcome measure. As shown in Table 2 (Panel A), the moderation model is significant (F-value = 7.68, $p < 0.01$, adjusted $R^2 = 0.12$), and the interaction term, (CSC-DEVELOPED)(CostStructure-COMBINED), has a significant positive effect on USEFULNESS (b3 = 0.12, $p < .05$), thereby supporting the moderation role of CostStructure-COMBINED on the relationship between CSC-DEVELOPED and USEFULNESS. As provided in Table 2 (Panel B), the results of the simple-slope tests show that the relationship between CSC-DEVELOPED and USEFULNESS is positive and insignificant at the 10th percentile/very low value of CostStructure-COMBINED (effect = 0.08, $p > 0.05$) and positive and significant at the 25th percentile/low (effect = 0.13, $p < 0.05$), 50th percentile/moderate (effect = 0.19, $p < 0.01$), 75th percentile/high (effect = 0.27, $p < 0.01$) and 90th percentile/very high (effect = 0.35, $p < 0.01$) values of CostStructure-COMBINED.[190] This finding is visualised in Figure 2, which displays the weaker positive relationship between CSC-DEVELOPED and USEFULNESS at very low levels of CostStructure-COMBINED compared to the positive one between the two constructs at the remining levels of CostStructure-COMBINED.

In conjunction, the results provide that CostStructure-COMBINED has an influence on the optimal level of CSC-DEVELOPED from the perspective of the moderation sub-form of fit.

[190] This trend of relationship was also confirmed by the findings of the application of the Johnson-Neyman technique, which provided that the relationship between CSC-DEVELOPED and USEFULNESS is positive and insignificant at very low values of CostStructure-COMBINED (-0.79 and below), whereas it is positive and significant at low, moderate, high and very high values of CostStructure-COMBINED (-0.68 and above). Based on the values of the various CostStructure-COMBINED levels shown in Table 2 (Panel B), the values (-0.79 and below) provided by the results of the Johnson-Neyman technique represent very low CostStructure-COMBINED values, given that the highest value (-0.79) is lower than the 25th percentile, i.e., low, CostStructure-COMBINED value of -0.70. The values (-0.68 and above) provided by the results of the Johnson-Neyman technique represent low, moderate, high and very high CostStructure-COMBINED values because the lowest value (-0.68) representing a low CostStructure-COMBINED value is: (a) higher than the 10th percentile, i.e., very low, CostStructure-COMBINED value of -1.16; (b) higher than -0.79 that was considered a very low CostStructure-COMBINED value by the Johnson-Neyman technique; (c) about equal to the 25th percentile, i.e., low, CostStructure-COMBINED value of -0.70; and (d) lower than the 50th percentile, i.e., moderate, CostStructure-COMBINED value of -0.18.

More specifically, the results of the simple-slope tests (Table 2, Panel B) and Figure 2 reveal that the moderation effect of CostStructure-COMBINED is monotonic, in that the relationship between CSC-DEVELOPED and USEFULNESS is positive at all levels of CostStructure-COMBINED. Furthermore, the moderation effect of CostStructure-COMBINED on the relationship between CSC-DEVELOPED and USEFULNESS conforms: (1) the moderation influence of CostStructure-MANUFACTURING, i.e., the dominant trend of the moderation effects of cost structure (see Section 8.4.1.1), in denoting the importance of increasing CSC at moderate values of the contingency factor; and (2) both the moderation impact of CostStructure-MANUFACTURING (see Section 8.4.1.1) and its moderation effect on the relationship between CSC-CostDrivers and USEFULNESS, reported earlier in this Appendix, in emphasising the importance of increasing CSC at higher values of the contingency factor. However, it conflicts with them in finding partial support for the importance of increasing CSC at lower values of the contingency factor.[191]

[191] Partial support refers to the fact that the relationship between CSC and the outcome measure was found to be positive and significant (effect = 0.13, $p < 0.05$) at low but not very low values of the contingency factor (see Table 2, Panel B).

Table 2: The results of the moderation effect of CostStructure-COMBINED on the relationship between CSC-DEVELOPED and USEFULNESS

Moderation model: USEFULNESS= $b_0 + b_1$ CSC-DEVELOPED + b_2 CostStructure-COMBINED + b_3 (CSC-DEVELOPED)(CostStructure-COMBINED)

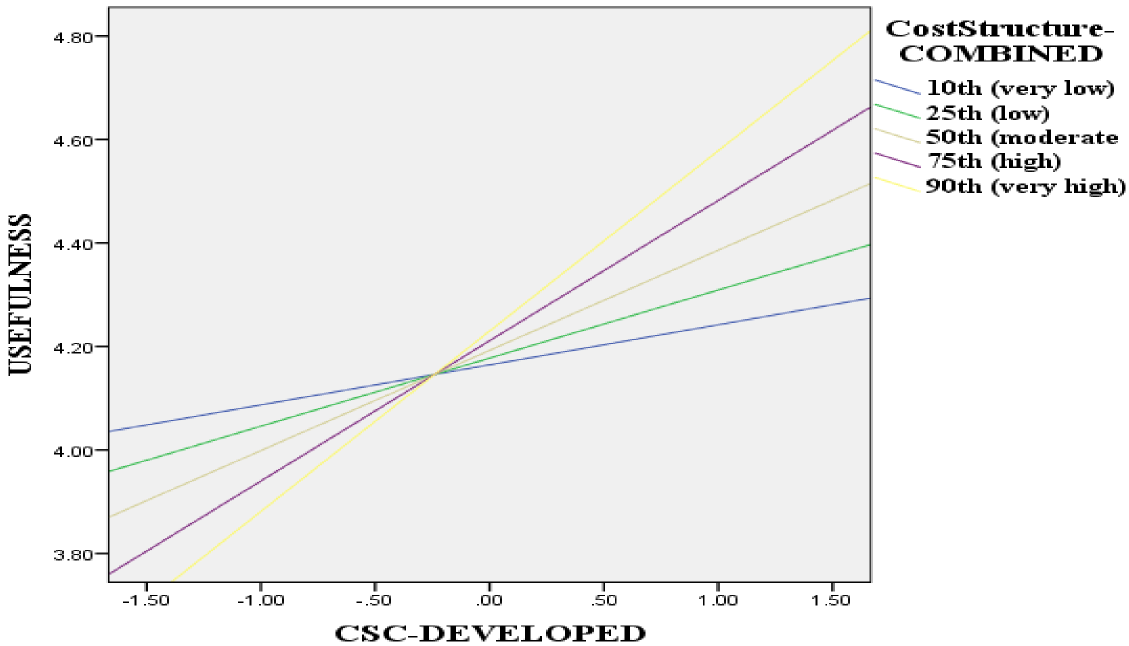
Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.20	0.05		88.23	0.000	
CSC-DEVELOPED (b_1)	0.22	0.05	0.35	4.49	0.000	1.01
CostStructure-COMBINED (b_2)	0.03	0.05	0.05	0.58	0.561	1.06
(CSC-DEVELOPED)(CostStructure-COMBINED) (b_3)	0.12	0.06	0.17	2.14	**0.034**	1.06
F-value	7.68					
Sig.	**0.000**					
Adjusted R^2	0.12					

Panel B:

CostStructure-COMBINED value	**Effect**	**SE**	**t-value**	**Sig.**
10th percentile (-1.16)	0.08	0.08	1.02	0.312
25th percentile (-0.70)	0.13	0.06	2.24	**0.026**
50th percentile (-0.18)	0.19	0.05	4.03	**0.000**
75th percentile (0.47)	0.27	0.06	4.77	**0.000**
90th percentile (1.12)	0.35	0.08	4.23	**0.000**

Figure 2: The moderation effect of CostStructure-COMBINED on the relationship between CSC-DEVELOPED and USEFULNESS



Appendix 8-4: The results of the moderation version of the quadratic model related to cost structure (CostStructure-COMBINED) (quadratic model with a significant R^2 difference)

Table 1 displays the results of the moderation version of the quadratic model involving CostStructure-COMBINED as the contingency factor, CSC-CostDrivers as the CSC measure and USAGE as the outcome measure. As presented in Table 1 (Panel A), the moderation model is significant (F-value = 4.83, $p < 0.01$, adjusted $R^2 = 0.06$), and the interaction term, (CSC-CostDrivers)(CostStructure-COMBINED), has a significant positive effect on USAGE (b3 = 0.17, $p < .01$), supporting the moderation role of CostStructure-COMBINED on the relationship between CSC-CostDrivers and USAGE. As provided in Table 1 (Panel B), the results of the simple-slope tests reveal that the relationship between CSC-CostDrivers and USAGE is negative and insignificant at the 10th percentile/very low value of CostStructure-COMBINED (effect = -0.05, $p > 0.05$), positive and insignificant at the 25th percentile/low value of CostStructure-COMBINED (effect = 0.02, $p > 0.05$) and positive and significant at the 50th percentile/moderate (effect = 0.11, $p < 0.05$), 75th percentile/high (effect = 0.22, $p < 0.01$) and 90th percentile/very high (effect = 0.36, $p < 0.01$) values of CostStructure-COMBINED.[192] This finding is visualised in Figure 1, which exhibits the weak negative

[192] This trend of relationship was also confirmed by the findings of the application of the Johnson-Neyman technique, which provided that the relationship between CSC-CostDrivers and USAGE is negative and insignificant at very low values of CostStructure-COMBINED (-1 and below), positive and insignificant at low values of CostStructure-COMBINED (-0.73 to -0.45) and positive and significant at moderate, high and very high values of CostStructure-COMBINED (-0.25 and above). Based on the values of the various CostStructure-COMBINED levels shown in Table 1 (Panel B), the values (-1 and below) provided by the results of the Johnson-Neyman technique represent very low CostStructure-COMBINED values, given that the highest value (-1) is lower than the 25th percentile, i.e., low, CostStructure-COMBINED value of -0.75. The values (-0.73 to -0.45) provided by the results of the Johnson-Neyman technique represent low CostStructure-COMBINED values because they are both: (a) higher than the 10th percentile, i.e., very low, CostStructure-COMBINED value of -1.20; (b) higher than the highest value (-1) of the CostStructure-COMBINED values that were considered by the Johnson-Neyman technique as very low values (-1 and below) and; (c) lower than the 50th percentile, i.e., moderate, CostStructure-COMBINED value of -0.24. The values (-0.25 and above) provided by the results of the Johnson-Neyman technique represent moderate, high and very high CostStructure-COMBINED values, given that the lowest value (-0.25) representing a moderate CostStructure-COMBINED value is: (a) higher than the 25th percentile, i.e., low, CostStructure-COMBINED value of -0.75; (b) higher than the highest value (-0.45) of the CostStructure-COMBINED values that were considered by the Johnson-Neyman

relationship between CSC-CostDrivers and USAGE at very low levels of CostStructure-COMBINED, the weak positive relationship between the two constructs at low levels of CostStructure-COMBINED and the strong positive one between the two constructs at moderate, high and very high levels of CostStructure-COMBINED.

Overall, the results show that CostStructure-COMBINED has an influence on the optimal CSC-CostDrivers from the perspective of the moderation sub-form of fit. The results of the simple-slope tests (Table 1, Panel B) and Figure 1 indicate that the moderation effect of CostStructure-COMBINED is non-monotonic, in that, at very low levels of CostStructure-COMBINED, the relationship between CSC-CostDrivers and USAGE is negative, whereas, at the remaining levels of CostStructure-COMBINED, the relationship between the two constructs is positive. In addition, the moderation influence of CostStructure-COMBINED is consistent with most of the moderation impacts of cost structure (see Section 8.4.1.1 and Appendix 8-3) in signifying the importance of increasing CSC at moderate and higher values of the contingency factor.

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technique as low values (-0.73 to -0.45); and (c) lower than the 75th percentile, i.e., high, CostStructure-COMBINED value of 0.39.

Table 1: The results of the moderation effect of CostStructure-COMBINED on the relationship between CSC-CostDrivers and USAGE

Moderation model: USAGE= $b_0 + b_1$ CSC-CostDrivers + b_2 CostStructure-COMBINED + b_3 (CSC-CostDrivers)(CostStructure-COMBINED)

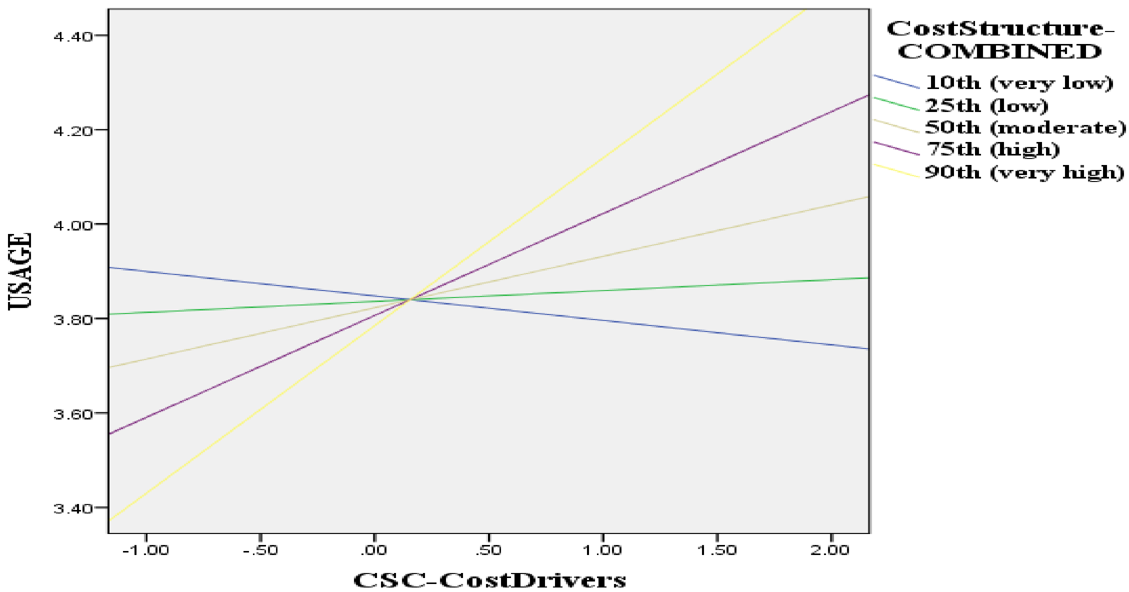
Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	3.82	0.05		71.92	0.000	
CSC-CostDrivers (b_1)	0.15	0.05	0.20	2.81	0.006	1.01
CostStructure-COMBINED (b_2)	-0.03	0.05	-0.03	-0.49	0.627	1.01
(CSC-CostDrivers)(CostStructure-COMBINED) (b_3)	0.17	0.06	0.18	2.65	**0.009**	1.01
F-value	4.83					
Sig.	**0.003**					
Adjusted R^2	0.06					

Panel B:

CostStructure-COMBINED value	**Effect**	**SE**	**t-value**	**Sig.**
10^{th} percentile (-1.20)	-0.05	0.09	-0.58	0.561
25^{th} percentile (-0.75)	0.02	0.07	0.34	0.736
50^{th} percentile (-0.24)	0.11	0.05	2.01	**0.046**
75^{th} percentile (0.39)	0.22	0.61	3.55	**0.001**
90^{th} percentile (1.22)	0.36	0.10	3.63	**0.000**

Figure 1: The moderation effect of CostStructure-COMBINED on the relationship between CSC-CostDrivers and USAGE



Appendix 8-5: The results of the moderation version of the quadratic model related to business-unit size (SizeRevenue) (quadratic model with a significant R^2 difference)

Table 1: The results of the moderation effect of SizeRevenue on the relationship between CSC-COMPOSITE and USEFULNESS

Moderation model: USEFULNESS= $b_0 + b_1$ CSC-COMPOSITE + b_2 SizeRevenue + b_3 (CSC-COMPOSITE)(SizeRevenue)

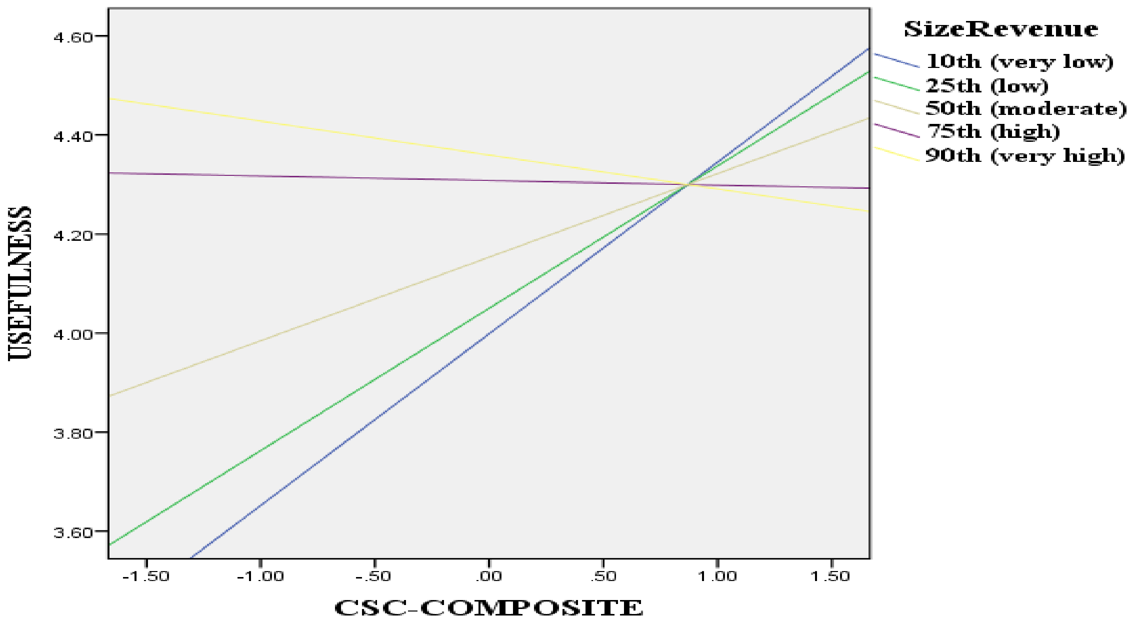
Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.17	0.05		79.14	0.000	
CSC-COMPOSITE (b_1)	0.15	0.06	0.22	2.77	0.006	1.43
SizeRevenue (b_2)	0.14	0.05	0.20	2.67	0.008	1.35
(CSC-COMPOSITE)(SizeRevenue) (b_3)	-0.17	0.05	-0.22	-3.23	**0.001**	1.07
F-value	11.85					
Sig.	**0.000**					
Adjusted R^2	0.14					

Panel B:

SizeRevenue value	**Effect**	**SE**	**t-value**	**Sig.**
10th percentile (-1.18)	0.35	0.09	3.80	**0.000**
25th percentile (-0.82)	0.29	0.08	3.73	**0.000**
50th percentile (-0.10)	0.17	0.06	2.98	**0.003**
75th percentile (0.98)	-0.01	0.06	-0.14	0.887
90th percentile (1.34)	-0.07	0.08	-0.90	0.371

Figure 1: The moderation effect of SizeRevenue on the relationship between CSC-COMPOSITE and USEFULNESS



Appendix 8-6: The results of the other quadratic models related to competition (COMP)

Table 1: The results of the quadratic model involving COMP, CSC-CostPools and USEFULNESS

Quadratic model: USEFULNESS= b_0 + b_1 CSC-CostPools + b_2 COMP + b_3 (CSC-CostPools)^2 + b_4 (CSC-CostPools)(COMP) + b_5 (COMP)^2

Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.14	0.10		41.21	0.000	
CSC-CostPools (b_1)	0.57	0.32	0.18	1.76	0.080	2.40
COMP (b_2)	-0.51	0.56	-0.13	-0.91	0.365	4.54
(CSC-CostPools)^2 (b_3)	-1.01	0.79	-0.11	-1.28	0.203	1.53
(CSC-CostPools)(COMP) (b_4)	0.56	1.30	0.05	0.43	0.669	2.74
(COMP)^2 (b_5)	2.98	1.07	0.34	2.79	**0.006**	3.23
F-value	6.16					
Sig.	**0.000**					
Adjusted R^2	0.12					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	0.06	2.53
Numerical-misfit line	1.08	1.42
First principal axis	-372.84	624.26**
Second principal axis	0.61	-1.03

*** p < 0.05, ** p < 0.01.**

Figure 1: Response surface analysis for the quadratic model involving COMP, CSC-CostPools and USEFULNESS

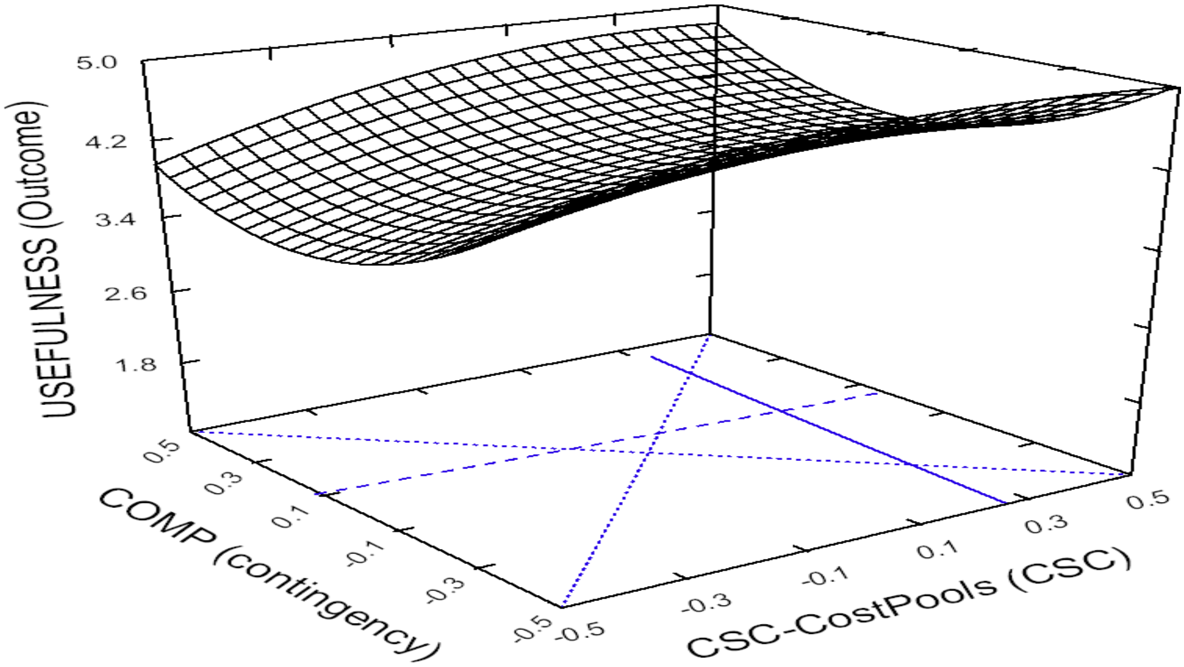


Table 2: The results of the quadratic model involving COMP, CSC-CostDrivers and USEFULNESS

Quadratic model: USEFULNESS= $b_0 + b_1$ CSC-CostDrivers + b_2 COMP + b_3 (CSC-CostDrivers)^2 + b_4 (CSC-CostDrivers)(COMP) + b_5 (COMP)^2

Panel A:

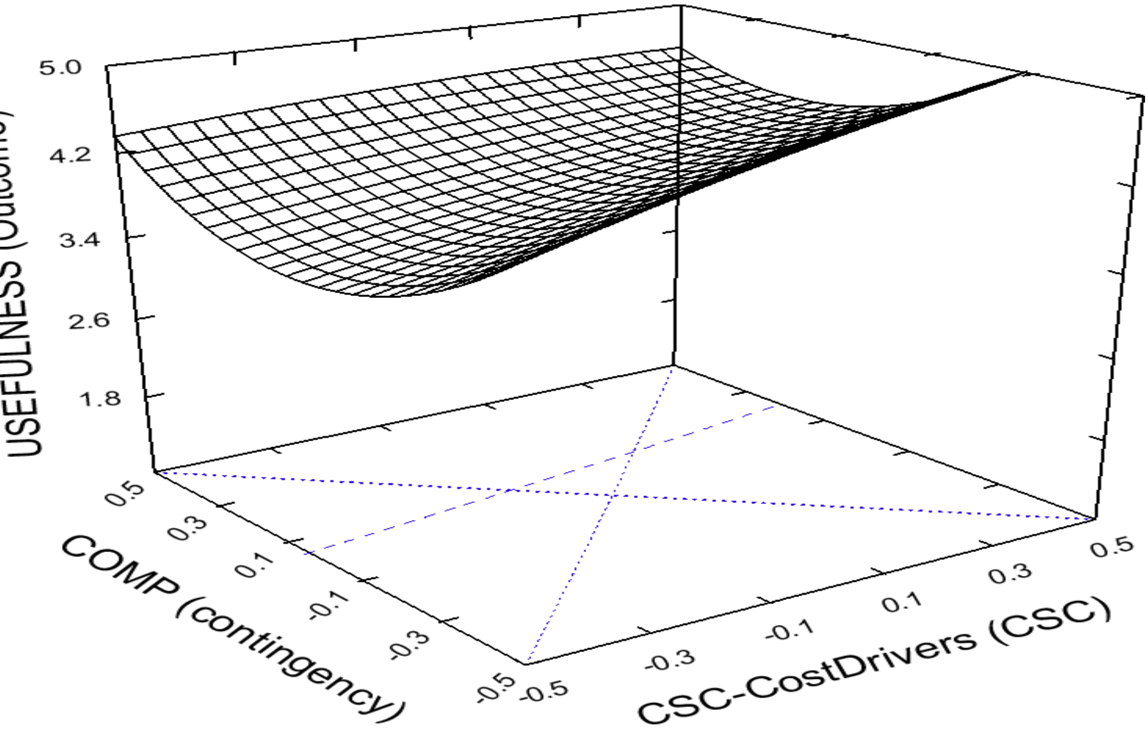
Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.06	0.09		45.17	0.000	
CSC-CostDrivers (b_1)	0.78	0.39	0.24	2.01	0.046	2.92
COMP (b_2)	-0.67	0.53	-0.17	-1.28	0.201	3.78
(CSC-CostDrivers)^2 (b_3)	-0.15	0.75	-0.02	-0.21	0.836	1.06
(CSC-CostDrivers)(COMP) (b_4)	-1.13	1.52	-0.09	-0.75	0.457	3.13
(COMP)^2 (b_5)	3.10	1.08	0.35	2.87	**0.005**	3.13
F-value	3.71					
Sig.	**0.003**					
Adjusted R^2	0.06					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	0.11	1.82
Numerical-misfit line	1.45	4.08
First principal axis	-293.46	115.06* (outside the data range)
Second principal axis	0.66	-0.26

*** p < 0.05, ** p < 0.01.**

Figure 2: Response surface analysis for the quadratic model involving COMP, CSC-CostDrivers and USEFULNESS



Appendix 8-7: The results of the other quadratic models related to organisational culture (CultureOutcome, CultureDetail and CultureControl)

Table 1: The results of the quadratic model involving CultureOutcome, CSC-COMPOSITE and USEFULNESS

Quadratic model: USEFULNESS= b_0 + b_1 CSC-COMPOSITE + b_2 CultureOutcome + b_3 (CSC-COMPOSITE)^2 + b_4 (CSC-COMPOSITE)(CultureOutcome) + b_5 (CultureOutcome)^2

Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.02	0.09		47.34	0.000	
CSC-COMPOSITE (b_1)	0.77	0.29	0.25	2.64	0.009	2.33
CultureOutcome (b_2)	0.74	0.36	0.21	2.06	0.041	2.72
(CSC- COMPOSITE)^2 (b_3)	-1.59	0.68	-0.16	-2.33	**0.021**	1.20
(CSC-COMPOSITE) (CultureOutcome) (b_4)	-1.51	0.94	-0.15	-1.61	0.110	2.33
(CultureOutcome)^2 (b_5)	0.94	0.75	0.11	1.25	0.214	2.05
F-value	11.74					
Sig.	**0.000**					
Adjusted R^2	0.21					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	1.51**	-2.16
Numerical-misfit line	0.04	0.86
First principal axis	-10.09	16.22
Second principal axis	1.20	**-1.93****

*** p < 0.05, ** p < 0.01.**

Figure 1: Response surface analysis for the quadratic model involving CultureOutcome, CSC-COMPOSITE and USEFULNESS

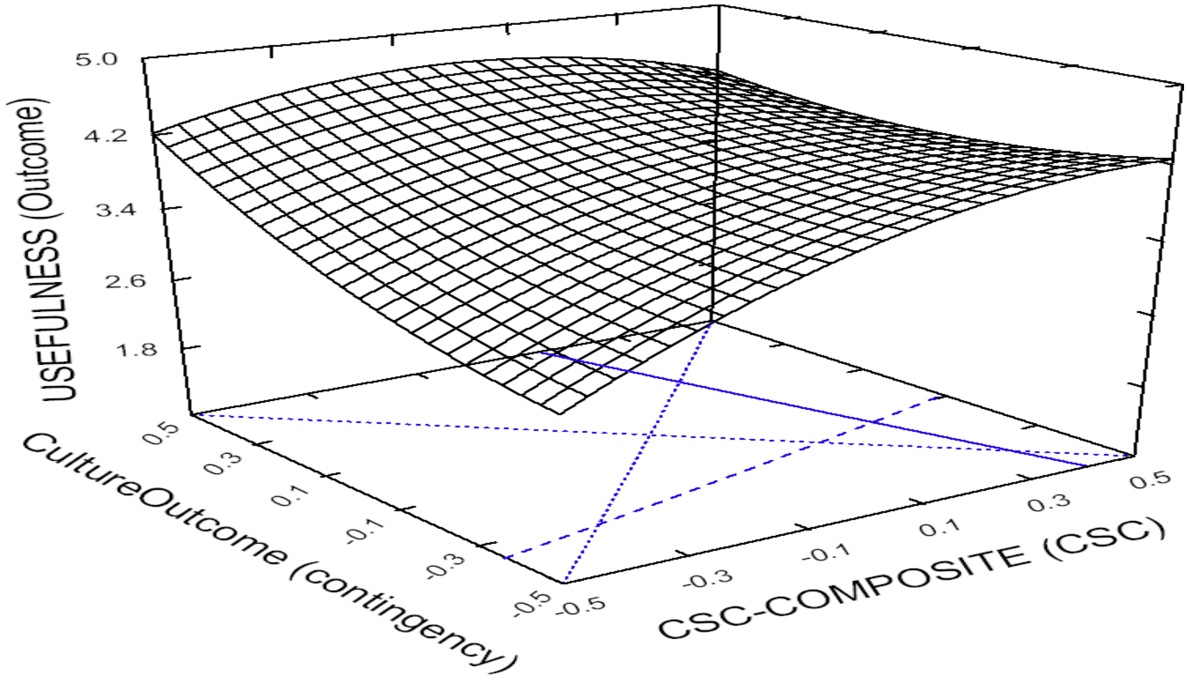


Table 2: The results of the quadratic model involving CultureDetail, CSC-COMPOSITE and USEFULNESS

Quadratic model: USEFULNESS= b_0 + b_1 CSC-COMPOSITE + b_2 CultureDetail + b_3 (CSC-COMPOSITE)^2 + b_4 (CSC-COMPOSITE)(CultureDetail) + b_5 (CultureDetail)^2

Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.11	0.08		51.79	0	
CSC-COMPOSITE (b_1)	0.82	0.27	0.27	3.06	0.003	1.87
CultureDetail (b_2)	0.66	0.29	0.21	2.28	0.024	2.08
(CSC- COMPOSITE)^2 (b_3)	-1.54	0.69	-0.16	-2.23	**0.027**	1.19
(CSC-COMPOSITE) (CultureDetail) (b_4)	-1.56	0.89	-0.15	-1.75	0.081	1.87
(CultureDetail)^2 (b_5)	0.38	0.67	0.05	0.57	0.573	1.71
F-value	9.77					
Sig.	**0.000**					
Adjusted R^2	0.18					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	1.48**	-2.72
Numerical-misfit line	0.16	0.40
First principal axis	-4.05	5.88
Second principal axis	1.41	**-2.05****

*** p < 0.05, ** p < 0.01.**

Figure 2: Response surface analysis for the quadratic model involving CultureDetail, CSC-COMPOSITE and USEFULNESS

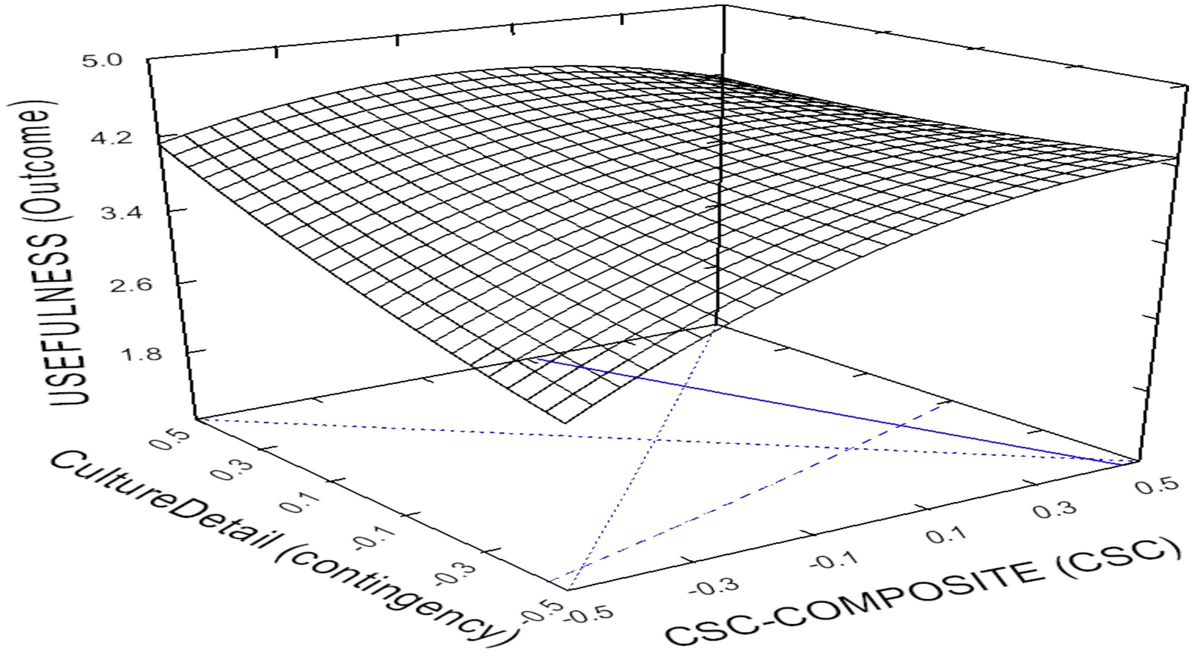


Table 3: The results of the quadratic model involving CultureControl, CSC-CostPools and USEFULNESS

Quadratic model: USEFULNESS= $b_0 + b_1$ CSC-CostPools + b_2 CultureControl + b_3 (CSC-CostPools)^2 + b_4 (CSC-CostPools)(CultureControl) + b_5 (CultureControl)^2

Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.14	0.07		59.87	0.000	
CSC-CostPools (b_1)	0.69	0.25	0.22	2.76	0.006	1.54
CultureControl (b_2)	0.40	0.26	0.12	1.53	0.128	1.57
(CSC-CostPools)^2 (b_3)	-1.41	0.73	-0.15	-1.93	0.056	1.43
(CSC-CostPools) (CultureControl) (b_4)	-2.50	0.99	-0.20	-2.53	**0.012**	1.53
(CultureControl)^2 (b_5)	1.89	0.81	0.16	2.33	**0.021**	1.16
F-value	9.39					
Sig.	**0.000**					
Adjusted R^2	0.18					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	1.09**	-2.02
Numerical-misfit line	0.29	2.98
First principal axis	-9.69*	22.78*
Second principal axis	0.87*	**-2.04****

*** p < 0.05, ** p < 0.01.**

Figure 3: Response surface analysis for the quadratic model involving CultureControl, CSC-CostPools and USEFULNESS

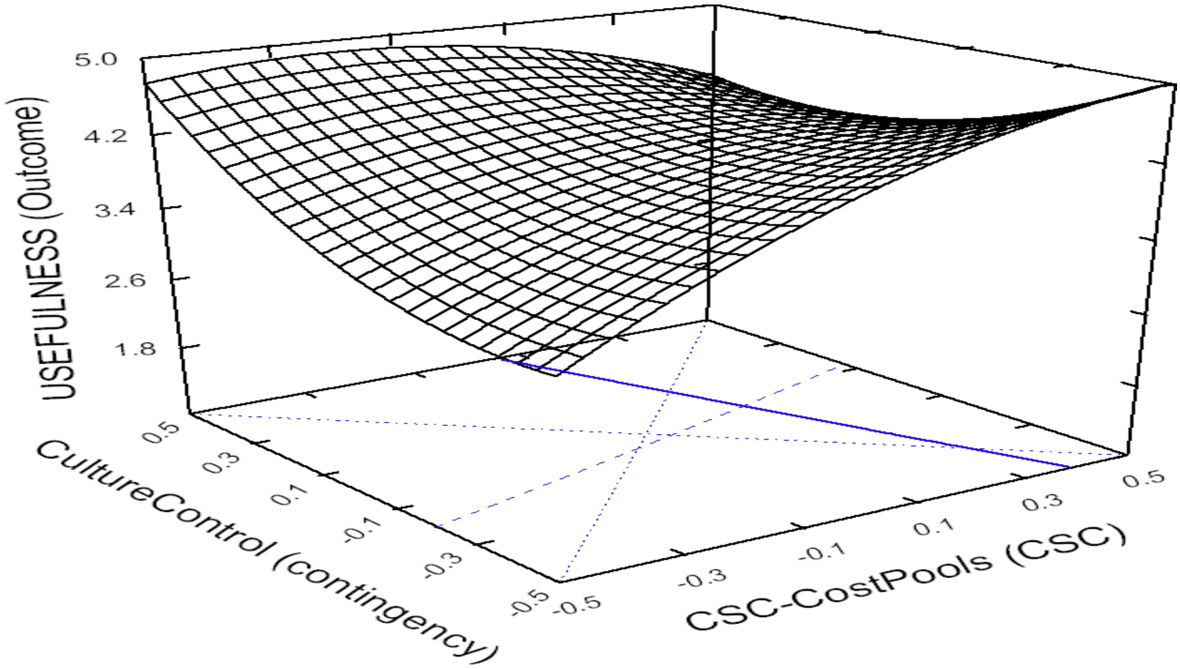


Table 4: The results of the quadratic model involving CultureControl, CSC-COMPOSITE and USEFULNESS

Quadratic model: USEFULNESS= $b_0 + b_1$ CSC-COMPOSITE + b_2 CultureControl + b_3 (CSC-COMPOSITE)^2 + b_4 (CSC-COMPOSITE)(CultureControl) + b_5 (CultureControl)^2

Panel A:

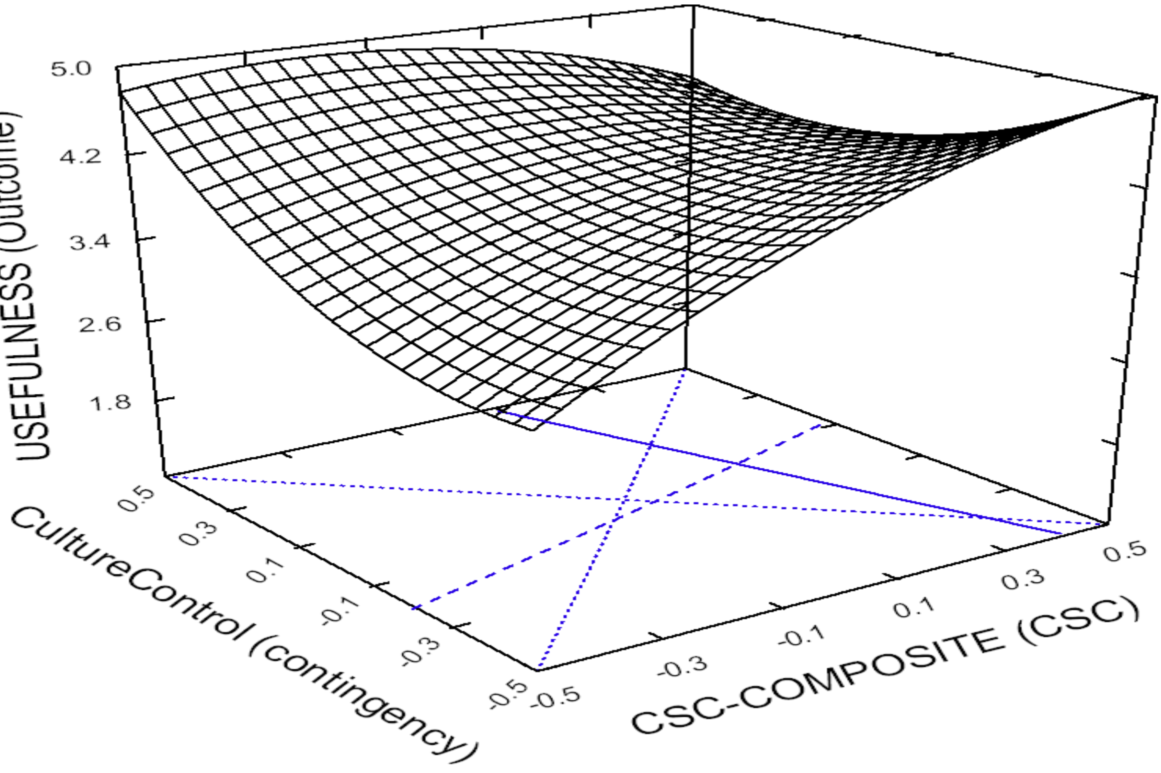
Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	4.12	0.07		59.70	0.000	
CSC-COMPOSITE (b_1)	0.71	0.23	0.24	3.11	0.002	1.46
CultureControl (b_2)	0.44	0.25	0.14	1.75	0.081	1.48
(CSC-COMPOSITE)^2 (b_3)	-1.29	0.68	-0.14	-1.91	0.058	1.19
(CSC-COMPOSITE) (CultureControl) (b_4)	-2.42	0.95	-0.21	-2.56	**0.011**	1.54
(CultureControl)^2 (b_5)	2.00	0.82	0.17	2.44	**0.015**	1.18
F-value	9.172					
Sig.	**0**					
Adjusted R^2	0.17					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	1.16**	-1.71
Numerical-misfit line	0.27	3.13
First principal axis	-11.93*	24.59*
Second principal axis	.91*	**-1.87****

*** p < 0.05, ** p < 0.01.**

Figure 4: Response surface analysis for the quadratic model involving CultureControl, CSC-COMPOSITE and USEFULNESS



Appendix 8-8: The results of the other quadratic models related to TMKA

Table 1: The results of the quadratic model involving TMKA, CSC-CostPools and USEFULNESS

Quadratic model: USEFULNESS= $b_0 + b_1$ CSC-CostPools + b_2 TMKA + b_3 (CSC- CostPools)^2 + b_4 (CSC- CostPools)(TMKA) + b_5 (TMKA)^2

Panel A:

Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	3.68	0.12		31.01	0.000	
CSC-CostPools (b_1)	0.19	0.40	0.06	0.46	0.644	4.19
TMKA (b_2)	3.18	0.65	0.82	4.89	0.000	7.04
(CSC-CostPools)^2 (b_3)	-0.92	0.72	-0.10	-1.27	0.204	1.43
(CSC-CostPools)(TMKA) (b_4)	0.97	1.15	0.11	0.85	0.398	3.87
(TMKA)^2 (b_5)	-3.42	1.10	-0.47	-3.11	**0.002**	5.83
F-value	12.05					
Sig.	**0.000**					
Adjusted R^2	0.22					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	3.36**	-3.37*
Numerical-misfit line	-2.99**	-5.31*
First principal axis	0.64	-0.85
Second principal axis	78.29	**-103.89****

*** p < 0.05, ** p < 0.01.**

Figure 1: Response surface analysis for the quadratic model involving TMKA, CSC-CostPools and USEFULNESS

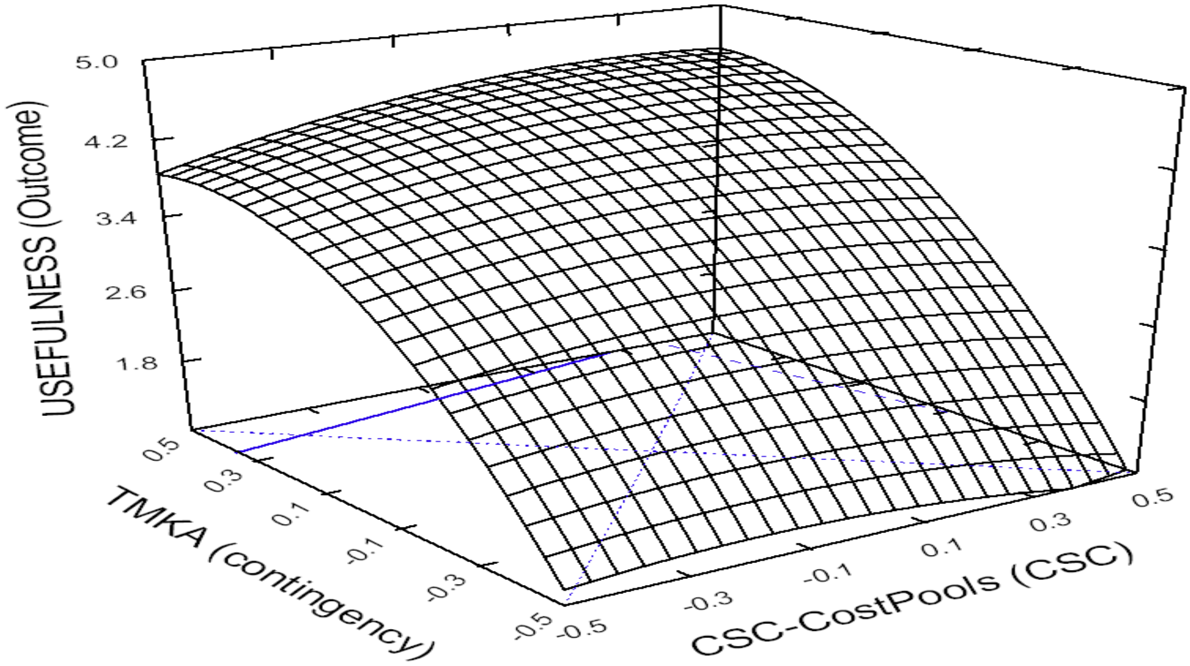


Table 2: The results of the quadratic model involving TMKA, CSC-CostDrivers and USEFULNESS

Quadratic model: USEFULNESS= b_0 + b_1 CSC-CostDrivers + b_2 TMKA + b_3 (CSC- CostDrivers)^2 + b_4 (CSC- CostDrivers)(TMKA) + b_5 (TMKA)^2

Panel A:

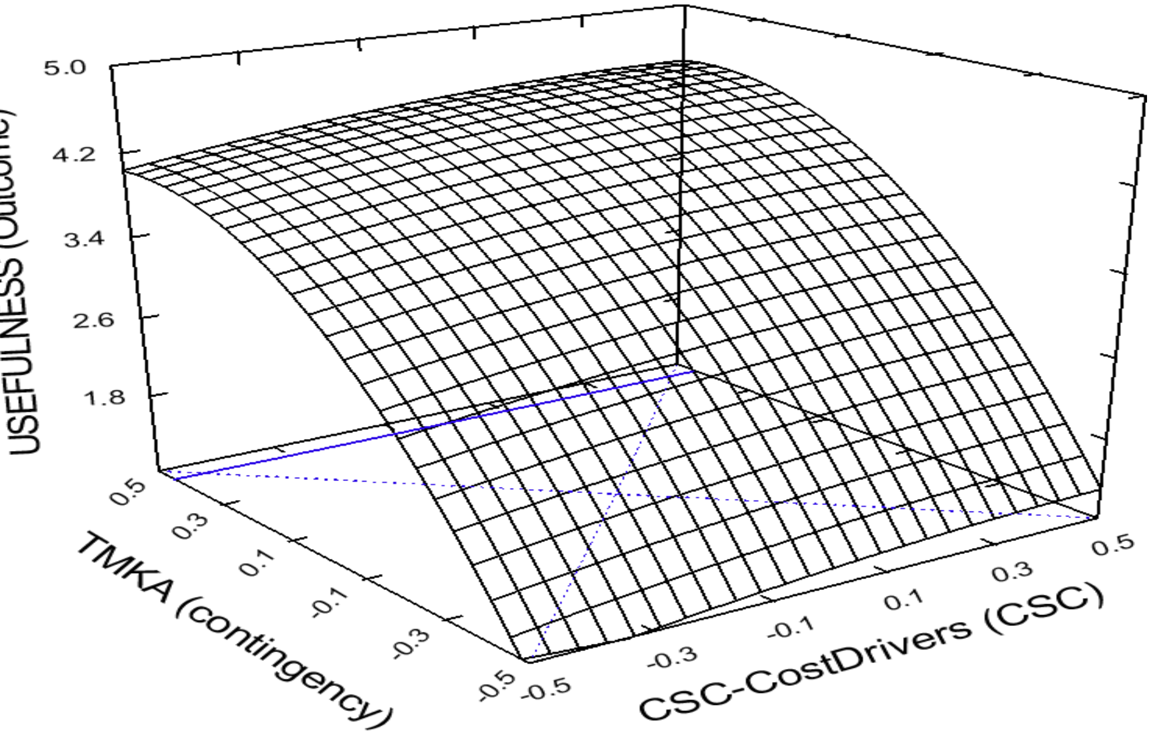
Variable	**Unstandardized Coefficients**	**SE**	**Standardized Coefficients**	**t-value**	**Sig.**	**VIF**
Constant (b_0)	3.64	0.10		35.13	0.000	
CSC-CostDrivers (b_1)	0.41	0.42	0.12	0.96	0.337	3.97
TMKA (b_2)	3.15	0.61	0.81	5.17	0.000	5.95
(CSC-CostDrivers)^2 (b_3)	-0.38	0.68	-0.04	-0.56	0.574	1.02
(CSC-CostDrivers)(TMKA) (b_4)	-0.01	1.19	0.00	-0.01	0.991	3.90
(TMKA)^2 (b_5)	-3.52	1.11	-0.49	-3.17	**0.002**	5.68
F-value	10.09					
Sig.	**0.000**					
Adjusted R^2	18.80					

Panel B:

Line	**Slope**	**Curvature**
Numerical-fit line	3.55**	-3.91*
Numerical-misfit line	-2.74**	-3.89*
First principal axis	0.40	-0.38
Second principal axis	744501.24	**-712689.29** (Outside the data range)**

*** p < 0.05, ** p < 0.01.**

Figure 2: Response surface analysis for the quadratic model involving TMKA, CSC-CostDrivers and USEFULNESS



Appendix 9-1: The results of the first step of residual analysis

Table 1: The results of the first step for the second combination of the cost structure and business-unit size measures (CostStructure-MANUFACTURING and SizeRevenue)[a]

	CSC measure							
	CSC-CostPools		CSC-CostDrivers		CSC-COMPOSITE		CSC-DEVELOPED	
Variable	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
COMP	0.06	1.11	0.06	1.11	0.07	1.11	0.04	1.07
CostStructure-MANUFACTURING	-0.06	1.08	0.00	1.08	-0.04	1.08	0.03	1.09
CultureDetail	0.03	1.97	-0.03	1.97	-0.01	1.97	-0.05	1.86
CultureOutcome	0.00	2.27	-0.08	2.27	-0.05	2.27	0.07	2.37
CultureControl	-0.10	1.72	0.02	1.72	-0.03	1.72	0.16	1.67
PC	-0.08	1.11	-0.01	1.11	-0.07	1.11	-0.01	1.07
SizeRevenue	**0.49****	1.24	**0.33****	1.24	**0.46****	1.24	0.07	1.17
TMS	0.14	2.21	0.17	2.21	0.16	2.21	0.04	2.35
TMKA	0.04	2.17	0.04	2.17	0.07	2.17	0.13	2.44
Indirect effect of TMKA:								
TMKA direct impact on TMS	**0.69****	N/A	**0.69****	N/A	**0.69****	N/A	0.73**	N/A
TMKA indirect impact on CSC	0.10	N/A	0.12	N/A	0.11	N/A	0.03	N/A
Adjusted R^2	**0.30****		**0.12****		**0.26****		0.04	

*** $p < 0.05$, ** $p < .01$.**

a. The significance tests are based on 5000 bootstrap samples.

b. The coefficients are standardised, as produced by SmartPLS.

Table 2: The results of the first step for the fourth combination of the cost structure and business-unit size measures (CostStructure-COMBINED and SizeRevenue)[a]

	CSC measure							
	CSC-CostPools		CSC-CostDrivers		CSC-COMPOSITE		CSC-DEVELOPED	
Variable	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
COMP	0.05	1.11	0.06	1.11	0.06	1.11	0.05	1.07
CostStructure-COMBINED	-0.12	1.11	0.00	1.08	-0.09	1.11	-0.04	1.13
CultureDetail	0.03	1.96	-0.03	1.97	-0.02	1.96	-0.06	1.86
CultureOutcome	-0.01	2.25	-0.08	2.27	-0.05	2.25	0.07	2.36
CultureControl	-0.10	1.72	0.02	1.72	-0.03	1.72	0.15	1.67
PC	-0.09	1.11	-0.01	1.11	-0.07	1.11	-0.01	1.07
SizeRevenue	**0.47****	1.26	**0.33****	1.24	**0.44****	1.26	0.05	1.20
TMS	0.15	2.22	0.17	2.21	0.17	2.22	0.04	2.35
TMKA	0.04	2.17	0.04	2.17	0.07	2.17	0.13	2.45
Indirect effect of TMKA:								
TMKA direct impact on TMS	**0.69****	N/A	**0.69****	N/A	**0.69****	N/A	0.73**	N/A
TMKA indirect impact on CSC	0.10	N/A	0.12	N/A	0.11	N/A	0.03	N/A
Adjusted R^2	**0.31****		**0.12****		**0.27****		0.04	

*** p < 0.05, ** p < .01.**

a. The significance tests are based on 5000 bootstrap samples.

b. The coefficients are standardised, as produced by SmartPLS.

Appendix 9-2: The results of the second step of residual analysis

Table 1: The results of the second step for the second combination of the cost structure and business-unit size measures (CostStructure-MANUFACTURING and SizeRevenue)[a]

Panel A:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.03	1.31	0.02	1.31
	Negative-Residuals	-0.06	1.31	-0.01	1.31
CSC-CostPools	**Adjusted R^2**	0.00		-0.01	

Panel B:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.04	1.21	0.03	1.21
	Negative-Residuals	0.00	1.21	-0.08	1.21
CSC-CostDrivers	**Adjusted R^2**	-0.01		0.00	

Panel C:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.05	1.28	0.03	1.28
	Negative-Residuals	-0.02	1.28	-0.02	1.28
CSC-COMPOSITE	**Adjusted R^2**	-0.01		-0.01	

*** p < 0.05, ** p < .01.**

a. The significance tests are based on 5000 bootstrap samples.

b. The coefficients are standardised, as produced by SmartPLS.

Table 2: The results of the second step for the third combination of the cost structure and business-unit size measures (CostStructure-COMBINED and SizeEmployees)[a]

Panel A:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.07	1.28	0.04	1.28
	Negative-Residuals	-0.04	1.28	0.06	1.28
CSC-CostPools	**Adjusted R^2**	0.00		-0.01	

Panel B:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.03	1.20	-0.01	1.20
	Negative-Residuals	-0.04	1.20	-0.10	1.20
CSC-CostDrivers	**Adjusted R^2**	-0.01		0.00	

Panel C:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.07	1.24	0.01	1.24
	Negative-Residuals	-0.02	1.24	0.00	1.24
CSC-COMPOSITE	**Adjusted R^2**	0.00		-0.01	

*** p < 0.05, ** p < .01.**

a. The significance tests are based on 5000 bootstrap samples.

b. The coefficients are standardised, as produced by SmartPLS.

Table 3: The results of the second step for the fourth combination of the cost structure and business-unit size measures (CostStructure-COMBINED and SizeRevenue)[a]

Panel A:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.03	1.31	0.03	1.31
	Negative-Residuals	-0.05	1.31	0.00	1.31
CSC-CostPools	**Adjusted R^2**	-0.01		-0.01	

Panel B:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.04	1.21	0.03	1.21
	Negative-Residuals	0.00	1.21	-0.08	1.21
CSC-CostDrivers	**Adjusted R^2**	-0.01		0.00	

Panel C:

		Outcome measure			
		USEFULNESS		USAGE	
CSC measure	**Variable**	**Coefficients[b]**	**VIF**	**Coefficients[b]**	**VIF**
	Positive-Residuals	0.05	1.28	0.04	1.28
	Negative-Residuals	-0.01	1.28	-0.01	1.28
CSC-COMPOSITE	**Adjusted R^2**	-0.01		-0.01	

*** $p < 0.05$, ** $p < .01$.**

a. The significance tests are based on 5000 bootstrap samples.

b. The coefficients are standardised, as produced by SmartPLS.

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