

**Information Use by Multi-Agency Teams in Time Constrained, Uncertain
and Complex Environments**

Jyoti Laxmi Mishra

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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To my husband, my love

&

My daughter, my source of inspiration.....

Abstract

This research investigates information practices issues in a time constrained, uncertain and complex environment with a focus on emergency management. During a major incident, commanders from the multi-agency emergency services such as from the police, fire and rescue, and ambulance need to come together to manage the incident. Depending on the nature of the incident, commanders involved in emergency management vary; hence they meet on an ad-hoc basis. The literature states that information should be shared among members of a team for coordination. It is thus necessary to understand issues underlying information sharing. Also, one of the major tasks in emergency management is to make decisions. From an information science perspective, it is imperative to understand how information is used by decision makers to make decisions. Thus, two research questions of interest are (1) the issues which impact information sharing and (2) how information is used for making decisions. This research takes an interpretive approach in which activity theory is used as a methodological and analytical framework to address these research questions.

Investigating the first research question, it was found that different components impact information sharing. These components are grouped into six dimensions providing more holistic understanding of the context, which is advocated in information practices research. A model (the POSSTT model) is proposed as a framework to study information sharing of such ad-hoc multi-agency groups. Addressing the second research question, contributions are made to the ongoing debate on types of decision making. In theory, type 2 (analytical) decision making is promoted by many researchers; however, in practice it was found that in a time constrained environment, decision makers may use a combination of type 1 (intuitive) and type 2 (albeit not deliberative) decision making. A model for how experienced people use information to make decision is proposed. In addition, a need is realised for sub-dividing the experienced decision making model into an “experienced decision maker” model, and, an “experienced and confident decision maker” model. These contributions have practical implication for policy making and system design.

Table of Contents

Acknowledgement	ii
Abstract	iv
Table of Contents	v
List of Figures	x
List of Tables	xii
Chapter 1 Introduction	1
1.1 Research Motivation	1
1.2 Research Gap.....	2
1.2.1 Ad-hoc Multi-Agency Team Environment.....	2
1.2.2 Multifaceted approach to Study Context	4
1.2.3 Information Sharing	5
1.2.4 Information Use for Making Decisions	6
1.3 Research Questions.....	7
1.4 Importance of this Research	7
1.4.1 Time Constrained, Uncertain and Complex Environments	8
1.4.2 Team Coordination for Multi-Agency Response to Major Incidents.....	8
1.4.3 Need of Information Practice for Emergency Management	9
1.4.4 Need of Decision Making in Emergency Management	10
1.5 Research Context: Emergency Management.....	11
1.5.1 Participants	12
1.6 Contributions.....	13
1.7 Overview of Remaining Chapters.....	14
Chapter 2 Literature Review	15
2.1 Overview	15
2.2 Information Behaviour/Information Practice	16
2.3 Context as the Focus of Study in Information Practices	17
2.3.1 Theorising Context	19
2.3.2 Uncertainty as Task and Context	23
2.3.3 Complexity as Context	25
2.3.4 Time Factor as Context	27
2.4 Research in Time Constrained, Uncertain and Complex Environments	28
2.5 Information Use: Sharing and Deciding	29
2.5.1 Information Sharing.....	31
2.5.2 Decision Making.....	40

2.5.3	Related Research in Decision Making.....	47
2.5.4	Post Decision Making Information Seeking	57
2.5.5	Concluding Decision Making.....	57
2.6	Information Sharing and Decision Making.....	58
2.7	Conclusion	59
Chapter 3	Methodology.....	63
3.1	Introduction.....	63
3.2	Meta-Theoretical Perception	64
3.3	Methodology.....	66
3.3.1	Alternative Approaches to Activity Theory.....	66
3.3.2	Activity Theory	67
3.3.3	Research Design	72
3.3.4	Methods.....	72
3.3.5	Analysis Process	76
3.4	Reliability and Validity.....	81
3.5	Ethical Issues	82
3.6	Conclusion	82
Chapter 4	Analysis using Activity Theory	84
4.1	Introduction.....	84
4.2	How Emergency Services Work.....	84
4.3	Activity 1: Being Activated	89
4.3.1	Action 1: Coordinating with C&C	91
4.3.2	Action 2: Information Seeking	94
4.3.3	Action 3: Decision on Mobilising Resources	94
4.3.4	Action 4: Decision to Wait	95
4.3.5	Action 5: Decision on the Location	96
4.4	Activity 2: En-route.....	98
4.4.1	Action 1: Information Seeking	99
4.4.2	Action 2: Decoding the Moments.....	102
4.4.3	Action 3: Decision Making for Resources	102
4.5	Activity 3: At the Incident Place	104
4.5.1	Action 1: Information Assimilation	105
4.5.2	Action 2: Command, Control and Coordinate (C3).....	111
4.5.3	Operations	113
4.5.4	Action 3: Decision Making	116

4.5.5	Action 4: Taking over the Silver Commander Role	116
4.5.6	Action 5: Decision to be Offensive or Defensive	117
4.5.7	Action 6: Analyse Different Options	117
4.5.8	Action 7: Setting Priorities	118
4.5.9	Action 8: Resource Allocation	118
4.5.10	Action 9: Keeping Public and Staff Safe	118
4.6	Activity 4: Silver Meeting	119
4.6.1	Action 1: Set Agenda/Terms of Reference	121
4.6.2	Action 2: Coordinating with Other Agencies	122
4.6.3	Action 3: Share Information.....	122
4.6.4	Action 4: Allocate Tasks	124
4.6.5	Action 5: Allocate Resources in Multi-Agency Environment	125
4.6.6	Action 6: Understand other Agencies and their Culture	126
4.6.7	Action 7: Preparation to Brief Gold Command.....	127
4.6.8	Action 8: Decision of RVP Location	127
4.6.9	Action 9: Setting Priorities in Multi-Agency Teams	127
4.6.10	Action 10: Decision on Setting Gold Command.....	127
4.7	Information Practices and Decision Making at Different Stages	128
4.7.1	Notification Stage and En-Route.....	129
4.7.2	At the Incident Place.....	130
4.7.3	During the Silver Meeting (Ideal case of co-location)	131
4.8	Conclusion	132
Chapter 5 Findings: Information Sharing		133
5.1	Introduction.....	133
5.2	Need of Information Sharing in Multi-Agency	135
5.2.1	Common Operating Picture	135
5.2.2	Create Wider Picture.....	135
5.2.3	Significant Decisions	136
5.2.4	To Make Others Understand Your Perspective	136
5.2.5	Information Lost if not shared	136
5.2.6	Using Resources of Other Agencies	137
5.2.7	For the Welfare of Public and Staff.....	137
5.3	Information Sharing Issues.....	138
5.3.1	Personal Factors.....	138
5.3.2	Organisational Dimension.....	141

5.3.3	Social Dimension	147
5.3.4	Spatial Dimension	149
5.3.5	Temporal Dimension.....	155
5.3.6	Technological Dimension	157
5.4	Conclusion	162
Chapter 6	Discussion on Information Sharing	165
6.1	Introduction.....	165
6.2	Context	166
6.3	Personal Dimension: Experience and other Human Factors	168
6.4	Organisational Dimension: Culture, Rules and Trust	170
6.5	Social Dimension: Terminology, Confidentiality	173
6.6	Spatial Dimension: Distant or Face-to-Face Interaction	175
6.7	Temporal Dimension: Concise Communication	178
6.8	Technological Dimension: Social and Technological Issues	180
6.9	Summary of Findings	183
6.10	Contribution 1: The POSSTT Model for Information Sharing	185
6.11	Conclusion	186
Chapter 7	Findings in Information Use for Making Decisions	188
7.1	Introduction.....	188
7.2	Decision Making	189
7.3	Type 1 or Type 2	190
7.3.1	Type 1.....	190
7.3.2	Type 2.....	192
7.3.3	Dual Processing.....	193
7.4	Decision Making Aids	195
7.4.1	Log.....	195
7.4.2	Action Cards	196
7.4.3	Plans/Rules.....	196
7.5	Group Decision Making	197
7.5.1	Issues in Group Decision Making	197
7.6	Issues in Decision Making.....	200
7.6.1	Time.....	200
7.6.2	Public Expectation.....	202
7.6.3	Lack of Information	203
7.6.4	Information in Bits	203

7.6.5	Change the Course of Decision Made.....	204
7.6.6	Norms.....	205
7.7	Post Decision Making Information Seeking	206
7.8	Conclusion	208
Chapter 8	Discussion on Information Use for Making Decisions.....	210
8.1	Introduction.....	210
8.2	Contribution 2: Information Use for Making Decisions	212
8.3	Contribution 3: Expert Problem Solving Model	220
8.3.1	Experts Information Seeking.....	221
8.3.2	Post Decision Making Information Seeking	221
8.4	Conclusion	222
Chapter 9	Conclusions and Implications	224
9.1	Introduction.....	224
9.2	The Research Gap: At a Glance	224
9.3	Implication for Theory.....	225
9.3.1	Contribution 1: The POSSTT Model for Information Sharing	225
9.3.2	Contribution 2: Information Use for Making Decisions.....	226
9.3.3	Contribution 3: Expert Problem Solving Model.....	227
9.3.4	Integrated framework for effective emergency management	227
9.4	Implication for Policy and Practice.....	229
9.4.1	Rules and Regulations.....	229
9.4.2	Training	231
9.4.3	Technology.....	232
9.5	Limitations.....	233
9.6	Further Research	234
9.7	Concluding Remarks.....	234
	References	236
	Appendices.....	259
	Appendix 1: Request for Data Collection.....	259
	Appendix 2: Interview Questions.....	260
	Appendix 3: Silver City	267

List of Figures

Figure 1.1 Structure of the remaining chapter	1
Figure 1.2 Circular relation between phases of emergency management (NEHRP)....	11
Figure 1.3 Command structure of the emergency services in the UK.....	12
Figure 1.4 Overall structure of the thesis	14
Figure 2.1 Structure of chapter 2.....	16
Figure 2.2 Problem solving model by Wilson (1999a)	25
Figure 2.3 Information behaviour model (Wilson, 1981)	31
Figure 2.4 Focus of this research	31
Figure 2.5 Recognition-Primed Decision Model (Klein, 1997b, p. 286).....	43
Figure 2.6 Conflict management model (CMM)	47
Figure 2.7 A conflict-theory model of decision making (Janis & Mann, 1977, p. 70)...	49
Figure 3.1 Overall structure of chapter 3.....	63
Figure 3.2 Vygotsky's model of activity theory (1 st Generation)	67
Figure 3.3 The hierarchical structure of activity (Leont'ev, 1981).....	68
Figure 3.4 Leont'ev's model of activity theory (2 nd Generation) represented by Engeström (1987).....	68
Figure 3.5 3 rd generation activity theory with two activity systems interacting Engeström (2001, p. 136).....	69
Figure 3.6 Four levels of contradictions in a network of human activity systems (Engeström, 1987, p. 87).....	71
Figure 3.7 Use of MindGenius to establish the relationship between categories	80
Figure 4.1 Chronological stages of silver commander in managing major incident	84
Figure 4.2 Different stages of activity and actions	88
Figure 4.3 Activity system for getting informed	90
Figure 4.4 Action and goal	91
Figure 4.5 Contradiction between subject and tools used.....	93
Figure 4.6 Action-goal for information seeking	94
Figure 4.7 Decision making as an action for location	96
Figure 4.8 Activity system while silver commander is en-route.....	99
Figure 4.9 Information seeking for being informed.....	100
Figure 4.10 Decoding activities to know about situation of the incident	102
Figure 4.11 Quest for resources.....	103
Figure 4.12 Activity system of silver commander on arrival to the incident ground .	105

Figure 4.13 Information assimilation for sense-making	105
Figure 4.14 Activity system for co-located silver commanders.....	121
Figure 4.15 Action and goal for setting agenda.....	121
Figure 4.16 Action and goal for coordination	122
Figure 4.17 Action and goal for updating	123
Figure 4.18 Action and goal for task allocation	124
Figure 4.19 Action and goal to prepare for briefing gold	127
Figure 5.1 Findings: sharing as information use	134
Figure 5.2 Proposed POSSTT model for information sharing in ad-hoc multi-agency team	163
Figure 6.1 The proposed POSSTT model for information sharing in ad-hoc multi-agency team	166
Figure 7.1 Structure of chapter 7	189
Figure 7.2 Process followed by silver commanders (contradicting CMM model).....	192
Figure 7.3 Group decision making and factors affecting the process	200
Figure 7.4 Information coming in bits.....	204
Figure 7.5 Changing the course of action with more information	205
Figure 7.6 Decision making process for silver commanders	207
Figure 7.7 General Information use for decision making in time constrained, uncertain and complex environments	207
Figure 8.1 Information use for decision making in time constraint, uncertain and complex environments	218
Figure 8.2. The conflict management model.....	218
Figure 8.3. Experienced and confident decision makers' use of information	220
Figure 8.4 Expert problem solving model: an extension to Wilson's (1999a) model.	222
Figure 9.1 Integrated Framework for Effective Emergency Management.....	228

List of Tables

Table 3.1 Highly referred free nodes generated from open coding.....	79
Table 4.1 Information practices and decisions made at Stage 1 and Stage 2	129
Table 4.2 Information practices and decisions made at Stage 3 (incident place)	130
Table 4.3 Information practices and decisions made at Stage 4 (silver meeting).....	131

Chapter 1 Introduction

1.1 Research Motivation

The way information is gathered, shared and used to underpin organisations' decision making is important and the subject of a growing body of literature. In information science¹ research, however, the working environment studied is usually a stable one, such as academic work, student activity or libraries. Moreover, the teams studied in terms of their collaboration are normally established, where members meet regularly and have adequate time for making decisions. In contrast, in recent years public attention has often focused on decision making in "extreme events"² emergency response, such as terrorist bombings (World Trade Centre attack, 7th July London bombing in 2005), tsunamis, nuclear accidents, earthquakes, floods and hurricanes, to name but a few. In the former incidents the environment activities are routine or undertaken by established teams; during emergencies, ad-hoc multi-agency teams need to work together in time constrained, uncertain and complex environments. This thesis is concerned with addressing some of the gaps in from an informational perspective, in the way in which such emergencies are tackled and how they might be addressed more effectively. This chapter is organised as shown in Figure 1.1.

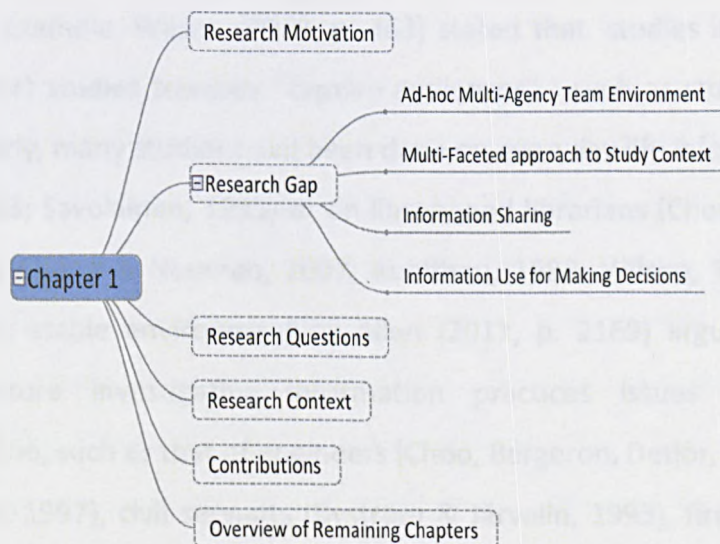


Figure 1.1 Structure of the remaining chapter

¹ Information science is defined as the discipline concerned with the user and use of information (Wilson, T. D. 2000. Human Information Behavior. *Informing Science*, 3(2): 49-56)

² Extreme events, as used by Comfort (2007) for major incidents

1.2 Research Gap

This research is motivated by gaps identified in the literature on information use in complex environments for ad-hoc multi-agency teams. It is different from many other studies in four important ways as outlined below.

- i. The environment being researched is that of an ad-hoc multi-agency team which needs to work in a time constrained, uncertain and complex environment
- ii. While a multifaceted approach is advocated by many studies as useful for holistic understanding of the information practices³, the extant literature often still lacks rigorous research
- iii. The combination of information use and decision making is not in general investigated rigorously in other information science studies
- iv. Though collaborative team work is a persisting issue, how information is shared among ad-hoc multi-agency teams is an underexplored area

These points will be elaborated further in the following sub-sections.

1.2.1 Ad-hoc Multi-Agency Team Environment

Research in information science has mostly dealt with “information behaviour”⁴ in academia. For example, Wilson (2008, p. 463) stated that ‘studies in the field have tended to distort studies towards “captive audiences” ’ such as students or school children. Similarly, many studies have been done on everyday life information seeking (McKenzie, 2003; Savolainen, 1995) or on library and librarians (Chowdhury, Gibb, & Landoni, 2011; Chung & Neuman, 2007; Kuhlthau, 1988; Wilson, 1999b), which is typically a very stable environment as Allen (2011, p. 2169) argued. There is a growing literature investigating information practices issues in professional environments too, such as that of engineers (Choo, Bergeron, Detlor, & Heaton, 2008; Ellis & Haugan, 1997), civil servants (Byström & Järvelin, 1995), fire fighters (Lloyd,

³ In this research, information practice is defined as the act of seeking and using information to perform tasks. Information use can consist of acquiring, sharing and using information to make decisions; as well as storing information for future use

⁴ Information behaviour is defined by Pettigrew et al. (2001) as ‘the study of how people need, seek, give and use information in different contexts, including the workplace and everyday living’

2007) or police (Allen, 2011), lawyers (Choo et al., 2008; Makri, 2008), blue collar workers (Veinot, 2007) or the army (Sonnenwald, 2006). However, as noted by Allen (2011, p. 2168) the extant literature lacks rigorous research in time constrained, uncertain and complex environments, with a few exceptions (Choo, 2009; Sonnenwald & Pierce, 2000).

The context Sonnenwald and her colleagues' (Sonnenwald, 2006; Sonnenwald & Pierce, 2000) investigated can be argued to be different from the present research. As stated by Bharosa et al. (2010, p. 51), the structure of work in the military is different from other multi-agency tasks as in the army, they have more disciplined and hierarchical structure and command and control is centralised whereby decisions are made by higher ranked commanders. However, in other multi-agency teams, the structure may not be as centralised and decisions have to be made in a more collaborative way. Similarly, research conducted by Allen (2011), although it addresses task complexity, uncertainty and time constrained environments, investigates one agency only (police forces) and does not address the multi-agency challenge.

There are several important situations where people from different agencies need to collaborate on an ad-hoc basis for effective work, such as in hospitals, airlines and in disaster response (Ren, Kiesler, & Fussell, 2008, p. 105). Due to differences in the culture and routine of these agencies (Ren et al., 2008), task complexity increases further in the multi-agency environment (Bharosa et al., 2010). Although Choo (2009), addressed the multi-agency environment, task complexity and uncertainty, his research investigated early warning systems which fall under the preparedness phase of the emergency management cycle (emergency management phases will be explained in 1.5) where, it can be argued, there is a longer time available for decision making. Even Choo stated that early warning systems have a long gestation period (ibid). Moreover, in such an ad-hoc multi-agency environment where time is constrained and the situation is uncertain and complex, several information practice questions can be posited which have not been investigated in depth. For example, what are the information practice issues when members of ad-hoc multi-agency

teams have different objectives but need to work together on common aims? How can the work environment of such organisations be improved?

1.2.2 Multifaceted approach to Study Context

In the information practice literature the concept of “context” has emerged as a very important theme and, it has been argued, needs to be at the forefront of the research in order to understand information practices (Johnson, 2003), as without context there is no meaning (Talja, Keso, & Pietiläinen, 1999, p. 753). Context, ‘the quintessence of a set (or group) of past, present and future situations’ (Sonnenwald, 1999, p. 178), is necessary to capture a holistic perspective in information science research (Fisher, Landry, & Naumer, 2007a; Talja et al., 1999). It provides a multifaceted lens (Fisher, Durrance, & Hinton, 2004, p. 756) which enhances the understanding of human information behaviour (Fidel, Pejtersen, Cleal, & Bruce, 2004, p. 939). Although context constitutes a *frame of reference*, its conceptualisation is often problematic to researchers in information science research (Courtright, 2007, p. 273).

Different framework exists in the literature which considers context for the holistic understanding of information practices. For example, Dervin (1992) proposed a sense-making approach as a meta-theory which can guide studying information seeking. Pettigrew et al. (2001, p. 65) stated that the sense-making approach by Dervin ‘addresses all types of context’. Sonnenwald and livonen (1999) advocated the information behaviour framework proposed by Ranganathan (1957) for studying context. Similarly, Allen et al. (2011, p. 2171) stated that activity theory can be used ‘to provide a robust and nuanced theoretical construct to understand the concept of context’. Using activity theory to study the work place environment, Cassens & Kofod-Petersen (2006) identified different facets of contexts such as personal, task, social, spatio-temporal and environmental. Similarly, Engeström (1999, p. 354) used the socio-spatial, temporal and ethical dimensions to understand the context in which groups work. As stated above, activity theory has been used in many studies to understand context and will also be adopted in this research.

1.2.3 Information Sharing

Information sharing⁵ is an under-researched area in the information science literature (Wilson, 2010). Wilson, after reviewing the literature on information sharing in different disciplines, identified that information sharing is mostly studied in other research areas and not rigorously in information science (ibid.). He further stated that the context in which information sharing is investigated is very limited such as in health care (Hedges-Greising, 2011) or in supply chain management (Arnold, Benford, Hampton, & Sutton, 2010).

The extant literature suggests the importance of information sharing is more intense in an environment where members from multiple agencies need to coordinate. For example, Dennis (1996a) stated that team decision making creates a greater pool of information. When people from different agencies come together to manage a task, teams should coordinate so that effective decisions can be made. For team coordination, team members need to have a common operating picture⁶ (Comfort, 2007; Knecht, 2008; Pitt, 2008) or shared mental models (Kraiger & Wenzel, 1997, p. 64) and need to brainstorm (Laughlin, 1999) for which information should be shared (Liu & Chetal, 2005). Communication (or information sharing) can contribute to collective sense-making (Heverin & Zach, 2011) which is important for developing a common operating picture. However, information sharing in a multi-agency environment is not investigated in detail and is recommended by a number of researchers to be investigated further (Bharosa et al., 2010). Moreover, there are questions that can arise in information sharing in multi-agency working, such as how information is shared among members of a multi-agency team and what are the factors that influence information sharing. These have not been extensively addressed in the information science literature.

⁵ Information sharing is defined as 'the voluntary act of making information available to others' (Davenport, 1997, p.87)

⁶ Common Operating Picture is the language of practice which as Comfort (2007, p. 191) defines is 'a sufficient level of shared information among the different organisations and jurisdictions participating in disaster operations at different locations, so all actors readily understand the constraints on each and the possible combinations of collaboration and support among them under a given set of conditions'

1.2.4 Information Use for Making Decisions

The extant literature states information practices includes information needs, information seeking, information use (Savolainen, 2007), synthesizing, analyzing, filtering and retrieving (Talja & Hansen, 2006). Although many researchers concentrate on information seeking research, the field of information science lacks rigorous research in information use (Kari, 2007; O'Farrill, 2008). Information use has been associated with decision making by different researchers (Berryman, 2006; Kirk, 2002; Vakkari, 1998; Zeffane & Gul, 1993). While information is important to make decisions (Higgins, 1999, p. 132), how information is used in the decision making process is not investigated in depth, especially in the context of time constrained, uncertain and complex environments, with the exception of a few researchers (Allen, 2011; Choo, 2009).

In the process of studying how information is used for making decisions, this research also addresses the ongoing debate on the type of decision making, intuitive (type 1) or analytical (type 2). To begin with, in the decision making literature, decisions were seen as best made by analyzing all the options and then choosing the optimal one. However, due to bounded rationality (Simon, 1955) people may not be able to analyze all the available options, but may instead choose from among a few satisfactory options, which is termed satisficing (Simon, 1957). In information science research also, as pointed by Allen (2011) and Zach (2005), the analytical (rational or satisficing) mode of decision making is dominant. Allen (2011) cited the work of Savolainen (2006) where he indicated that in information science, people analyse options and decide which source to use for information search and seeking. However, the studies investigating decision making in time constrained, complex and uncertain environments, identified that decision makers may not analyse options deliberately. For example, Klein (1998) in his investigation of decision making by fire fighters identified that decisions are made by recognizing the pattern of the incident and may not be analyzing options consciously. This type of decision making falls under the heading of naturalistic decision making (NDM). In line with the findings of Klein; Choo (1998, p. 192) stated that *during time critical and novel situations, people may make their judgements based on intuition or creativity and sometimes may not even use*

information to make decisions. It can be seen that different views are presented in the extant literature (in information science and decision making) regarding mode of decisions, which needs to be investigated. Moreover, by analyzing how information is used by decision makers in time constrained, complex and uncertain environments, the current gap in the literature on information science and decision making where Allen (2011) stated that 'there is a pressing need for the..... studies of information behaviour by expert decision makers in situations that are non routine yet complex and where decisions are time pressured' can also be addressed.

In short, this research identified research gaps which need to be addressed to build upon the existing body of knowledge and theory in the information science and decision making literature.

1.3 Research Questions

This research concentrates on two types of information use: sharing information and deciding. To address the research gaps outlined above, the following key questions are of interest:

1. What issues influence information sharing during ad-hoc multi-agency team decision making?
2. How is information used for making decisions in time constraint, uncertain and complex environments?

1.4 Importance of this Research

In this section, the research context, which is time constrained, uncertain and complex, will be addressed. Emergency management was chosen as a context to explore information use for decision making. In section 1.4.1, first, a justification of why emergency management falls under the heading of a time constrained, uncertain and complex environments which is information intensive too will be discussed in the light of the existing literature on emergency management will be provided. Second, the problem of coordination in the multi-agency environment of the emergency services will be outlined in section 1.4.2. Third, in section 1.4.3, the need of studying information sharing to address coordination amongst multi-agency teams in the emergency context will be addressed. This will be done by highlighting the

information related issues in emergency management and also by reviewing extant literature in information science on emergencies. Fourth, the importance of decision making in emergency will be explored, in section 1.4.4, which will provide a deeper understanding of why this research investigates information use (decision making and information sharing) during response to a major incident.

1.4.1 Time Constrained, Uncertain and Complex Environments

Time is a very important factor during emergency management as emergency responders need to act within a very short-time period (Quarantelli, 1970). They need to work in unfamiliar (Tierney, 1985), unpredictable (Heide, 1989), dynamic (Comfort, Sungu, Johnson, & Dunn, 2001) and complex (Comfort, 2007) environments. The complexity increases further when emergencies escalate and very short-time schedules are available (Carver & Turoff, 2007). This fast changing situation demands adaptability in performance (Comfort, 2007), due to which emergency responders are under pressure (Carver & Turoff, 2007). When situations cannot be controlled and rules are not appropriate, due to the uniqueness of the incident (Tierney, 1985), uncertainty and complexity increases further (Carver & Turoff, 2007). Thus the literature in emergency management describes difficult situations in which emergency responders need to work, characterised by time constraints, uncertainty and complexity.

1.4.2 Team Coordination for Multi-Agency Response to Major Incidents⁷

During emergencies, as Carver and Turoff (2007, p. 35) stated, a team 'needs to work together [] to support each others' objectives even when they have never before worked together'. Heide (1989) emphasised the need for inter-organisational coordination. Multi-agency coordination, although very important (Celik & Corbacioglu, 2010), remains one of the major problems in emergency management (Haddow, Bullock, & Coppola, 2008; Handmer & Parker, 1991; Jenkins, 2006; Quarantelli, 1988; Smith & Dowell, 2000). *Sharing information and having*

⁷ In this research, the terms "major incident", "emergency", "crisis", and "disaster" are used interchangeably for general understanding although there is an underlying difference. See Quarantelli, E. L. (2000). *Emergencies, Disasters and Catastrophes are different Phenomena*, Priliminary Paper, University of Delaware. Available at: <http://dspace.udel.edu:8080/dspace/bitstream/handle/19716/674/PP304.pdf?sequence=1>

interoperability among the systems used by different agencies can mitigate the problem to a certain extent (Chen, Sharman, Chakravarti, Rao, & Upadhyaya, 2008a; Weiser, 2007). Many researchers (Comfort, 2007; Knecht, 2008) have argued the need for a common operating picture for effective coordination and understanding among multi-agency teams. Quarantelli (1988, p. 373) stated that coordination difficulties are due to 'lack of consensus among organisations'. To overcome this situation, Weick (1995) suggests that in an uncertain and complex environment where information is ambiguous and equivocal, sense-making can help extract cues and solve a problem. Making sense of the situation among groups can aid in developing a common operating picture as it creates a shared mental model (Kraiger & Wenzel, 1997). Carver and Turoff (2007, p. 34) also recommended work on the communication aspects, stating that open exchange of information can provide the timely perception required in an emergency environment. In other words, if communication among the members of a group is effective, team coordination can be effective indicating the importance of information sharing.

1.4.3 Need of Information Practice for Emergency Management

The importance of information practice research for group collaboration is also highlighted by Savolainen (2007, p. 123), who stated that information practice research 'supports [] relationship between information and collaboration practices'. From the information science perspective, analysis of emergency management does not only address collaboration or coordination but also addresses several underlying information related issues. For example:

- information source (Robert & Lajtha, 2002)
- information sharing or communication process (Quarantelli, 1988)
- information overload (Carver & Turoff, 2007; Zeigler & Johnson, 1989)
- information failures (Macintosh-Murray & Choo, 2002)
- incomplete use of information (Folb, Detlefsen, Quinn, Barron, & Trauth, 2010)

In addition to these issues, Heide (1989) mentioned that 'people possessing information do not realise that another person who needs it, doesn't have it', indicating an underlying issue in information sharing.

Similarly, the emergency response and recovery guide published by the Cabinet Office, highlighted the importance of information to respond to an emergency, stating that 'information is critical to emergency response [] and must not be underestimated' (Cabinet_Office, 2010, pp. 17, 24). It also stated that sharing information builds situational awareness and the development of a Common Recognised Information Picture⁸ (CRIP). Although, literature in information science highlighted the need to study the information practices of disaster professionals, as they are involved in intense information activities (Folb et al., 2010), little research has been done in information science that identified the importance of investigating information practices in disaster or emergency situations (Folb et al., 2010; Macintosh-Murray & Choo, 2002; McKnight & Zach, 2007; Sonnenwald & Pierce, 2000).

1.4.4 Need of Decision Making in Emergency Management

Decision making is an important aspect of emergency management (Danielsson & Ohlsson, 1999; Hart, Heyse, & Boin, 2001; Smith & Dowell, 2000). The majority of research in emergency management investigates the decision making phenomena of emergency commanders (Crichton, Flin, & McGeorge, 2005; French, Carter, & Niculae, 2007; Helsloot & Ruitenbergh, 2004; Mackenzie et al., 2007). Decision making is often linked with timely and proper information (Danielsson & Ohlsson, 1999; Luyten, Winters, Coninx, Naudts, & Moerman, 2006) and has been found to be adversely affected by poor information sharing and lack of coordination (Bharosa et al., 2010, p. 50). Thus there is a need to study how information is used for making decisions during critical situations in emergency management.

In short, to conclude this section, it was identified that coordination among multiple agencies during emergencies is an underlying issue which can be improved by sharing information. In the next section, the stages in emergency management and the subject chosen for this study will be discussed.

⁸ CRIP is similar to Common Operating Picture defined in Footnote 6

1.5 Research Context: Emergency Management

Emergency management, as shown in Figure 1.2, is categorised by the Federal Emergency Management Agency (FEMA) in four different cycles, mitigation, preparedness, response and recovery. The stages include as Warfield (2008) stated:

1. mitigation is the phase where the effects of disasters are minimised or the effects of unavoidable disasters are reduced
2. preparedness constitutes planning how to respond to a disaster
3. the response phase constitutes immediate assistance provided and efforts made to minimise the hazards created by the disaster viz., evacuation, emergency relief, search and rescue
4. the recovery phase is where the aim is to try to get all systems to normal, or better, so that the community returns to normality (Warfield, 2008)



Figure 1.2 Circular relation between phases of emergency management (NEHRP)

The interest of the present research is in the response phase, as it is the most critical, complex, dynamic and transparent phase in which decisions have to be made in a time constrained environment (Comfort et al., 2001; Haddow et al., 2008). Moreover, the effectiveness of emergency management depends on how effectively commanders respond to an emergency.

1.5.1 Participants

This research studies the Emergency Services in the UK. Within the response phase, the Civil Contingencies Act 2004 specifies Category 1 and Category 2 (Government.Report, 2005). Category 1 responders are the blue light services viz. police forces, fire and rescue services, ambulance services, along with local authority and environment agencies. Category 2 responders include utilities, highway agencies, the Red Cross, army, telecommunication companies and other government agencies. Category 1 responders are further classified as gold (strategic), silver (tactical) and bronze (operational) levels depending on the role as shown in Figure 1.3. In any major incident⁹, there will be many operational level commanders who are responsible for the crew on the ground. Some tactical commanders, from each emergency service such as police, fire and ambulance will be appointed. Depending on the nature of the incident, a representative from the local authority and the Environment Agency can also be involved at the tactical level. One gold command is set up in major incidents.

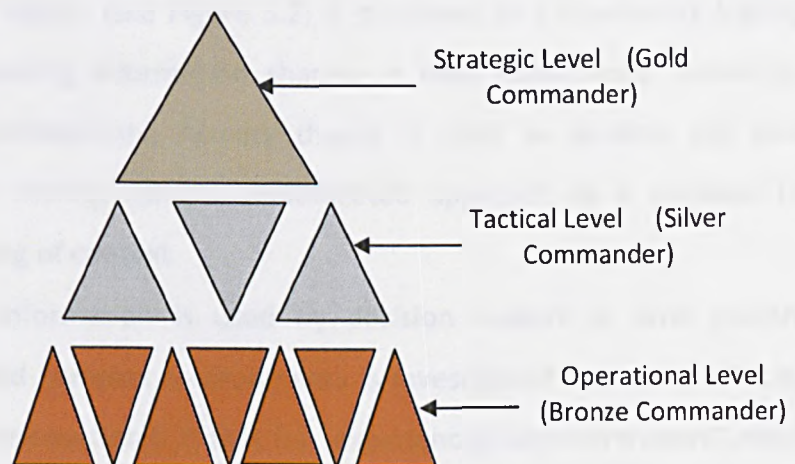


Figure 1.3 Command structure of the emergency services in the UK

This research focus will be on silver commanders as they are the coordinators of the incident and need to make tactical decisions in complex, uncertain and time constrained environments. To make effective decisions, they need timely and accurate information. They also need to command and control their bronze commanders and simultaneously need to fulfil the aims and objectives set by the gold

⁹ A major incident is defined by LESLP (2007, p.7) as 'any emergency that requires the implementation of special arrangements by one or more of the emergency services... and will include the involvement [] of large numbers of people'.

commanders. They need to take charge of formulating tactics so that the strategy set by gold command is met (LESLP, 2007:21). Thus the use of information at this level is both high and important. With concurrent incidents occurring during the response phase as will be shown in section 5.2.5, the work task of silver commanders becomes very complex. Uncertainty is also very high, as every incident is unique in nature; silver commanders often have to work in a very dynamic and uncertain environments (Comfort et al., 2001).

1.6 Contributions

This research makes theoretical contributions to the information use literature, and sheds light on the ongoing debate in the decision making literature. It also has important implications for practitioners in policy, training and system designing.

From this research, three significant contributions can be found towards the state-of-the-art:

- The POSSTT model (see Figure 5.2) is proposed as a framework highlighting factors impacting information sharing in time constrained, uncertain and complex environments. Activity theory is used to analyse the issues in information sharing using a multifaceted approach as it provides holistic understanding of context.
- Also, how information is used by decision makers in time constrained, uncertain and complex environments is investigated in chapters 7 and 8. It was found (see section 8.2) that for “experienced decision makers”; the use of information for decision making (Figure 8.1) is different to the information use model for “experienced and confident decision makers” (Figure 8.3). Thus two different models are proposed illustrating how information is used. Furthermore, this research also contributes to the ongoing debate on type 1 and type 2 decision making.
- Furthermore, the problem solving model by Wilson (1999b) is extended to illustrate problem solving by experts (Figure 8.4). Unlike traditional information science research that suggests that information seeking stops after the problem is solved, the research findings (section 7.7 and 8.3.2)

suggest that if a justification process is in place, then information seeking may take place even after decisions are made (or even after a problem is solved).

1.7 Overview of Remaining Chapters

The rest of the thesis structure is as shown in

Figure 1.4. In chapter 2, the literature review focuses on information practice with a special focus on information use. Within information use, this research is investigating decision making and information sharing and these subjects will be reviewed to understand the extant literature. Activity theory is used as a methodological and analytical framework. It is used to design interview questions and for data analysis purposes which will be explained in chapter 3. In chapter 4, activity theory will be used for analysing the activities of Silver Commanders in a chronological manner. Chapter 5 and chapter 6 are dedicated to the findings and discussion on information sharing. Chapter 7 and chapter 8 then highlight the decision-making findings and the discussion therein. Significant tensions and contradictions that were exposed by the use of activity theory in chapter 4 on information sharing and decision-making will be addressed in chapter 5 and chapter 7. The thesis concludes in chapter 9 with a discussion of the implications for theory and practice.

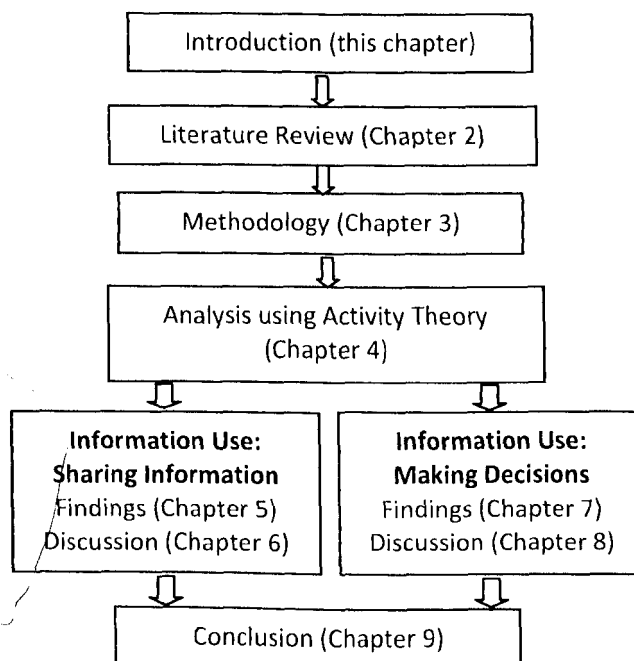


Figure 1.4 Overall structure of the thesis

Chapter 2 Literature Review

“Know where to find the information and how to use it - That's the secret of success”

- Albert Einstein

2.1 Overview

This research focuses on information use by ad-hoc multi-agency teams in time constrained, uncertain and complex environments, namely emergency response. In this context, within the broader umbrella of information use, the focus in this thesis is on information sharing and decision making. Building on the introduction chapter, this chapter brings together the separate literature streams of information context, information practice/ behaviour and information use to set the foundation for the research undertaken in this thesis.

The overall structure of this chapter is shown in Figure 2.1. In section 2.2, a brief introduction to information behaviour/practices research will be presented highlighting the paradigm shift from system centred to user centred in information science research. In section 2.3, a discussion of the literature on the fluid concept of “context” will be presented; highlighting the theories that facilitate its inclusion in information science. This will be followed by a discussion on uncertainty and task complexity. Section 2.4 will bring together these concepts to show how they inform the present research. To widen understanding of the issues surrounding information use, in section 2.5, a discussion on the literature concerning information sharing and decision making will be presented. The chapter will conclude by outlining the research gaps identified in the literature.

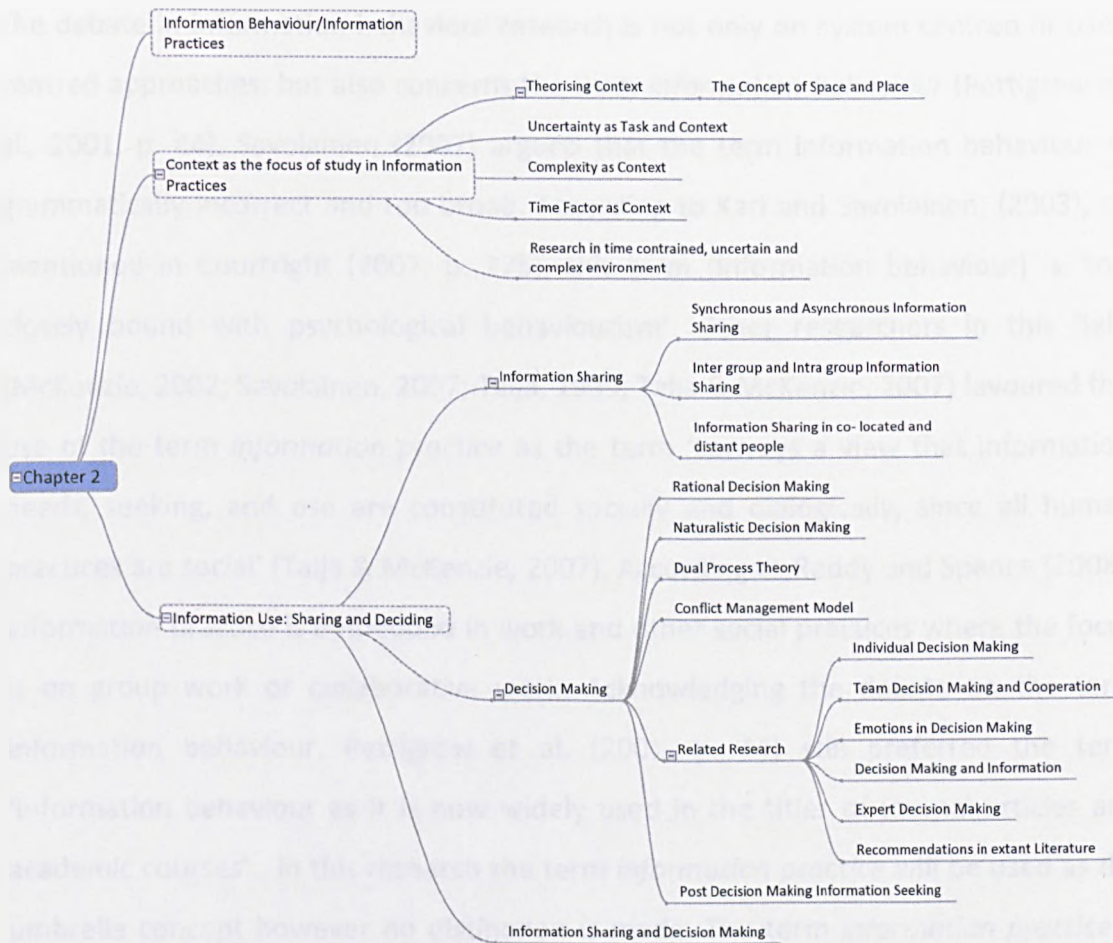


Figure 2.1 Structure of chapter 2

2.2 Information Behaviour/Information Practice

With Dervin and Nilan (1986), urge as a need for the research focus on contextual aspects of users' situations, a paradigm shift took place from the traditional system centred approach to user centred approach in information science research (Talja & Hartel, 2007). The traditional, or system centred, approach focused on objective information such as documentary information sources (Johnstone, Bonner, & Tate, 2004) and was related to the 'searching and retrieving [of] relevant documents' (Ellis et al., 2002, p. 884). The focus was mostly on how sources were used to retrieve information and how often the sources were used (Case, 2002). The alternate, or user centred, approach focuses on subjective information (meaning constructed in relation to context); where a user actively constructs the information (Dervin & Nilan, 1986).

The debate in information behaviour research is not only on system centred or user centred approaches, but also concerns the term *information behaviour* (Pettigrew et al., 2001, p. 44). Savolainen (2007) argued that the term information behaviour is grammatically incorrect and too broad. According to Kari and Savolainen, (2003), as mentioned in Courtright (2007, p. 275), this term (information behaviour) is 'too closely bound with psychological behaviourism'. Other researchers in this field (McKenzie, 2002; Savolainen, 2007; Talja, 1999; Talja & McKenzie, 2007) favoured the use of the term *information practice* as the term 'conveys a view that information needs, seeking, and use are constituted socially and dialogically, since all human practices are social' (Talja & McKenzie, 2007). According to Reddy and Spence (2008), information practice is embedded in work and other social practices where the focus is on group work or collaborative work. Acknowledging the debate on the term information behaviour, Pettigrew et al. (2001, p. 44) still preferred the term 'information behaviour as it is now widely used in the titles of journal articles and academic courses'. In this research the term *information practice* will be used as the umbrella concept however no distinction is made. The term *information practice* is preferred because it links to the meta-theoretical position this research has taken (in terms of practice theory) which will be explained in chapter 3. In this research, information practice is defined as the act of seeking and using information to perform tasks. Information use can consist of acquiring, sharing and using information to make decisions; as well as storing information for future use.

Information need is not included in the definition because when the term *practice* or *behaviour* is used, it means to *act*, and *need* is not an action. However, the importance of information needs is acknowledged in this thesis as imperative as only after people feel the need, they will seek or use information.

2.3 Context as the Focus of Study in Information Practices

Information practice research has largely focused on academics, researchers and students as subjects of research (see Madden, Ford, Miller, & Levy, 2006; Sadler & Given, 2007). A few studies focused on work setting such as civil servants or engineers (Byström & Järvelin, 1995; Ellis & Haugan, 1997), blue-collar workers (Veinot, 2007), fire-fighters (Lloyd, 2007) and nurses (Johannisson & Sundin, 2007),

amongst others. Some of these studies, although these addressed fire-fighters and nurses, were set where time is not a constraint. For example, Lloyd (2007) investigated how fire-fighters learn to become expert which can be argued to be not a time constrained environment. In information practice research a few studies have been carried out on time constrained, complex and uncertain environments, such as (Choo, 2009; Allen et al. 2011). In this section, time constraint, uncertainty and complexity as components of context will be discussed.

By placing importance on context researchers are able to capture a more holistic perspective in information practice research (Fisher et al., 2007a), such as by considering spatial and social factors (Savolainen, 2009b). In the review of conceptual frameworks in information practices, Pettigrew et al. (2001, p. 54) stated that many information seeking models using the *cognitive approach* (or the user centred approach) are context independent and the interest is 'in studying how an individual will apply his or her model or view of the world to the processes of needing, seeking, giving, and using information' (Pettigrew et al., 2001, p. 47). However, in the social cognitive viewpoint (or social viewpoint), which will be explained in section 2.3.1, 'context becomes the focus for understanding information behaviour' (Pettigrew et al., 2001, p. 47).

To study context multifaceted approaches are used (Pettigrew et al., 2001). Fisher et al. (2004, p. 756) added that a multifaceted lens facilitates analysing context, which is important to information practice researchers. Fidel et al. (2004, p. 939) added that multi-dimensional¹⁰ analysis enhances the understanding of information practices. One such theoretical framework which describes context and also provides a multi-dimensional view is activity theory (Walsh, Kucker, Maloney, & Gabbay, 2000). Allen et al. (2011, p. 776) have been using activity theory as a theoretical lens in the field of information behaviour for over seven years. They argued that activity theory is able 'to overcome many of the uncertainties' in information behaviour research and can be used as 'a theoretical frame, which specifically focuses on social context'. Activity theory has also been used in other studies to understand the context of work place (Cassens & Kofod-Petersen, 2006) or group work (Engeström et al., 1999).

¹⁰ The term multi-faceted and multi-dimensional are used synonymously in this research

2.3.1 Theorising Context

From the foregoing discussion, it can be concluded that context is used to capture the holistic perspective of information practices (Fisher et al., 2007a) and that approaches are needed that are able to account for the multiple dimensions of context. Johnson et al. (2006, p. 570) pointed towards several concepts such as information grounds and, information horizon to understand information behaviour in context. These concepts are reviewed here to identify their applicability in this thesis.

Information Grounds

Pettigrew (1999) proposed the concept of information grounds. She defined information grounds as 'an environment temporarily created by the behaviour of people who have come together to perform a given task, but from which emerges a social atmosphere that fosters the spontaneous and serendipitous sharing of information' (Pettigrew, 1999, p. 811). In her study of the flow of human services information in the setting of a community-based foot clinic, Pettigrew used the interaction of multiple factors viz., the physical environment, situational factors (nurse situation, patient situation) and clinical activities for the conceptualisation of information ground. In the physical environment or place, Pettigrew included details such as building type, room and its layout. She found that inclusion of the physical environment in the study aided understanding of the information flow. Pettigrew studied the clinical activities by observing senior citizens and nurses. This helped her in understanding that information flow is not only from nurses to seniors, but also among nurses, and from senior to the nurses, and among the seniors in the waiting area. From this study, Pettigrew came up with the concept of *information ground* and concluded that various contextual studies can facilitate the study of information practices. In another study of interaction and exchange of college students in an informal situation, Fisher et al. (2007a) noted that few researchers are considering situational factors, such as places in the investigation of information behaviour. Thus, Fisher and her colleagues proposed a trichotomy of people, place and information as a framework within the information ground concept to understand context. The concept of information ground can be used to study the context and information sharing/flow within it as Pettigrew (1999, p.812) advocated that information sharing

takes place multi-directionally in the information ground. This theory, albeit effective in understanding the context, information flow and other social interactions, is constrained to everyday life and informal setting. The present research has its information practice ground in a very formal setting, due to which the propositions stated by Fisher et al. (2004, p. 756) for information ground does not fit as explained below.

Pettigrew's (1999) research mainly concentrates on less time bounded tasks such as social interaction between nurses and senior citizens, immigrant's information outcomes (Fisher et al., 2004). Fisher's work is limited in scope as it does not explain the impact of time constraint on information ground. Moreover, in the information ground, the need of information do not arise immediately (Fisher et al., 2004, p. 757). People do not seek information but interact with each other, and identify their need accordingly. On contrary, in formal settings such as in emergency services, people are hungry for information. Due to time constraints, they may not wait for information to be given to them, rather they ask for information explicitly or sometimes implicitly.

Information Worlds

Similar to the concepts of information ground, information world takes into account everyday life information seeking within a small world. Chatman (1991, p. 439) citing Garfinkel (1964), stated that 'small worldview leads to a great familiarity with the everyday events that provide a common, taken-for-granted sense of reality'. Chatman further stated that lives in small worlds 'can tell a great deal about ways in which cultural and social spaces hold opportunities and challenges' (cited in Fulton, 2010, p. 241). She identified that two different worlds exist for the subjects of her study, 'the inside world and the outside world' (Chatman, 1996, p. 193). To this Burnett et al. (2001, p. 537) added, people from the inside world do not seek information from the outside world and their inside world is guided by norms which provide a sense of order and balance. Chatman used social network theory to understand their information behaviour due to its emphasis on 'mutual support and resource exchange' (Chatman, 1996, p. 193). She identified four concepts, risk-taking, secrecy, deception and situational relevance, which can be used to define the information world of impoverished people.

Though Chatman's small world concept is good to understand the information world of different communities, it possesses several limitations. Savolainen (2009b, p. 38) stated that the concept of small world place emphasises spatial factors as constraints and thus has a narrow focus and needs further expansion (ibid, p. 44). Due to the spatial dimensions as constraints, when people are distant, small world may not be applicable.

Information Horizon

Sonnenwald (1999) proposed the concept of *information horizon* as a space where many information resources are present, and resources have knowledge of each other to explore information behaviour. Sonnenwald (1999, p. 180) distinguished between situation and context, stating that context is larger than situation and may consist of several situations (which keep changing). Within this context and situation, an information horizon is present, thus providing a context for identifying information behaviour. Savolainen (2008, p. 277) defined horizon as 'an imaginary field which opens before the mind's eye of the onlooker'. Information horizon, which is determined by individuals and society, includes the information resources which may have knowledge of each other, information retrieval tools and other observations in the world (Sonnenwald, 1999, p. 185).

Fields and Pathways

Fields and pathways are the concepts in information behaviour which respectively represent static and dynamics of information seeking (Johnson et al., 2006, p. 570). According to Johnson (2003, p. 735), it is necessary to understand context to understand information seeking as it is 'central of most theoretical approaches to information seeking'. To do so they used *information fields* to provide the infrastructure which is required for information activities (Johnson, 2003) and *pathways* to understand the way information is used (Savolainen, 2008).

Thus there are several concepts proposed in the information science literature which can be used to account for "information practice in context". In particular, use of the terms *space* (Chatman, 1992; Fisher et al., 2007a; Sonnenwald, 1999) and *place* (Fisher et al., 2004; Fisher et al., 2007a) have been identified as recurring important concepts and will be explored in more detail in the following section.

2.3.1.1 The Concept of Space and Place

Fisher et al. (2007a) recommended for research into the nomenclature of the contextual terms such as place and space. The literature reveals that there is a significant difference between space and place and contradictory use of these terms amongst information science researchers. Kolb (2006) differentiated place from space (having no special significance) stating that place is the 'structure of social norms which gives special meaning to movement and actions'. He also stated that the concept of place is real and transferable to the *virtual space* such as online environment. Harrison and Dourish (1996) added to the distinction of place and space and stated that people are located in space but they act in place, thus giving importance to the behaviour and action of human beings. The concept of space is useful in the virtual world. Contextualised space notions such as *common ground* can be achieved in the virtual environment (Shami, Erickson, Kellog, & Levine, 2011), which then leads people to exchange information to reach mutual understanding. They further noted that designing systems on such common ground will 'help designers create experiences that can reduce the time, effort and environmental cost of travel' (p.1718). They conducted their research on a distributed conference which was intended to bring conference attendees virtually together. Using empirical data, they also illustrated how the participants found the use of interactive virtual technologies being better than a real face-to-face poster session as the presenter is able to know the background of attendee (p. 1721). They concluded that there are 'unlimited places in spaces, which facilitates common ground among large numbers of people' (ibid. p.1722). Kolb (2006) further added that 'virtual space can provide the required area and social practice can create real place there'.

Kolb (2006) added that place in virtual space, similar to place in physical space, 'depends on the detailed character of spatiality, the way their textures fit with their social use guided by their social norms'. In short, it can be stated that for distant locations, especially for virtual environments, the concept of space and place is very important. These concepts help technology developers design systems which promise to deliver virtually real environment for the practitioners to work such as 'hybrid schools created by private tutors' (Kolb, 2006). Kolb also stated that even in

temporary place norms can be established. In the study presented in this thesis, the silver meeting¹¹ that takes place near the incident is an example of a temporary place which has several norms associated with it. Therefore, this framework of place and space, and the distinction therein, might aid in understanding the context in which emergency responders work. Supporting the importance of studying the concept of place, Williamson and Roberts (2010, p. 282) quoted Massy (1994) who 'argued against the conceptualisation of place as static' but should be 'thought in the context of space-time'. The work by Wellman (2006) also indicated that the direction of research, due to modern information technology and human mobility is moving from little boxes (co-located) to "glocalised" (sparsely knitted) to networked individualism (where place is created in space). Thus a trend is observed in the research orientation from face-to-face interaction to distantly located information studies.

Based on this short review of context, and space and place it can be stated that it is necessary to account for context in the study of information practice. In order to do so different situational factors need to be taken into account. It was identified that place is the structure where social meaning is given. However, it was identified in this research that most of these studies on the concept of space and place have limited scope. When people are distant from each other, it is not only computing devices that are used but other telephony devices are also used. Thus in this research, instead of considering place in virtual space, place in real space will be considered.

In the next section, different contextual factors viz., uncertainty, complexity and time will be discussed.

2.3.2 Uncertainty as Task and Context

Uncertainty in Vakkari's (1998, p. 374) terms is 'experienced lack of knowledge about the task dimension'. According to Anderson (2010), there are many meanings attributed to uncertainty in information science studies and it is often associated with 'ambiguity, doubt, vagueness or imprecision'.

¹¹Silver Meeting: A meeting that takes place between silver commanders from different agencies which will be further explicated in chapter 4

As underscored by Allen (2011, p.2169) in information practice research, uncertainty is an ‘activator of deliberative goal directed information seeking behaviour’, but uncertainty as an overall context has not been studied. Uncertainty is often associated with the type of source accessed. For example, Sawyerr (1993) in the investigation of perception of environmental uncertainty and environmental scanning behaviour (of information) identified that with greater environmental uncertainty there was an increase in frequency of scanning i.e. increase in information seeking. Daft and Lengel (1986) identified that with the high-level of perceived strategic uncertainty, the use of personal (as opposed to impersonal sources) and external (as opposed to Internal) sources of information is high. Chowdhury et al. (2011) identified that when the internet is used as a source, uncertainty may not decrease due to vast amount of information available on the web indicating that information overload can be a cause of uncertainty. They also identified that unfamiliarity with the source can be a cause of uncertainty in seeking information. Thus different types of source and competencies in using these sources can have a different impact on the reduction of uncertainty. Kuhlthau (1993, p. 343) in her Information Search Process (ISP) model, classified task into different stages based on the level of uncertainty viz.,

- initiation (‘awareness of need of knowledge’)
- selection (‘general topic defined’)
- exploration (‘information encountered albeit not consistent’)
- formulation (‘uncertainty diminishes and confidence begins to increase’)
- collection (‘effective interaction between user and system’) and
- presentation (‘searching task is complete’)

She identified that the level of uncertainty increases during the stage of exploration and is also high during the initiation stage. Similarly, Wilson (1999a, p. 839) linked problem solving with uncertainty, stating that uncertainty reduction is a key part of problem solving, as shown in Figure 2.2. He categorised problem solving into different stages such as problem identification (identifying the types of problem); problem definition (finding out the nature of the problem); problem resolution (‘how do I find the answer to my problem?’) and finally solution statement (presenting answer to the problem). Wilson further argued that uncertainty can be present till the final stage

but decreases in each stage (Wilson, 1999a, p. 841). In a recent study of information seeking in the digital environment, Chowdhury et al. (2011) argued that uncertainty does not decrease or cease by the end of the task as was stated by earlier researchers (Michael & Blake, 2007; Wilson, 1999b).

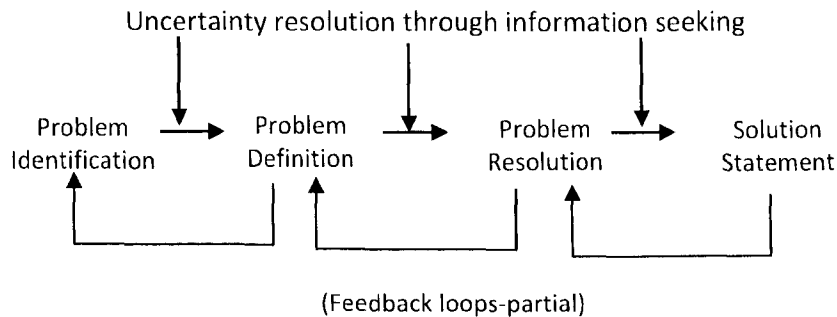


Figure 2.2 Problem solving model by Wilson (1999a)

Literature also links uncertainty with task complexity (Daft, Sormunen, & Parks, 1988; Tihamiyu, 1992). “Complex task” in the information science research is equivalent to task uncertainty (Vakkari, 1998). A positive relation exists between the two, i.e. if the environment is uncertain then the task will be complex (Culnan, 1983). Alchian (1950, p. 212) in a similar manner stated that uncertainty arises from the ‘human inability to solve complex problems’. Thus, if the task is complex then uncertainty is higher. However, uncertainty can be a context too. In major incidents, situations are mostly uncertain in nature. Thus in this research, uncertainty is a task and a contextual factor. Uncertainty as context (situational factor) has only featured in a few studies in the information science literature, and in particular in the context of environmental scanning (Benczúr, 2005; Choo, 2001).

From the literature reviewed in this section, it can be identified that uncertainty is a contextual factor which might increase task complexity. However, as Anderson (2010) argued uncertainty does not always have a negative impact but it can be a source of creativity i.e., in an uncertain situation innovative ideas develop.

2.3.3 Complexity as Context

In addition to task uncertainty, task complexity is another contextual factor that is relevant to this study which will be reviewed in this section.

Task complexity is often linked with information use and information source (Byström & Järvelin, 1995; Culnan, 1983). Information sources can be formal (e.g. documentary sources) and informal (e.g. interpersonal communication) (Culnan, 1983). Depending on the complexity of task, different types of information sources can be used (Byström & Järvelin, 1995). Byström and Järvelin (1995) found that people make use of less channels or sources of information for complex tasks; as more time is spent on understanding the problem or the task. They also found that in difficult and unique work situations no particular channel is known as “best” and hence people resort to accessing many channels of information

In investigating the growth of theories in task complexity and information needs, Vakkari (1998, p. 374) compared several studies (Byström & Järvelin, 1995; Culnan, 1983; Pinnelli, De Rose, Di Giulio, & A, 1993; Zeffane & Gul, 1993) and found that task certainty is a mediator between ‘task complexity and information source’. O’Reilly (1982) in studying the use of information source added further that rather than the information quality, accessibility of information source is a factor impacting the use of information during task complexity, uncertainty and work experience of decision makers.

Task complexity is also linked with experience. Byström and Järvelin (1995) suggested that the information needs of an individual depend largely on the experience and prior knowledge of the person performing the task. Lloyd (2007) in her study of how fire fighters seek information while learning the role emphasised that construction of information is gained from experience. Thus as Byström and Järvelin (1995, p. 208) stated, experienced people possess more information on how to solve problems. Through experience people also bring certain assumptions and culture (Goffman, 1983). Investigating the way information is collected and used by engineers and technical professionals Allard et al. (2009) found that internal sources , such as information from trustworthy colleagues are preferred; this echoes the findings of similar early studies (Byström & Järvelin, 1995).

Depending on the information seeking, need and use, task complexity can be classified into four main types viz. automatic (routine/operational) task, normal information processing task, known- genuine decision tasks and genuine decision

tasks (Byström & Järvelin, 1995, p. 195). The classification is based on the capability of 'piori determinability' (p.194).

Byström and Järvelin (1995) stated that with the increase in the complexity of a task, the need for information also increases, thus many channels are explored. While Su and Contractor (2011) identified that during complex tasks, channels (or technologies) are not often used. This inconsistency in the results can be explained on the basis of underlying assumptions of temporal factor. Su and Contractor made their statement on the complexity including criticality of time while, in their research Byström and Järvelin (1995) note although they used time as situational factor in the model, impact was not found. This illustrates the importance of time as a situational factor and this will be investigated in the next section.

2.3.4 Time Factor as Context

According to Savolainen (2006, p. 110) time is 'one of the main contextual factors of information seeking' and involves the time taken for accessing or selecting information sources. If too much information is provided then it takes too much time to search for information (Edmunds & Morris, 2000, p. 19).

Time is also associated with collaboration. Sonnenwald (2006) while investigating information sharing behaviour of command and control workers working in a time critical environment identified that people working together may not realise the skill of each other as they do not have enough *time to develop* understanding. Allen, while investigating information behaviour and decision making in a police patrol environment, stated that most of the studies in the extant information behaviour literature do not consider time in an explicit way (Allen, 2011, p. 2168). Similarly, referring to the models such as information ground (Pettigrew, 1999) and small worlds (Chatman, 1996) which consider temporal context in everyday context, Savolainen (2006, p. 116) pointed out that in these models time constraints of information seeking are 'less clearly defined'. He further stated that there is 'a lack of empirical studies... in real life situations' (p.121). Thus time as context is identified to have limited scope in extant literature.

Case (2002, p. 35) defined time pressure as the time taken (minutes, hours, days, week, or months) to search for information. According to Quarantelli (1970) time is a very important factor during emergency management as emergency responders need to act within a short time period. However, given the time sensitive nature of this work, with the exception of a few researchers (such as Allen, 2011; Choo, 2009; Sonnenwald, 2006), there is a paucity of empirical inquiry on the emergency response context. This is highlighted as a major gap in the information behaviour literature, which will be explored in the next section.

2.4 Research in Time Constrained, Uncertain and Complex Environments

As has been observed on a few occasions in this thesis, a very limited number of authors have identified the importance of investigating information practice in time constrained, uncertain and complex environments such as disaster or emergency situations (Allen, 2011; Folb et al., 2010; Macintosh-Murray & Choo, 2002; McKnight & Zach, 2007; Sonnenwald & Pierce, 2000). Folb et al. (2010) argued that there is a *need to study information practices of disaster response professionals as they are involved in information intensive activities*. Their work showed that disaster professionals sought information from sources that are readily accessible such as from experienced and trusted colleagues. Similarly, a study conducted by Macintosh-Murray and Choo (2002) investigating the reasons for information failure during catastrophes identified that information is required to reduce uncertainty. Using Taylor's (1991) model of Information Use Environment (IUE), Macintosh-Murray and Choo, further stated that in a team where people are from diverse backgrounds, such as from 'care teams in health care organisations', 'multiple views of the information use environments' are required to 'understand their influence on the flow and use of information' (Macintosh-Murray & Choo, 2002, p. 242). The need for collaboration is imperative in the time constrained environment of emergencies such as command and control (Sonnenwald, 2006; Sonnenwald & Pierce, 2000). Sonnenwald and Pierce (2000, p. 461) revealed three concepts which are required for group tasks such as, 'interwoven situational awareness (which consists of shared understanding of the situation); need for dense social networks (frequent communication between participants about the work context and situation) and contested collaboration'.

Similarly, decision making is also an important part of emergency research was highlighted by Allen (2011). They stated that when people work in time constrained, complex and uncertain environments, decisions might be made from intuition, which needs to be considered in information science research (ibid).

In this section it has been observed that there is limited research on disaster and emergency response; in particular in settings where multiple organisations, teams or agencies (fire, police etc.) coalesce to manage a contingency in an ad-hoc manner. Further, it has been noted that few studies have considered time critical work and, in particular, complex and uncertain work settings. This is highlighted as a gap that will be addressed by the research set out in this thesis.

2.5 Information Use: Sharing and Deciding

While information behaviour is described as searching, using, modifying, sharing, hoarding and ignoring (Davenport, 1997), information behaviour and information practices research is dominated by inquiry into information need and seeking and less attention has been given to information use (Kari, 2007; O'Farrill, 2008; Wilson, 1997, p. 552).

Hart and Rice (1991) stated that information use starts from the moment people are connected to an information source. The literature suggests that information can be used for the following purposes:

- learning (Wilson, 1997, p. 552)
- problem solving (Wilson, 1999b)
- clarifying a situation and receiving comfort (Tuominen and Savolainen cited in Pettigrew, 1999)
- for interpreting cues (Savolainen, 2009a, p. 2244)
- for enlightenment (sense-making)

Similarly, Taylor (1991) (cited in Choo et al., 2008, p. 794) listed information use for:

- instrumental (use for action)
- factual (know facts)
- conformational (verify)
- projective (predict)

- motivational (keep going), and
- personal or political (for own development or for social use).

Providing more detailed Kari (2001, p. 122) proposed 31 information types of usage, they are: analysing, answering, apologizing, avoiding, clarifying, cleaning, commanding, consoling, deciding, developing, editing, evaluating, forgiving, founding, giving birth, going, helping, informing, non-doing, orientating, playing pools, reflecting, registering, studying, synthesizing, taking attitude, trading, treating, unravelling, working, and writing down which falls under the instrumental usage of action as described by Taylor (1991).

Information use is identified to be an action that takes place after the search for information search has taken place, or information is acquired or received (Belkin and Vickery (1985) cited in Ellis et al., 2002, p. 885). The focus in this thesis is on finding how information, that is already acquired or obtained after searching or obtained by serendipity, is used. Special focus is given to how the acquired/received information is used for sharing and making decision by and among members of ad-hoc multi-agency organisations. While decision making is one of the information usages listed in Kari's (2001) findings, it is worth noting that information sharing is not included. Information sharing is also termed as information exchange (Wilson, 1981, 2010). It is also worthwhile to note here that, in information science, information sharing is considered as a separate topic, similar to the themes of information seeking or information need. This can also be seen from the information behaviour model proposed by Wilson (1981), as shown in Figure 2.3. In this model, information use and information exchange (information sharing) are two different entities.

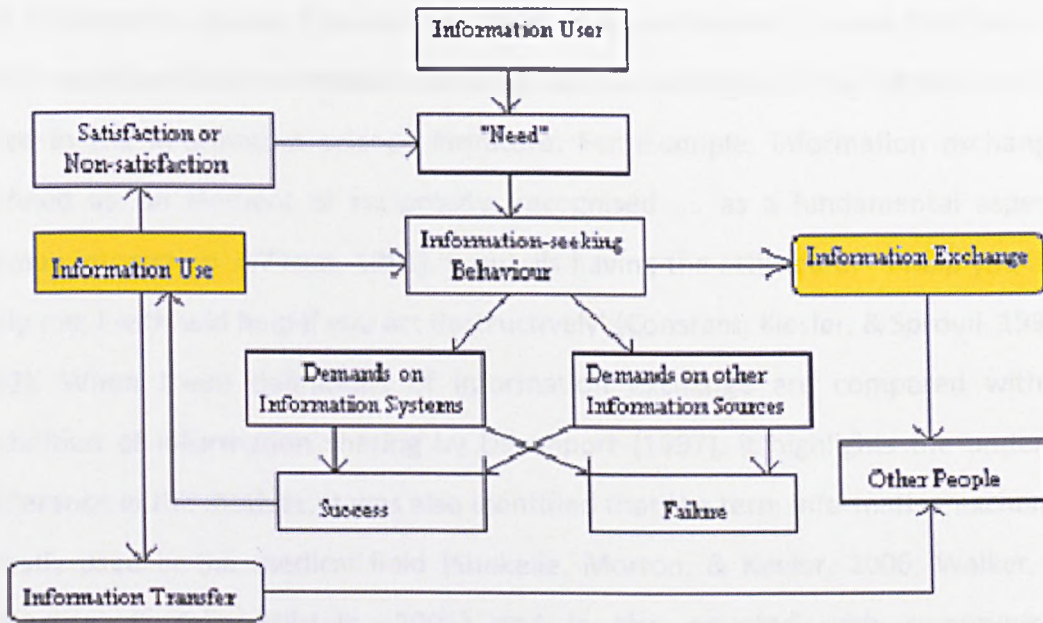


Figure 2.3 Information behaviour model (Wilson, 1981)

However, as stated by Hughes (2006) information use takes a holistic approach including need, seeking and learning of the information behaviour/ practices, thus in this research, information sharing is considered as a part of information use. Thus this research will focus on two different aspects of information use as is conceptualised in Figure 2.4.

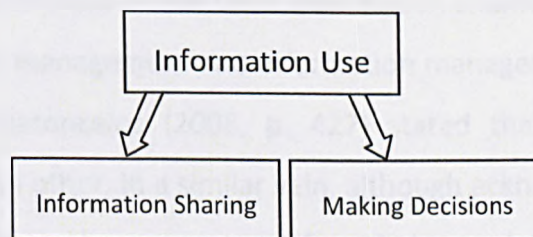


Figure 2.4 Focus of this research

In the next section literature on information sharing and making decisions will be discussed.

2.5.1 Information Sharing

In this research the definition of information sharing by Davenport (1997, p. 87) as 'the voluntary act of making information available to others' is adopted. In this research the definition of information sharing by Davenport (1997, p. 87) as 'the voluntary act of making information available to others' is adopted. Before exploring

the information sharing literature in detail, it is worthwhile to note that there are other terms such as information exchange and knowledge sharing which have been used in the information science literature. For example, information exchange is defined as 'an element of reciprocity, recognised as a fundamental aspect of human interaction' (Wilson, 1981). It entails having the attitude of 'I help you if you help me; I withhold help if you act destructively' (Constant, Kiesler, & Sproull, 1994, p. 402). When these definitions of information exchange are compared with the definition of information sharing by Davenport (1997), it highlights the underlying difference in the motives. It was also identified that the term information exchange is mostly used in the medical field (Shekelle, Morton, & Keeler, 2006; Walker, Pan, Johnston, & Adler-Milstein, 2005) and is also equated with communication (Hersberger, Murray, & Rioux, 2007, p. 137). Similarly, in information science research, knowledge sharing is used synonymously to information sharing. Seonghee and Boryung (2008, p. 282) defined knowledge sharing as '...the process of being aware of knowledge needs and making knowledge available to others by constructing and providing technical and systematic infrastructure'. However, Wilson (2010) argued that 'knowledge ... [is] a set of mental processes involving understanding and learning...' and is not what is being shared rather it is information that people share thus inclining towards the use of the term information sharing. Pointing towards this debate on knowledge management and information management in the information science literature, Vasconcelos (2008, p. 427) stated that the terms are often complimentary to each other. In a similar vein, although acknowledging that different researchers differentiate the concepts of knowledge and information, Bartol and Srivastava (2002, p. 65) used the terms interchangeably stating that 'there is little practical utility in making a distinction between knowledge and information'. Thus in this research, the terms information exchange, information sharing and knowledge sharing are used synonymously whilst acknowledging the difference highlighted in the literature.

Wilson (2010) stated that information sharing is 'a relatively unexplored part' of information behaviour/practices research. In information science it has been addressed in different contexts such as health care, business and industry (Wilson, 2010). While reviewing literature on information science in various fields, Wilson

concluded that information sharing is mostly linked with trust, privacy, legal requirements, risk and benefit and proximity. According to Wilson, if people trust each other then they are more willing to share information. Similarly he stated that if risk is low and benefit is high then information sharing takes place readily. Though the conclusions from the literature review on information sharing are feasible, Wilson's work lacks empirical analysis in information sharing. Even Wilson (2010) urged for the need for more empirical research in different areas to analyse information sharing. Apart from trust, risk/benefit, privacy, legal requirements, proximity and organisational culture (Wilson, 2010), other factors such as expectations (information shared in return), social norms (Fulton, 2009, p. 753), motivation, timing (Widén-Wulff & Davenport, 2007; Widén-Wulff & Ginman, 2004) are also important in sharing information. Fulton (2009, p. 764) in the investigation of genealogists trying to identify their Irish ancestors identified that repeated information sharing depends on the reciprocal sharing of information i.e. if information is shared in return then people are more willing to share information.

In a collaborative work place setting, due to ambiguity of information Reddy and Spence (2008) emphasised the need for information sharing. They also stated that information sharing aids decision making among groups of people. In this research, as stated in chapter 1, it is necessary for emergency responders to share information so that they can create a common operating picture. Sonnenwald et al. (2004, p. 991) stated that people may not have the same understanding of the information and, thus, commonly shared mental models (or common operating picture) may be difficult to obtain. This demands the need to explore information sharing literature for a deeper understanding of information sharing across groups. A mental model as defined by Yen et al. (2006, p. 635) as 'an internal representation of a situation that has a property of "completeness" at a certain level of granularity and shared mental model is a hypothetical cognitive construct that extends the notion of individual mental models to team context' (p. 636). In an academic environment, Talja (2002) categorised information sharing into the following categories, which show the range of possible sharing:

- strategic (conscious strategy for maximising efficiency)
- paradigmatic (establishing a novel approach)

- directive (sharing between teacher and student)
- social (information sharing for community building)
- no sharing

It is thus necessary to dig deeper into the information sharing practices. One of the recognised works in the field of information sharing is Talja and Hansen's (2006) study which pointed towards the difficulty of applying old models in information behaviour for collaborative tasks (p.114). They proposed a new term for sharing of information among groups called "collaborative information seeking and retrieval" (CIS&R). The argument they put forward is that information sharing is sharing of already acquired information, whilst CIS&R deals with cooperative searching for information. This description put forward by Talja and Hansen (2006) is not suitable to the present research setting for several reasons. First, CIS&R is limited to document and human sources only, whereas in emergency management, responders extensively use voice communication such as radios and mobile phones. So Talja and Hansens notion of CIS&R neglects key information sources and sharing tools of the subjects of inquiry in this thesis. Second, Talja and Hansen (2006, p. 116), citing Fidel et. al (2004), stated that for information sharing people must be working in same organisation and must meet for everyday work. This strict and structured requirement clearly does not fit the research setting in this thesis because emergencies/major incidents are not routine and involve multi-agency team work. However, the type of information seeking put forward by Talja and Hansen, asynchronous (using mediators) and synchronous (face-to-face interaction), co-located and remote collaboration, and intragroup or intergroup collaboration will be used as a framework to structure information sharing issues. These are briefly discussed in the next section.

2.5.1.1 Synchronous and Asynchronous Information Sharing

Synchronous information sharing takes place when people in the group are face-to-face, while asynchronous information sharing takes place with distributed individuals with the help of technology. There are a number of studies, with diverging opinions, on the best way to share information. Olson and Olson (2000, p. 160) stated two advantages of being co-located such as: people can understand the culture, and become familiar and aware of each other. Similarly, Ellis and Haugan (1997, p. 392)

identified that face-to-face communication is preferred over electronic communication as one of his interviewees highlighted, 'you lose a dimension when you communicate through email'. Weick (1993, p. 642) stressed further that only during face-to-face interaction, can 'the core of organizing' be seen. If people meet face-to-face then they can develop trust and can also make connections and build community (Fisher, Saxton, Edwards, & Mai, 2007b, p. 137). For asynchronous information sharing, mixed results were identified (Barua, Ravindran, & Whinston, 2007). For group work and multi-agency collaboration, the common operating picture, as discussed in chapter 1, is very important. Communication technologies are very useful tools in the management of emergencies and in particular for facilitating collaborative work and information sharing (Sagun, Bouchlaghem, & Anumba, 2009). However, Hara and Kling (2002) found that technology may not have a positive effect on collaborative tasks. In a study of two separate organisations for IT (information technology) use, they identified that an organisation using IT *intensively* may not have a good community of practice. Similarly, Sonnenwald et al. (2008, p. 2322) stated that technology mediated information sharing can be effective at times and ineffective sometimes. Thus, there are several views regarding use of technology for sharing information. Concerning the technologies used to facilitate collaborative work and information sharing, it has been noted that there is a lack of literature that addresses the mandatory and desirable features in technology (Chen et al., 2008a; Dawes, Cresswell, & Cahan, 2004; Marincioni, 2007). Dawes et al. (2004, p. 55) stated that technology significantly determines the organisations actions thus it should be easily accessible to those whose work depends on it. For multi-agency information sharing, Chen et al. (2008a) stated that multi-agency technologies should be compatible with each other such that interoperability is possible for information sharing. McLennan et al. (2006) urged the necessity of an end-user approach rather than a platform centric approach. They argued that the issue in disaster management is not the technology itself but the interoperability between multi-organisations for information sharing. However, as Sagun et al. (2009, p. 215) acknowledged from the literature in disaster management most of the communication problems during disasters are not due to insufficient capability of technology but the issues with content and information flow which relate to social problems in the use of technology. This view is

in contrast with Orlikowski and Iacono (2001, p. 121), who stated that in information systems research the focus has been given more to the context than the technology itself. This also contradicts literature (Johnson, 2003) on information practices/behaviour which advocated for the need of study of context and action within it rather than the technology itself. Thus different viewpoints related to technology and its use is found in the extant literature. However, common to both fields of information systems and information science is the acknowledgement that technology is embedded within the social system (Orlikowski & Iacono, 2001; Talja & Hansen, 2006). This research will use this paradigm of intertwined approach to technology and social systems to address the issue of technology within the emergency situation, to understand the underlying issue of information sharing.

Pettigrew (1999) claimed that the information ground concept can be used to understand the information flow within a team. However, the concept was found to be limited in application. Information sharing within a team does not take place only in face-to-face interaction but when team members are not co-located information can still be shared using different types of technologies; this is not incorporated in information ground theory proposed by Fisher et al. (2004). Their research lacks the interaction of humans with each other and the environment using mediators such as tools and technologies as present in the current research setting.

There is a significant amount of literature on information science that investigates worldwide web and online environment (Foster, 2006). Counts and Fisher (2010) used the information ground concept to look at information practices when mobile devices are used to access social network sites. Mesmer-Magnus et al. (2011) found that virtual information sharing (via computers) results in positive outcome towards sharing of unique information but has negative impact on openness. These literatures deal with information sharing either from face-to-face interaction or by using internet sources. However, investigation is limited in scope for mediation using voice communication such as mobile phones or radio with few exceptions (such as Olson and Olson, 2000).

2.5.1.2 Inter group and Intra group Information Sharing

For collaborative work, Sonnenwald et al. (2008, p. 2327) stated that a common ground consisting of 'shared language, shared goals and shared visions' are required. This common ground aids people in understanding what information is available from which individual (Olson & Olson, 2000, p. 167). Sonnenwald (2006) also stated that everyday work and cultural practices affect shared understanding and hence the sharing of information. Literature on intra group information sharing indicates that trust is a very important factor which affects information sharing (Olson & Olson, 2000; Sonnenwald, 2006). Fulton (2009, p. 754) citing Rioux stated that people in close knit relationships 'store and recall the information need of others'. Thus, a link can be seen between collaborative tasks and dense social networks which can also be linked with trust (Sonnenwald & Pierce, 2000, p. 461). For collaboration and information exchange in everyday life, Fisher et al. (2007a) added that homogeneity, such as common interests, enables information exchange. Trust is also often linked with environment (Doney, Cannon, & Mullen, 1998). As Mayer et al. (2001) stated, if the situation is risky then people are likely to trust each other. Paghaleh et al. (2011, p. 193) brought in the issue of cultural impact in information sharing, suggesting that the culture of an organisation should promote information sharing. Patricia et al. (1998) linked trust and culture and stated that the social norms and values, or the organisations culture, also impacts trust. Choo et al. (2008) also stated that the culture of an organisation impacts information use and sharing. Reflecting the trust literature in the present research setting, it can be concluded that trust is very important factor for the cooperation and thus for multi-agency information sharing. Where there is trust amongst members of multiple agencies, the culture, values and social norms become known, which leads to expectations and the knowledge of what can be provided by which agency. Weick (1993, p. 643) cited Campbell's triangle of "trust", "honesty" and "self-respect" and advocated the need for trust among a group of people to work in risky situations. Honesty, which is one of the corners of the triangle of imperatives of social life, can be obtained by sharing information and by maintaining transparency. Weick (1993, p. 643) stated further that if there is trust among members of an organisation then during unforeseen critical situations,

creative solutions can be created. Thus the role of trust in information sharing and especially in disaster situations is critical.

Few studies investigate the “type” of information shared during collaborative work (Hansen & Järvelin, 2005). During collaborative work, Sonnenwald et al. (2004) and Olson and Olson (2000, p. 157) both cited Clark (1996) and stated that *common ground* is necessary for the collaboration of group. In the common ground, it is necessary that the team members know about each other so that they can communicate on common topics. This is similar to the common operating picture advocated in this research. Situation awareness can also aid collaborative work (Olson & Olson, 2000, p. 161; Sonnenwald et al., 2004, p. 991). Associated to collaborative task is the motivation factor which impacts information sharing (Liu & Chetal, 2005; Nov, Naaman, & Ye, 2010). Olson and Olson (2000, p. 156) stated that lack of motivation is the major factor in the failure of collaboration. However, it can be argued that in an *intra-group setting* people may know each other well and they may meet on everyday basis. Information sharing among people from different agencies/organisation is not yet explored in depth, which is identified as a research gap.

2.5.1.3 Information Sharing amongst Co-located and Distant People

When people are geographically separated, mediating tools (technologies) are used for information sharing. Sonnenwald et al. (2008) investigated collaborative information sharing facilitated by video conference in the complex and dynamic environment of emergency care situations. They identified that although video technology may be good for providing care at places where expert medical personals are not available, mixed results for trust had been identified. They further stated that the mixed results ‘may reflect the potential negatives the technology might introduce’ (p.2332). Olson and Olson (2000) discuss issues of co-location and distributed collaborative work. They explain co-location as the situation where team members are physically together, having common space, such as meeting rooms. They also advocated that if “sense of place in space” is formed then that might aid distant collaboration among team members (p.143).

Several studies have been undertaken using *place* as the framework (Fisher et al., 2007b). Fisher and her colleagues cited Augst who proposed that library as a place is a 'social enterprise, site of collective memory and part of physical/public infrastructure' (p.136). Thus place impacts the way people interact and communicate with each other. It is not just a physical location but also a 'sum of perception, aesthetic, emotion, history' (Fisher et al., 2007b, p. 137). However, as Fisher et al. (2007a) stated there is a need to differentiate between space and place in information studies which will aid in understanding human information practices in the social world. Fisher, Saxton et al. (2007b, p. 138) cited Cresswell who defined place as :

- location (fixed),
- locales (material setting for social relation),
- sense of place (subjective and emotional attachment)

Cresswell also defined space as a more abstract concept than place where space separates place and is a realm without meaning. However using place as framework to investigate information studies in the library, Fisher et al. (2007b, p. 153) concluded that the concept of space did not apply to the analysis of individual responses. According to Savolainen (2009b), frameworks considering space are seen as information ground by Pettigrew and small world by Chatman. He further illustrated that the concept of space is a constraint in Chatman's small world. However, from the information ground concept by Fisher et al. (2007b), it can be seen that the concept of space is still not clarified, thus in literature, the concept of space is still vague.

2.5.1.4 Concluding Information Sharing

Information sharing is a relatively underexplored area of research in information behaviour (Wilson, 2010). It was identified that though face to face sharing of information is often preferred by members of the group (Sonnenwald et al., 2004), distant information sharing cannot be avoided (Olson & Olson, 2000, p. 139). When people are distant, technology is used as the mediator which makes it imperative to address the impact of technology on the collaboration/information sharing of multi-agency team members. Against this backdrop, it is necessary to study the social spaces which will aid in facilitating communication among people (Fisher et al.,

2007a). Sonnenwald (2006) while investigating the barriers of information sharing in command and control, stated that their findings may be applicable to other time stress situations such as disasters or major incidents. Thus it is interesting to identify several information sharing issues to compare with extant literature.

2.5.2 Decision Making

Decision making is defined as analysing and choosing the optimum option. However, Agosto (2002, p. 16) when investigating information seeking by young people on worldwide web search found that young people's decision making is rationally bounded. That is, people do not analyze all the available options rather they "satisfice". Choo (1998, p. 11) cited March and Simon (1993) who stated that people mostly choose satisfactory options rather than analyze all the options. Choo (1998, p. 192) also indicated that in time critical, complex and uncertain situations people may not even use information at all for making decisions. It thus becomes imperative to understand different forms of decision making which is the focus of this section.

2.5.2.1 Rational Decision Making

The core model in decision making was derived by von Neumann and Morgenstern (Edwards, 1961) which is based on individual prescriptive/normative Subject Expected Utility (SEU) and focuses on maximizing probability weighted utilities. Individual choices were modelled by maximising subjective expected utility in which the alternative with the highest SEU was chosen. Probabilities are subjective views of likelihood, consistent with Bayes' Theory, (Kahneman & Tversky, 2004). There is a multi-attribute version by Keeney and Raiffa cited in (Bond, Carlson, & Keeney, 2008) which concerns the issues of applying decision making in practice. Some psychologists felt that these decision making models, based on probability, cannot be applied in practice and they do not follow the actual pattern in which decision is made by decision makers. Thus emerged the descriptive theory of decision making which tries to understand how decision makers make decisions in practice (Case, 2002, p. 81). A key development is Prospect Theory (Kahneman & Tversky, 2004), which adapted the SEU framework but applied it differently in trying to understand and predict actual decision making. In short, the normative model explains what rational people ought

to do whereas the prospect theory or the descriptive theory analyzes what real people actually do. But this model also fails to account for practicality in terms of decision making as practitioners or decision makers do not follow these models. Also, these models fail to account for the group or team effort as, from an organisational perspective; decisions are often made in groups or by the group.

The general definition of decision making that has been found in the literature is the choice among two or more alternatives. Brunsson (1982) argued that it is impossible to evaluate all the alternatives as the normative model suggests. He further stated if there are fewer alternatives (or even only one alternative) it is good from the action perspective as with more alternatives, actors are more uncertain which reduces motivation and commitment. This suggests that cognitive activities (thinking); commitment (when many people are involved) and motivation (lack of information being provided to the actors) are key characteristics. In a similar vein of commitment to action, Berryman (2008, p. 197) citing Harrison (1999), stated that decision 'can be understood as that point at which an individual commits to action, a commitment which comes after an assessment of the options or choices available'. Also, from the action perspective, Brunsson (1982) argued that the process of identifying objectives and evaluating alternatives is a dangerous strategy as it leads to a requirement for data which is impossible or difficult to find during critical circumstances, leading to a conflict. Thus in the real world, it is difficult to make decisions amongst the many options available. This suggests that there is a need to analyse decision making during time pressure, complex and uncertain contexts. One school of thought which explores these contexts in depth is Naturalistic Decision Making (NDM), which will be reviewed in the following section.

2.5.2.2 Naturalistic Decision Making

In NDM, as Endsley (1997, p. 269) stated, decisions are made using 'a holistic process involving situation recognition and pattern matching to memory structures to make rapid decisions'. It is the study of how people use their experience to make decisions in field settings (Gore, Banks, Millward, & Kyriakidou, 2006, p. 926). Greitzer et al. (2010, p. 280) stated that highly experienced person process information at the subconscious level and do not need to 'interpret and integrate cues or consider

possible alternate actions' whereas middle experienced people use rule base level (if-then) and during novel situations, knowledge base level (analytical) is used. Klein (1998) illustrated further that during time critical, uncertain and complex situations like fire-fighting, decisions are not made by analyzing all the alternatives and then choosing the most suitable option rather, patterns are recognised and similar decisions to those which worked in the past will be chosen.

Few researches have highlighted the importance of the naturalistic method to identify the process of decision making over the traditional (laboratory) method (Klein, 2008; Lipshitz, 1993), as traditional methods like laboratory experiments are very unrealistic (Lipshitz, Klein, Orasanu, & Salas, 2001). Moreover, Klein (1997a, p. 50) listed reasons why NDM can be used to improve decision quality such as:

- classical methods cannot be applied to natural settings
- experienced decision makers use their own courses of action
- for context specific situations
- importance of situation awareness

Within NDM, Klein proposed Recognition Primed Decision Making (RPDM) which is used to 'describe how people can use their experience to arrive at good decisions without having to compare the strengths and weaknesses of alternative courses of action' (Klein, 1997b, p. 287) under time critical, ambiguous information and ill-defined goals. In the RPDM model, the current situation is matched with a pattern created in mind for which different by-products such as expectation, plausible goals, relevant cues and typical actions are recalled. If the situation matches the previous patterns then the course of action is implemented. Klein illustrated the RPD model (p.286) using three different levels as shown in Figure 2.5.

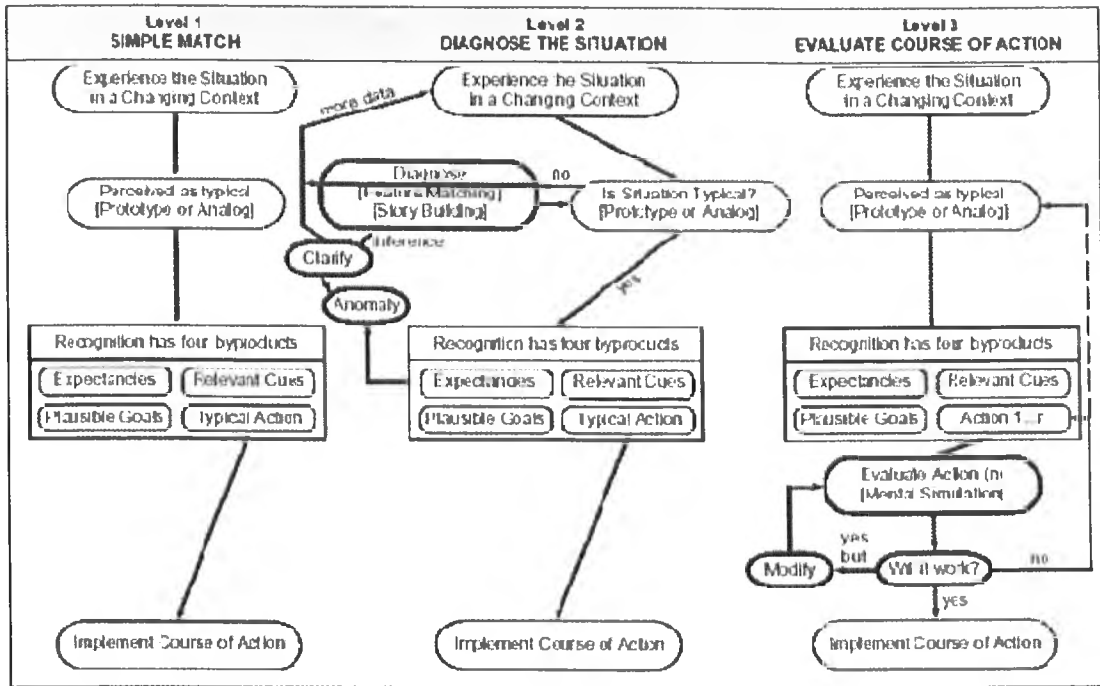


Figure 2.5 Recognition-Primed Decision Model (Klein, 1997b, p. 286)

There are several issues identified as major arguments in the decision making literature. Hamm (1988, p. 87) explicated that with more ill structured tasks, people are more inclined toward intuitive decision making. Alby and Zuccheromaglio (2006) put forward that under time pressure people act first and think later. These situations verify the RPDM model.

During an emergency, decisions need to be taken in a dynamic environment. Good decision makers are those individuals who can change their strategy with the change in scenario (Lipshitz et al., 2001). For the dynamic decision process; Kerr and Tindale (2004) added, decisions are to be made when the environment is changing and the decision maker is 'obtaining information about it' (p.489). Lipshitz et al. (2006) argued that to understand a dynamic situation, laboratory studies are not suitable. Thus the need of NDM as the concept for decision making should be taken into consideration (Danielsson & Ohlsson, 1999). Thus to investigate information practices in emergency management it is important to use NDM.

2.5.2.3 Dual Process Theory

Further to the argument concerning research in natural or laboratory environment, another debate is on dual-process theories (Hogarth, 2010). The dichotomy is between different thinking modes for making decisions. Stanovich and West (2000)

named it as system 1 and system 2 decision making. As stated in Hogarth (2010, p. 338), many researchers have presented this dichotomy under the name of *experiential* and *rational*, or, *tacit* and *deliberate*. Though the neutral term is system 1 and system 2 (Evans, 2008, p. 256), the term type 1 and type 2 is often preferred (Stanovich, West, & Toplak, 2011, p. 104). Type 1 decision making refers to intuitively made decisions which might be from *instinctive knowing* such as a “hunch” or “gut feeling” (Hammond, 2010, p. 327) and where information is processed from ‘non-conscious holistic information processing’ (Sinclair, 2010, p. 378) by relying ‘on long term memory’ (Allen, 2011, p. 2166). In this system, incoming information or other cues are used to recognise and retrieve the pattern that is organised in an individual’s mind. Decision making is not obvious as options are not analysed consciously. Whereas, type 2 is a formal process in which analysis is done before reaching a decision and is applied using formal tuition (Kahneman & Lovallo, 1993). In this type, the optimum decision is chosen from the available information. However, due to the bounded rationality of humans, sometimes in this method people opt towards satisficing (Simon, 1955), rather than optimising decision.

In Evans (2011, p. 88) view, the definition of type 1 in terms of non-conscious mind (Sinclair, 2010, p. 378) is a mistake. He argued that ‘type 1 processing can lead to emotions and feelings of intuition which are conscious, even though the underlying processing is not accessible’. Evans (2011, p. 88) further stated that ‘processing depends upon a number of rapid, unconscious support systems such as those which provide pragmatic cues to relevant context or retrieve relevant information from long term memory’.

In light of the discussion above, it seems imperative to provide definition on type 1 and type 2 systems. According to Stanovich et al. (2011, p. 105) type 1 encompasses ... ‘procedures and experiential associations that have been learned to automaticity and can operate at once in parallel but type 2 processing is largely serial’. Citing Schneider and Shiffrin who described the earliest dual-process models, Stanovich et al. (2011, p. 108) stated that during novel situations ‘controlled processing (type 2) requiring active attention, being serial in nature’ is required.

Illustrating the fallacy of definition and concepts within type 1 and type 2 system of decision making, Evans further discussed that type 2 thinking can also be faster, 'with experience people may develop useful heuristics which are quick and simple to process' (Evans, 2011, p. 89). Kahneman and Klein (2009) also stated that when rules are practiced it can be processed automatically in a type 1 manner. Stanovich et al. (2011, p. 108) expressed their view in similar manner stating that 'knowledge base can exist in the autonomous mind'. They further exemplified, 'high-level analytic knowledge learned over extended periods of time, including many normative rules of rational thinking can be contained in the autonomous mind'. Thus Stanovich et al. (2011, p. 109) concluded that,

'normative rules of rational behaviour can be learned and practiced to automaticity and thus able to trigger in the manner of a type 1 process'

They however cautioned that when

'highly compiled rules are over generalised, this learned information can sometimes be ... a threat to rational behaviour'

Concerning the argument that type 2 is superior to type 1 thinking, Evans (2008, p. 267) referring to RPDM (see section 2.5.2.2) as type 1 stated that research in expert decision making provide 'a somewhat different perspective'. In similar way, Hodgkinson et al. (2009, p. 285) stated that decision makers 'are successfully deal(ing) with complexity through the adoption of' heuristics. However, Evans (2008, p. 269) also categorised RPDM in type 2 thinking where he stated that heuristics and RPDM are similar and takes the form of type 2, 'albeit one less effortful'.

In information science research, this type of decision making system is investigated by few researchers, notably Allen (2011) and Choo (2009). Allen (2011) in his research, drawing upon the discussion on unitary and dual mode in the dual-processing theory (Hodgkinson et al., 2009), proposed five different modes viz., intuitive; intuition led, supported by deliberative information behaviour; deliberative information behaviour moderated by intuition; truncated deliberate information seeking; and parallel (intuition and deliberate working together) (p. 2179). Linking his findings to Klein's (1998), he suggested that *during time constrained, complex and uncertain events*, intuitive decision making was identified to be useful. On the other hand, Choo (2009)

utilised the cognitive continuum theory proposed by Hammond (1996) in which intuitive and analytical cognitive styles are described in the context of *continuum* on opposite poles (Hammond, 2010, p. 330). Choo used this theory as a lens to focus on detection accuracy in early warning systems.

As observed, different views are presented in the literature on type 1 and type 2 systems of decision making. RPDM which is proven to be effective in the complex environment (Klein, 1998), is described as type 1 and also as type 2 by Evans (2011). One of the major underlying questions is the relation between type 1 and type 2, which may shed some light on this debate. Evans (2007) suggested that the type of relationship between type 1 and type 2 might be pre-emptive, parallel-competitive or default heuristically cued response with the potential for intervention.

Thus it can be seen that there are various ways in which decisions are made such as analytical, intuitive and quasi-rational (dual processing). Simon (1992, p. 156) stated that intuition and analysis are not incompatible thus putting forward his view that both intuition and analysis can be processed together. Similarly, Allen (2011) illustrated that type 1 and type 2 can occur in parallel. It is now imperative to identify which type of decision making is promoted in emergency services for silver commanders, which will be done in the next section.

2.5.2.4 Conflict Management Model

In this section the conflict management model (CMM) used by the emergency services to promote type 2 mode of decision making will be described.

According to the manual of guidance produced by Association of Chief Police Officer (ACPO) in the UK, 'CMM provides a framework for recording command decisions and the rationale behind them' (NPIA, 2009). The conflict management model starts with the information being received by the silver commander, which then aids in assessing the risk and threat. Based on the policies available and the risk assessment, silver commanders need to sort out the tactical options. For each tactical option a threat assessment must be done. The decision making process follows the Lobster Pot pattern (as shown in Figure 2.6) from which the most promising tactical option is chosen and implied in practice. This is a continuous process and continues until the

incident is managed properly. It should also be noted here that the CMM is applicable in all the four stages of emergency viz. planning, mitigation, response and recovery, however this research will focus on the response phase only. It is worth mentioning here that officials acknowledge that the CMM model cannot always be used, especially in 'dynamically evolving incident, during which professional knowledge, skills and experience' developed during the service should be used (ibid).

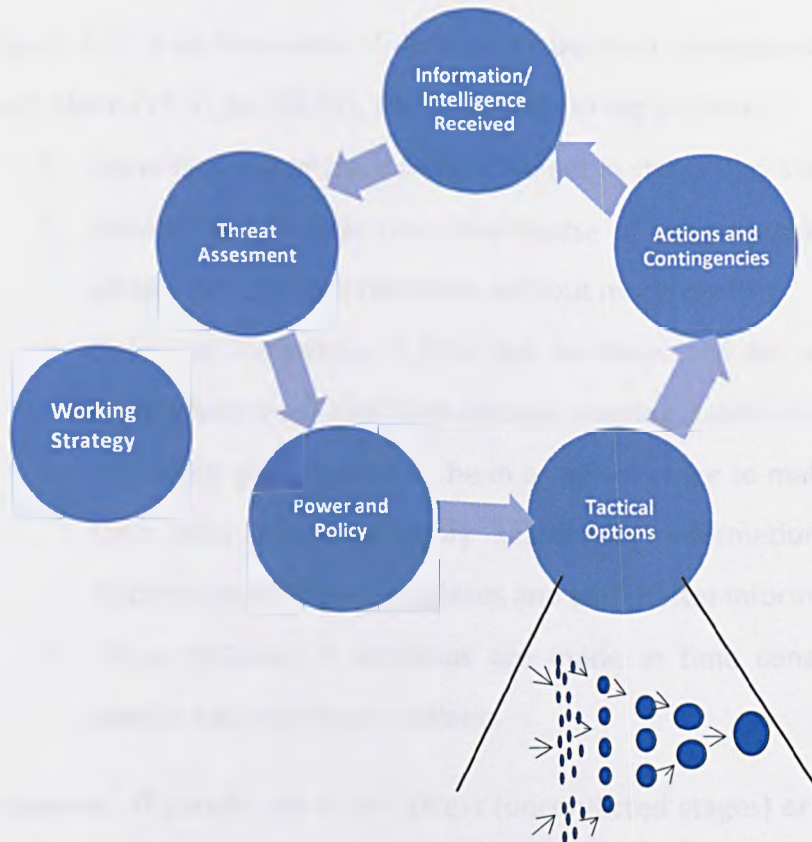


Figure 2.6 Conflict management model (CMM)

2.5.3 Related Research in Decision Making

Information is very important for decision making (Zeffane & Gul, 1993) and especially in ill defined, time critical and dynamic environments. Danielsson and Ohlsson (1999) while investigating large scale emergencies in Sweden, identified “coordination between actors”; “perceived stressor” and “accurate information” as few of the problems in decision making by emergency directors. Taking Danielsson and Ohlsson as the departing point the concepts of team coordination, emotion and information issues within decision making will be addressed in the following section.

However, before dwelling any further on team decision making, individual decision making needs to be addressed.

2.5.3.1 Individual Decision Making

Janis and Mann (1977, p. 70) proposed the conflict theory model (Janis & Mann, 1977, p. 55) for emergency decision making based on the study of disaster warnings. This model, shown in

Figure 2.7, is an extension of emergency decision making model. According to Janis and Mann (1977, pp. 52-53), there are five coping patterns:

- *Unconflicted Inertia*, if people are not in stress they stay with the old decision
- *Unconflicted Change to a new course of action*, when there is no risk then people change their decisions without much conflict
- *Defensive Avoidance*, if they are in stress and do not have any chance of finding better solution then decision making is defensive
- *Vigilance*, people need to be in a vigilant stage to make effective decisions as then they can thoroughly search for information, can assimilate new information without any biases and with better information processing
- *Hypervigilance*, if decisions are made in time constrained situations then people become hyper-vigilant

However, if people are in low stress (unconflicted stages) or if they are in extremely high stress (defensive or hypervigilant), then information processing is likely to be defective (Janis & Mann, 1977, p. 52), which results in ineffective decisions.

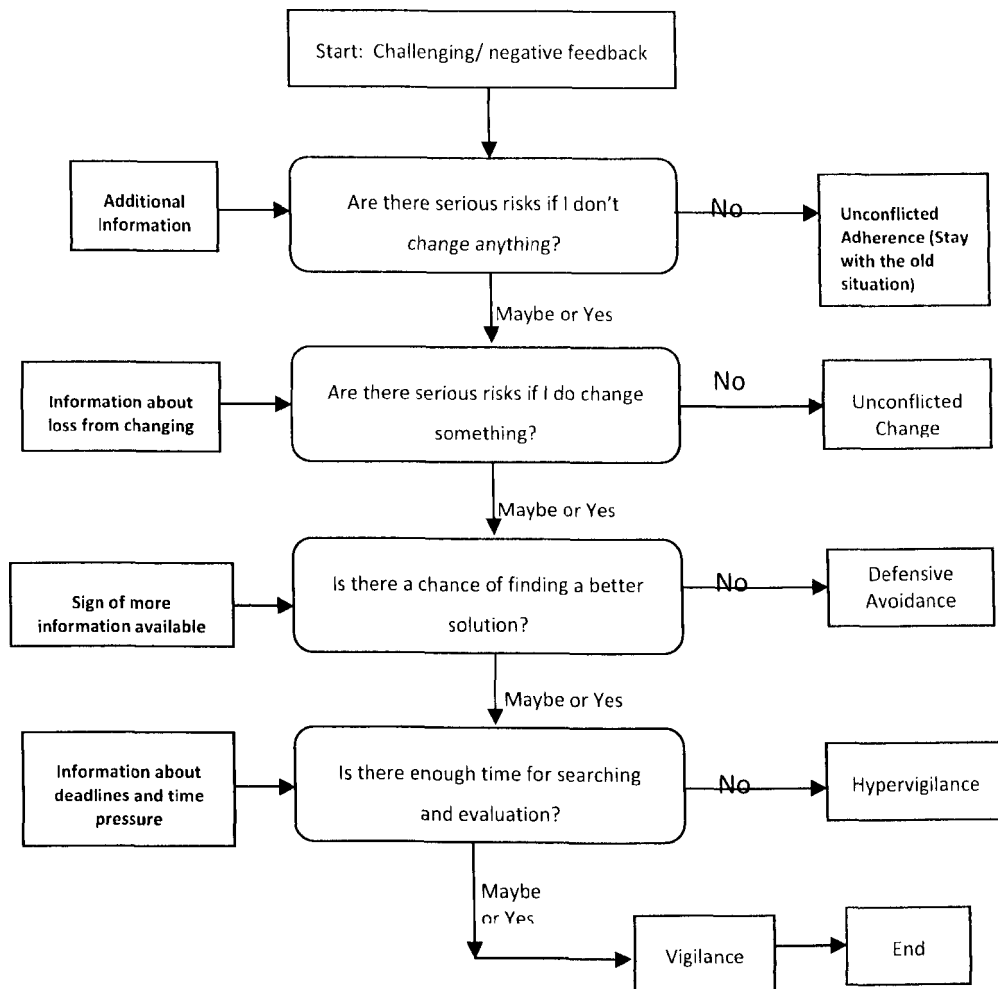


Figure 2.7 A conflict-theory model of decision making (Janis & Mann, 1977, p. 70)

This model is identified to be limited in scope and best suited to the general public not necessarily to emergency response decision makers. As the context of this research is on decision makers, that are expert professionals working in stressful environments, it is necessary to investigate the decision making model most suitable for the context.

2.5.3.2 Team Decision Making and Cooperation

Hollenbeck et al. (1998, p. 269) pointed to the lack of research in team decision making in the context where members have different expertise. They stated that team decision making has been investigated where group members have access to the same information source; for example a jury. However, in other contexts, such as hospital emergency room, military command, control room or academic research groups, team members are interdependent as they have access to information that may be important to other group member. Thus in this research the definition of

teams by Salas et al. (1992, p. 4) will be chosen in which they defined teams as: 'a distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform and how have a limited life-span of membership'.

Team decision making has been of interest to several researchers (Artman, 1999; Duffy, 1993; Rasker, Post, & Schraagen, 2000; Salas, Cooke, & Rosen, 2008). Dennis (1996a, p. 433) provided reasons, when groups share information there is a larger pool of information which contributes to better decision making. It also provides a platform for brainstorming and group goal setting (Laughlin, 1999), which 'increases general acceptance of the final choice' (Harrison, 1987, p. 274). Thus when decisions are made in groups, conflict is reduced. However, Dennis argued that if any information is unique to a decision maker within a group, it may not be shared, rather common information will only be discussed which will then be used to decide the preferences. Dennis (1996b, p. 532) identified several issues such as failure in using shared information; delay in information processing and delay in providing feedback which hinders group decision making.

In team decision making, the "shared mental model" is often emphasised (Rouse, Cannon-Bowers, & Salas, 1992), as it enhances coordination and hence improves team performance (Salas, Prince, Baker, & Shrestha, 1995, p. 127). Shared mental models aid situation awareness and help in understanding the behaviour of other team members (Salas et al., 1995, pp. 126-127).

Several recommendations are provided in the extant literature to make team decision making more effective. Kerr and Tindale (2004) suggested that for group decision to be effective, group members must be committed to goals and should recognise member expertise. Laughlin (1999) suggested group performance can be improved by providing sufficient information related to the task, thus indicating that sufficient information can mitigate the hindrances in group decision making. Baker et al. (2006, p. 1584) added that to promote teamwork, specific individuals with the correct knowledge, skills and attitudes should be chosen; work task should be modified or appropriate training given and feedback provided. Similarly, Smith and Dowell (2000)

indicated that a shared mental model, which is developed by the 'interaction with the world and from prior experiences', (Rasker et al., 2000, p. 1169), helps in coordination among temporary multi-agency team during an emergency.

In group decision making, decision support systems might be used (French et al., 2007). However, as pointed by Dennis (1996, p. 532), while support systems aid in exchanging more information due to hidden identity, people may not trust the information thus highlighting the importance of trust in group decision making. Brunsson (1982) in a similar vein, stated that if there is trust among the members of the group then sometimes action may be taken without going through the decision making process so emphasizing the importance of trust.

2.5.3.3 Emotions in Decision Making

Several researchers have investigated different aspects of emotion while making decisions in different conditions of time pressure, stress, panic (Noh & Gmytrasiewicz, 2005). According to Mellers et al. (1998, p. 451) decision makers vary by risk perception and emotions. With the increase in time pressure, the stress level increases significantly (Ozel, 2001). Ozel defined stress in terms of emotional state such as control, uncertainty, fear, worry and confusion and also in terms of ambiguity, irrelevancy and task-relevant information. She argued everyone in an emergency feels stress whenever the age, sex, experience; which she regards as a necessary state to motivate reaction and action.

People generally have the habit of choosing the information that they are comfortable with. Ozel (2001) illustrated her argument with a scene in hospital, where people were fined for using the alarmed emergency exit during non-emergencies, but during an actual fire only 6 out of 100 people actually used the fire exit, even though most of them knew the place well. This is one indication of the negative association of action with stress. Proulx (1993) supported this by stating that during stress, decision makers prefer familiar options and ignore unfamiliar ones.

Emotion is linked with the amount of information. Ozel (2001) highlighted that due to stress and time pressure; the same information can be interpreted in different ways. Danielsson and Ohlsson (1999) stated that the perceived stress during an emergency

due to the lack of information. Proulx (1993) added, stress is due to a unique problem or to a lack of information. Ozel (2001) supported this by stating that during the early stage of fire emergencies when the stress and time pressure is high, decisions are made based on incomplete information. McLennan et al. (2006) in a similar vein added that, information quality, information quantity and information relevance affects the cognitive state of emergency personnel, whereby people start filtering information (Dantas & Seville, 2006). Different emotional factors such as time pressure, stress, uncertainty that affect decision making can be linked to information overload or alternatively lack of useful information. In understanding what is the limit of information that can be processed by humans to make accurate decisions, Miller (1956, p. 92) stated that at one point in time, a human can only deal with seven *chunks of* information. Thus it can be seen that amount of information affects the emotion of decision makers, which in turn impacts decision making. It is thus imperative to understand the use of information in decision making which will be done in the next section.

2.5.3.4 Decision Making and Information

Judgment is dependent on the information received and availability of time. According to Miller (1956) humans are limited in information processing capacity for *absolute* judgment. It is also dependent on the quality of information. Fisher and Kingma (2001) stated that if the information is flawed then decisions are *likely to be flawed*. McLennan et al. (2006) linked information with uncertainty stating that uncertainty is caused by information load and lack of 'need to know' information.

There are various ways in which information is obtained by the decision makers. Kahneman et al. (1982), in a study of decision makers using heuristics, identified that in making a judgement, people generally rely on information that is more readily available. Information can be obtained by using several technologies which is often faster (Klein, 1998). Klein, however, cautioned that use of technology may lead to overload of information. He stated, 'previously information was missing because no one has collected it and in the future (using technology), information will be missing because no one can find it' (p.279). Linking information to decision making, he further added that in the emergency situation, the main errors in decision making are lack of

experience; lack of information and *de minimus* error (Klein, 1998, p. 274). Klein's finding can be a departing point in this research. Lack of information and lack of experience will be studied in this research however; *de minimus error*, which is due to bias, is out of scope for this research. In the next section, literature on experience and decision making will be reviewed in time critical, complex and uncertain situations.

2.5.3.5 Expert Decision Making

According to Shanteau (1992, p. 259), expert decision making is based on task characteristics. The person who is an expert in one area may not be an expert in another area. Thus it is imperative to understand the setting in which an expert makes decisions. This research investigates tactical commander decision making which is done in critical, time complex and uncertain environment. In such environment, decision making can be intuitive, rule based, analytical or creative (Flin, O'Connor, & Crichton, 2008). Kahneman and Klein (2009) stated intuition is nothing but the recognition of patterns which develops due to regularity in environment. Similarly, they defined creative decision making as the extracting of valid patterns from memory (p. 521). This suggests that intuition and creative decision making types arise from skills which may be due to experience and regularity of environment. It is however worth noting that intuition is not always from skills. Kahneman and Klein (2009, p. 522) made a distinction that in NDM intuition is from experience whereas in heuristics and biases, intuition is from simplifying rules. As this research's interest is on the experienced decision makers, when intuition is stated it means intuition from experience.

Shanteau and Stewart (1992, p. 97) in their review of decision making stated that before the 1970s literature highlights that decisions made by experts were flawed, until in 1977 when Murphy and Winkler (cited therein) found that due to experience, weather forecasters made better predictions/decisions. As cited by Shanteau (1992, p. 253), Meehl (1954) even stated that the 'experience of experts is not related to the judging ability' which shows there was no link between experience and judgment.

Decision making is linked with experience of a decision maker, as experience is a source of information. According to Shanteau (1992, p. 256) experts build a mnemonic model to remember information organised in the memory. Experts make

decisions based on the information stored in their memory (mental models), which come from their education and experience (Rennie & Gibbins, 1993, p. 41). During problem solving, connections between the current situation and previous situations are made and different possibilities run through before a decision is made. If information is accessed from structured memory then better results may be obtained and vice-versa. There exists a 'reciprocal relation between information being processed and memory structure that guides the processing' i.e. when structure starts organising and interpreting information, 'information induces change to the structure', this interplay clicks the long term memory and new information creates further understanding. Simon (1992) further added that the cues (information in the environment) 'initiates actions appropriate to the situations marked by these cues' (p.155). Simon termed this as the "expert model". Shanteau (1992, p. 254) added further that experts use little information to make their decisions. Court (1997, p. 129) cited Ullman (1992) who provided similar explanations of expert problem solving; Ullman showed that sensors such as sound and sight keep information in short-term memory which is then matched with the information stored in long-term memory. The three researchers reviewed in this section (Court, 1997; Rennie & Gibbins, 1993; Ullman, 1992) suggest that experts make better decisions as their knowledge (in memory) is more organised. Rennie and Gibbins (1993) added further that experts can find out what types of information are lacking to solve a problem. Although expert decision making is identified to be advantageous, Court (1997) and Rennie and Gibbins (1993) argue that decision making varies from person to person, as experience is subjective in nature.

In information science also, experience has been shown to be effective as a source of information. This acquired information acts as a source of information. Sonnenwald (1999, p. 187) in explaining the importance of situational studies, stated that many different options might be obtained from experienced people (such as librarians), showing that experienced people are more knowledgeable and have more information. Ellis and Haugan (1997, p. 393) identified that personal knowledge and experience depicts the choice of information channels. Similarly, with the example of how Dodge used his past experience to save his own life, Weick illustrated that experience can lead to better consequences (Weick, 1993, p. 639). Bhattacharjee and

Moreno (2002) stated, experience often helps when decision makers are encounter negative affective information. They also identified that decision making by experts is unaffected by positive or negative information, which shows experience aids in decision making. Sanbonmatsu et al. (1991, p. 134) also stated that people use comparative methods to compare one or many attributes. Thus, it can be suggested that if a decision maker is experienced then deciding a next action becomes easier. With more experience, decisions can even be made sub-consciously. This is very advantageous in time critical situations; as the context of this research. Experience often enables isomorphic learning, which according to Kirkwood (1999, p. 34), leads to the thinking that 'if circumstances are duplicated, the consequences will be the same'. Thus, for an experienced decision maker if the situation resembles a past situation, the actions or decisions to be made will be dependent on past experience. Many researchers showed experience helps decision makers to make decision as it acts as a source of information (e.g. Klein, 1998) by recognizing patterns to fill information gaps (Finkelstein, Whitehead, & Campbell, 2008, p. 25) . However, Finkelstein et al. warned that people 'are at risk of making bad decisions when they have enough experience to believe' [that they are right] (p.27). Reed (2000, p. 561) added, past experience is not reliable to guide the present or the future. Weick (1993, p. 639) too indicated that during time pressure, people 'regress to their most habituated ways of responding' indicating that people rely more on their past experience which results in expectations and assumptions and thus undesirable outcomes. In the Tenerife air disaster, Weick (1990) delineated how past experience of an aircraft pilot leads to assumption which resulted in a catastrophe. Court (1997, p. 123) in his research of engineers developing new products, showed that products were not developed considering the new information available but were based on information gained from experience. Thus indicating that experienced people may not use new information. Radecki and Jaccard (1995, p. 107) added further that when people feel they are more knowledgeable, they do not search for information systematically and 'may be more likely to use simplistic decision rules'.

2.5.3.6 Recommendations in the Extant Literature

The literature suggests different recommendations for making good decisions. Feedback is the most popular recommendation by many researchers (Bramble, 2009; Hodgkinson et al., 2009, p. 287; Thaler & Sunstein, 2008, p. 75). Rennie & Gibbins also suggested the use of checklists, which can be provided as an internal guideline to the decision makers. Finkelstein et al. (2008, p. 161), suggested four different methods 'experience, group debate and challenge, governance, and monitoring' to prevent decision makers from making flawed decisions. In addition to these recommendations, one of the main focuses of decision making research is on training (Crichton & Flin, 2001; Duffy, Ng, & Ramakrishnan, 2004; Gorman, Cooke, & Amazeen, 2010). Training is often the most recommended factor for effective and efficient individual or group decision making (Crichton & Flin, 2001; Salas et al., 1992). Crichton and Flin (2001, p. 259) highlighting the importance of training, stated that it is 'required to improve teamwork skills' and for the 'development of expertise in individuals and teams'. Baker et al. (2006, p. 1584) stated that training provides an opportunity for the team members to practice their skills and also helps in providing feedback. Klein (1997a, p. 54) proposed different methods to train individuals to make better decisions; some are listed below:

- designing Training Scenarios (also proposed by Moats et al. (2008))
- cognitive feedback (by giving emphasis on 'why the mistakes were made' and not only on what the mistakes were, p.55)
- test and evaluation techniques (by 'establishing criteria for measuring cognitive performance of trainees', p.56)

Klein (1998) reflecting on RPDM proposed that decisions can be improved by training people with familiar cases and typical scenarios. Similarly, Crichton and Flin (2001), taking into consideration lack of repetitive incidents in some contexts such as petrochemical incidents, proposed a tactical decision game (TDG), which can be used to train emergency personnel. TDG 'acts as substitute for actual experience and provides a suitable [] opportunity to enhance skill development and expertise' (Crichton & Flin, 2001, p. 260).

In addition to training, exercises and drills also aid in effective decision making. Note that training and exercising are considered as two different entities in Emergency Services. Training 'equip(s) people with relevant knowledge and skills' whereas exercising is used to test plans and procedures and provide experiential learning (CCS, 2003 p.65). The Civil Contingencies Secretariat (CCS) stated three different types of exercises, table top, live exercises and discussion based (seminar based) (Crichton & Flin, 2001, p. 260).

2.5.4 Post Decision Making Information Seeking

Use of information does not end with decisions being made. People perform a biased information search for supporting decisions already made (Jonas, Traut-Mattausch, Frey, & Greenberg, 2008). Shani and Zeelenberg (2007) stated that even after decisions are made, information is used to verify decisions. From the outcome of experiments, they identified that if people fear the result of a decision made to be negative then information seeking (for verification) is ignored to avoid regret. Their findings are similar to the dissonance theory (Festinger, 1964) where dissonance results in information avoidance. Other research in post-decision information seeking, reveal that people seek information to confirm decisions made (Frey, 1981; Jonas, Schulz-Hardt, Frey, & Thelen, 2001). As Jonas et al. (2008, p. 1180) highlighted 'people show a preference for supporting rather than conflicting information'. This according to Frey (1981, p. 52) is especially true when decision makers need to defend their decisions publicly rather than to themselves. To this Huber and Seiser (2001, p. 69) added, justification pressure leads to information seeking in support of decisions made.

2.5.5 Concluding Decision Making

Reviewing different arguments in decision making research, it can be concluded that there are different types of decision making. Though two broad categories of decision making research are stated in the literature, "intuitive" and "rational", Svenson (1996, p. 254) stated four levels of decision making:

- the first level refers to automatic and unconscious decisions such as RPD model where decisions are based on earlier experiences.

- in the second level, few attributes are considered for decision making and is based upon habits. Post decision justification falls under this level.
- the third level refers to choices from different options and is also called alternative focused thinking.
- the fourth level however is the “value focused thinking” where set of decision alternatives are not fixed.

In naturalistic decision making research, a gap in the literature is identified. For example: what is the information source? How do people search for information? What is the information flow? What kind of information is required which makes decision making easier? These are a few questions not investigated in depth in the extant literature. An attempt will be made in this research to answer these questions.

2.6 Information Sharing and Decision Making

From the literature reviewed in section 2.5.1, it was identified that information sharing is imperative for effective team decision making. Thus a link can be found between information sharing and decision making. For effective team decision making a shared mental model which is a degree of ‘overlap or consistency among team members’ (Yen et al., 2006, p. 636) and can be obtained by sharing information (Salas et al., 1995, p. 126). For groups where members are from different organisations, sharing of information is even more important as ‘members bring different informational resources to the group’ (Gigone & Hastie, 1993, p. 959). This creates an information pool which increases impact of cue (Stasser & Titus, 1985). However, the distribution of information within the group affects group decision making (Stasser & Titus, 1985). As uneven distribution of information leads to bias (Gigone & Hastie, 1993, p. 972), Stasser and Titus (1985, p. 1470) suggested that for informed and unbiased decision making information should be stored (pooled) together. Only information that is shared is discussed during group meetings which is termed as common knowledge effect by Gigone and Hastie (1993, p. 971) and other unshared information might be lost. Thus to preserve information from being lost, it needs to be shared (Stasser & Titus, 1985, p. 1476).

Cronin and Weingart (2007) have, however, acknowledged that teams do not always work efficiently and conflict persists in teamwork for several reasons such as (1) lack of information sharing (2) unwillingness to share information, or (3) not feeling comfortable to share information. Thus, unlike a shared mental model which focuses on the similarity or overlap of information among group members, the difference in knowledge should also be investigated and addressed. This inconsistency has been defined as a representational gap (Cronin & Weingart, 2007, p. 762). Thus various types of issues linking to team decision making, information sharing and information distribution are identified. However, from the literature reviewed, it can be concluded that if information is shared then *common ground*, which is essential for mutual understanding, can be formed.

2.7 Conclusion

This literature review has revealed a number of important themes:

- Context should be made the focus of research as it provides a holistic view of information practices. Multi-dimensional perspectives such as social, cultural, organisational should be used to study context. Situational factors such as concept of space and place are key to understanding context. Its importance is even greater when people are not co-located and different types of artefacts are used to create a place in the virtual space.
- Uncertainty is often associated with task complexity (Vakkari, 1999). Wilson (1999b, p. 841) linked problem solving with uncertainty stating that uncertainty reduction is a key part of problem solving. Uncertainty can also be considered as context (Choo, 2001).
- Out of four types of task complexity classified by Byström and Järvelin (1995, p. 195), this research positions itself in the higher complexity task group of known-genuine decision tasks. Sometimes emergency responders do know what the outcome should be but may not know how to obtain it (known-genuine decision tasks).
- It was identified that there is an argument for the definition of information use. Some researchers consider information use as post-searching behaviour (Belkin and Vickery, 1985 cited in Ellis et al., 2002), while some consider it

starts from the moment people are connected to the information source (Hart & Rice, 1991).

- Information sharing 'is the voluntary act of providing information to others' (Davenport, 1997, p. 87). It is often linked with trust, risk/benefit, legal requirements, proximity and organisational culture (Wilson, 2010); expectations and social norms (Fulton, 2009); motivation and timing (Widén-Wulff & Davenport, 2007). It was identified that information sharing in groups, within an organisation, is the main topic of interest (Mesmer-Magnus et al., 2011). To facilitate information sharing, co-location is often preferred (Olson & Olson, 2000), however distant information sharing is unavoidable during which technology is often used (Sagun et al., 2009).
- From the literature reviewed on decision making, it was identified that there is an ongoing debate on type 1 and type 2 decision making. In emergency services, the conflict management model based on type 2 decision making is used to train commanders, whereas type 1 is used during novel and time constrained situations (Klein, 1998). It was identified that experienced people use type 1 decision making, which is automatic. However, when rules are integrated, type 2 decision is often used as it is faster. It was observed that *different views are identified in the literature regarding dual process theories.*
- For effective team decision making, information should be shared among members (Dennis, 1996a), which results in shared mental models (Rouse et al., 1992).
- Two views are identified for decision making by experts. According to Rennie and Gibbins (1993), experts can locate relevant information easily to make decisions as due to education and experience, information is stored in experts memory and is initiated with the cues from the environment (Simon, 1992). Some researchers, however, expressed doubt in the way decisions are made based on past experience. Finkelstein et al. (2008, p. 27) warned that when people start feeling that they have 'enough experience to believe that they are right', decisions might be flawed.

Several gaps have been identified in the process of reviewing the literature as highlighted below.

Few researchers advocated that context can be studied by using multifaceted approach (Fidel et al., 2004; Fisher et al., 2004). However, it was identified that multi-dimensional approaches are not used extensively to understand information practices. This research therefore builds on the current corpus of research on understanding information sharing and use in context. Where models considering context have been developed (c.f., information ground (Chatman, 1992, 1999; Pettigrew, 1999)) they have been developed to understand a very different context of everyday life information seeking rather than work based practice. This limits the utility of these models.

Similarly, an underlying research gap was identified concerning information use. While reviewing information behaviour literature, Wilson (1997, p. 552) stated that much has been done on information need and seeking; however, information use is rather underexplored. Recently, several researchers (Bruce & Hughes, 2010; Choo, 2009; Kari, 2010) investigated information use, however the context they addressed can be argued to have limited relevance to complex, uncertain and time constrained environments. As stated in section 2.4, some studies (Allen, 2011; Choo, 2009; Sonnenwald, 2006) are similar to the present research in terms of context, however, the studies are limited in scope either being based on a single agency (Allen, 2011) or having different units of single agency (Sonnenwald, 2006) or not being in intense time critical situations (Choo, 2009; Folb et al., 2010).

As can be seen from the information behaviour model proposed by (Wilson, 1981, 2010) *information sharing is often considered as a separate topic similar to information need or information seeking or information use. However, in this research a holistic view of information use is taken, as proposed by Hughes (2006). It can be argued that information sharing is a part of information use. When people obtain/acquire information, they use it to inform others (information sharing in Davenport's (1997) view) or exchange with others (Wilson, 1981). Information sharing is an underexplored area of research (Wilson, 2010) which has not been vigorously investigated in information behaviour/practices research. Very few*

researchers (Sonnenwald, 1995, 2006) have studied the time constrained, complex and uncertain environment as this research aims to do.

Similarly, decision making as a form of information use is not explored in depth in information science research with a few exceptions (Berryman, 2008). It was identified that there are two different schools of thought regarding the mode of decision making; intuitive and analytic. Though, this research is not addressing directly the cognitive process involved in decision making (which has been done by Klein's (1998) RPDM model), an attempt has been made to analyse the decision making process from an information science perspective. In the process of analysing how information is used by decision makers during emergency response, some light will be shed on the debate concerning the mode of decision making. To the researcher's knowledge, there is little empirical research on the debate on mode of decision making.

Chapter 3 Methodology

3.1 Introduction

This research adopts a social constructivist viewpoint at a meta-theoretical level to investigate information use in the emergency response context. Edmondson and McManus (2007) highlighted the need for fit between meta-theoretical position, methodology and the research question(s). The guiding literature and schools of thought for adopting this approach will be discussed in this chapter. Activity theory, which fits the social constructivist approach, will be discussed next to illustrate how it can be used as a descriptive and analytical framework and how it provides a holistic view to study the context. This research takes a qualitative approach to analysis and uses data triangulation, relying on in depth semi-structured interviews, observations and analysis of government and practitioner reports and documents. The detailed process of analysis using the qualitative analysis software NVivo will then be described, followed by a discussion of reliability of the research and of ethical considerations. The overall structure of the chapter is as shown in Figure 3.1 below.

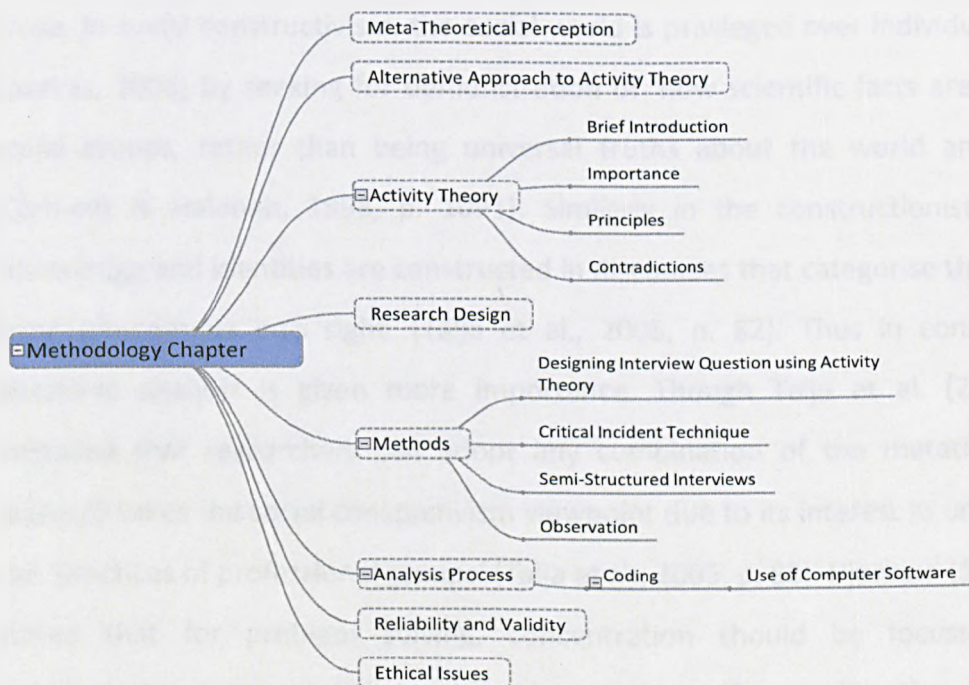


Figure 3.1 Overall structure of chapter 3

3.2 Meta-Theoretical Perception

Metatheories, 'theories about the description, investigation, analysis or criticism of the theories in a domain' (Hjørland, 2005, p. 5) are required in information science as in any area of research. Talja, Tuominen and Savolainen (2005, p. 80) analysed constructivism, social constructivism and constructionism, as the metatheories in information science research. From a constructivist viewpoint, reality is constructed in the mind, which demonstrates the user-oriented standpoint in information science research but, following criticism that the cognitive view faced in the 1980's, a social constructivism view was put forward by Ingwersen (1984) in which the argument is that 'while the mind constructs reality in its relationship to the world, this mental process is significantly informed by influences received from societal conventions, history and interaction with significant others' (Talja et al., 2005:81). Talja et al. (2005:85) added to the criticism of cognitive constructivism that from a constructivist meta-theoretical position, it is not appropriate to study broader information seeking, use and cooperative information seeking. Thus, to cater for the need to analyse situation relevance beyond just the individual, the social constructivist viewpoint arose. In social constructivism, the social world is privileged over individual (Smith & Sparkes, 2008) by seeking for demonstration of 'how scientific facts are created by social groups, rather than being universal truths about the world and universe' (Clement & Halonen, 1998, p. 1091). Similarly in the constructionist viewpoint, 'knowledge and identities are constructed in discourses that categorise the world and bring phenomena into sight' (Talja et al., 2005, p. 82). Thus in constructionism discourse analysis is given more importance. Though Talja et al. (2005, p. 82) indicated that researchers can adopt any combination of the metatheories; this research takes the social constructivism viewpoint due to its interest in understanding the 'practices of professional groups' (Talja et al., 2005, p. 88). Hjørland (1992) further stated that for problem solving, concentration should be focussed towards interpretation between individuals and not within. Thus, unlike the constructivist view point, where emphasis is given to subjectivism by analysing the individual as the unit of analysis (Matusov, 2007), theories adopting social constructivism emphasises the interaction of subjects to the social world by considering action as the unit of analysis. This is in line with practice theory, which bridges the mind-body (subjective-

objective) dichotomy (Østerlund & Carlile, 2005, p. 92). Miettinen (2006, p. 390) argued that practice theory 'is introduced as a reaction to social constructivism'. Providing a counter argument to this statement, Postholm (2008) acknowledges that both social constructivism and activity theory are similar in epistemology.

Practice theory is a social/cultural theory. Reckwitz (2002, pp. 246-248) stated four versions of social/cultural theories

1. mentalism ('mind is the place of social as it is the place of knowledge and meaning structure'),
2. textualism (symbolic structures are in the form of a chain of signs, in symbols and discourse),
3. intersubjectivism ('locates the social in interaction', highlighting use of ordinary language) and
4. practice theory (consisting of 'certain bodily and certain mental activities', where body and mental patterns are not different).

In practice theory, 'how social action is carried out and carried through is central' (Halkier, 2010, p. 72). Practice is defined as a routine behaviour (Reckwitz, 2002; Schatzki, 1996). Only actions unfolding the nexus of doing and saying are of interest and not unintentional actions which will be applied in this research. Similar to Østerlund & Carlile (2005, p. 92), in this research, practice theory is adopted not as a theory or methodology but as 'a loosely structured framework or scaffold'.

One such theory taking the social constructivist viewpoint (Hjørland, 2002; Hjørland & Albrechtsen, 1995) and linking to the concept of practice theory (Østerlund & Carlile, 2005, p. 91) is activity theory where for analysis activity or *practices* are considered. Miettinen (2006, p. 389) also acknowledged that activity theory and practice theory are similar. Activity theory suggests that 'an individual lives within a world that is at once physically, socially and subjectively constructed, and that living and acting in this world constitutes knowledge' (Talja et al., 2005, p. 86). In the next section, how activity theory can be used as a methodological framework to understand the information practices of ad-hoc multi-agency members will be outlined.

3.3 Methodology

In this section, methodological theories which consider “action” as the smallest unit of analysis will be reviewed. The selection of activity theory over other theoretical lenses will be outlined, followed by an explanation of activity theory and how it will be employed in this study.

3.3.1 Alternative Approaches to Activity Theory

At the initial stage of research, a number of research alternatives were considered such as situated action (Suchman, 1987), structuration theory, activity theory (Nardi, 1996) and improvisation (Mendonça & Wallace, 2007). In this research, activity theory will be used as a methodological and analytical framework due to its advantages over other theories.

As Nardi (1996, p. 36) pointed out, activity theory allows the context (activities) to be studied. However, it was identified also that, unlike situated action, using activity theory the reasons for being engaged in any activity can be identified when humans interact with the environment (Nardi, 1996). Improvisation is also used as methodological framework when the situation is unique, such as in emergencies (Mendonça & Wallace, 2007). However, as indicated by Beech et al. (2010) improvisation is not a free flow of practice but a contested aspect of activity where activity theory was used to understand the improvisation process.

Activity theory is also considered to be an extension to other social theories that deal with interaction such as structuration theory (Blackler, 1993, p. 873). Structuration theory has been used intensively in management research (Canary, 2010), to study technology (Orlikowski, 2000) or to study crisis (Harrison, Pardo, Gil-Garcia, Thompson, & Juraga, 2007). However, as pointed out by Canary (2010, p. 29) structuration theory ‘does not adequately conceptualise materiality and the ways that material and nonmaterial resources influence system actions’. Vaughan (2001, p. 190) added, structuration theory provides micro analysis but fails to provide the macro-analysis of social life. It also neglects ‘hierarchically organised collective actors and their differential contribution’ (in Vaughan, 2001, p. 188 citing Mouzelis 1991, p. 40). However, activity theory provides the hierarchical analysis of activity, action and

operation which facilitates micro and macro analysis. Thus activity theory will be used in this research as a methodological framework.

3.3.2 Activity Theory

According to Barab et al. (2004) activity theory is a 'good theory to work with for observing individuals at work, alone or in collaboration with others using electronic tools'. In the following sub-sections activity theory will be described along with its properties.

3.3.2.1 Brief Introduction to Activity Theory

Activity theory 'considers human behaviour in terms of activity systems, that is goal-directed' (Artemeva & Freedman, 2001, p. 167). Its origin can be traced to the work of a group of Soviet psychologists initiated by Lev Vygotsky in the 1920's and 1930's (Artemeva & Freedman, 2001; Engeström, 2001). Vygotsky's activity theory, also known as first generation activity model, considers, subject; object and a mediating artefact. The subject acts upon the object using the mediating artefact as shown below in Figure 3.2.

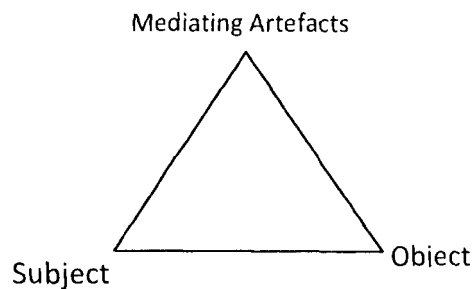


Figure 3.2 Vygotsky's model of activity theory (1st Generation)

In activity theory, the unit of analysis is activity. Activity can be further divided into actions and operations. This three-level model of activity, as shown in

Figure 3.3, is proposed by Leont'ev, one of Vygotsky's students and later a co-worker. The first layer is activity driven by an object-related motive. The second layer is an individual or group action driven by a conscious goal. An activity can be composed of one or several actions. The third layer is operations which is a routine process driven

by conditions. When there is a change in the condition, operations can become an action. Thus there is a bi-directional relationship between these levels.

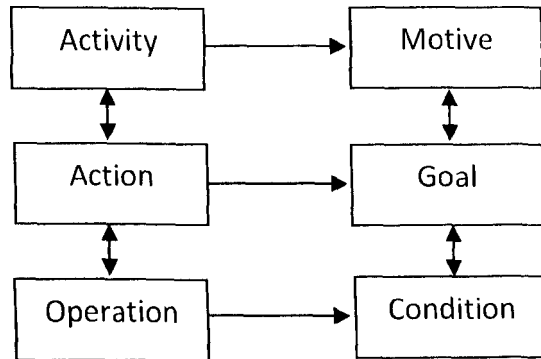


Figure 3.3 The hierarchical structure of activity (Leont'ev, 1981)

From the 1970's after some Russian psychologists brought the theory to Western Europe it has gained attention throughout the world. One of the highly cited work in activity theory is by Engeström who developed Leont'ev's structure by adding rules, community and division of labour as components in the model (see Figure 3.4). This came to be commonly known as 2nd generation activity theory.

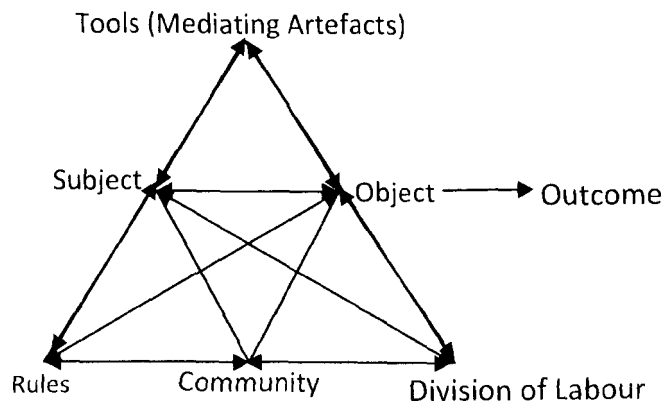


Figure 3.4 Leont'ev's model of activity theory (2nd Generation) represented by Engeström (1987)

The model shows that an activity is object oriented and is *triply-mediated* (Spasser, 2002:93).

- mediated by tools or artefacts, which provide the subject 'with the experience historically collected by his/her community' (Chen et al., 2008a:207). In an activity system, mediating artefacts may be internal such as sign, language or external physical tools.
- mediated by rules and regulations
- mediated by interpersonal relationships, roles (division of labour)

As shown in Figure 3.5, when two or more activity systems interact 3rd generation of activity theory can be used as Engeström highlighted (2001, p. 133), which makes it possible to analyse inter-organisational issues. In the third generation there should be a minimum of two different activity systems. Each activity system has its own objective but when these activities interact, then shared objectives are formed.

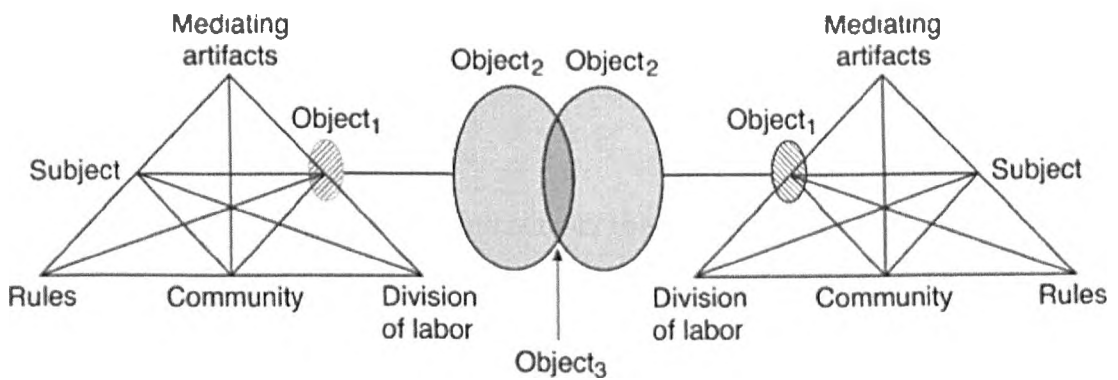


Figure 3.5 3rd generation activity theory with two activity systems interacting
Engeström (2001, p. 136)

3.3.2.2 Application of Activity Theory in Information Practices

Activity theory has been used in various information studies since the late 90's (Wilson, 2006, p. 144) and as the overarching framework for information management (Chen et al., 2008a; Kutti, 1999; Lim & Hang, 2003; Wilson, 2006). It is a conceptual as well as an analytical tool in which a subject (individual or group) uses mediating artefacts to act upon an object to achieve an outcome.

Engeström (2000, p. 961) explained that activity theory can be used under situations where one needs to make sense of actions in terms of their impact on the activity,

participants and their developmental potential. Chen et al. (2008a, p. 203) suggested that the approach is suitable in an 'area where artefacts are being developed for collaborative purposes'. The use of activity theory in this research is to understand the information practices that are followed by ad-hoc multi-agency team of emergency responders which can be understood by analysing actions.

Though activity theory enjoys various advantages, it has also been criticized by a number of researchers. Livari and Linger (1999) pointed towards the inability of activity theory to distinguish between activities. Thus they used a combination of situated action and activity theory. Engeström (2000) argued that activity theory is generally for durable object-oriented activity and it is different from short-lived goal-directed action, but succeeded in showing that activity theory can be applied to understand the short-term goals which are common in the emergency management context. Similarly, Bakhurst (2009) acknowledged the criticism of activity theory which is due to the 'underlying philosophical issues concerning the translation of the terms from Russian to English' (cited in Allen et al., 2011, p. 786).

3.3.2.3 Principles

Engeström (2001, p. 136) summarised activity theory in five principles viz.

- Collective, artefact-mediated and object-oriented activity system (where goal directed actions are said to be understood and interpreted only against the background of entire activity systems).
- Multi-voicedness of activity systems (individuals who form the group for certain activity are from diverse cultural-historical backgrounds. This often is a source of tension and innovation).
- Historicity of activity ('activity systems take shape and get transformed over lengthy periods of time').
- Contradiction, a structural tension within and between activity systems, is the source of change and development.
- Possibility of expansive transformations in activity systems (In the long run, the object and motive of the 'activity are reconceptualised to embrace a radically wider horizon of possibilities than in the previous mode of the activity').

3.3.2.4 Contradictions

A fundamental concept in activity theory is that of contradictions and tensions that occur within the activity structure. Contradictions keep the activity system in *constant instability* but are also the reason for innovation and help the researcher to focus on the *root causes of problems* (Engeström, 2000, p. 966). Thus for organisational growth, it is necessary to find contradictions which, when acted upon, result in innovation. This research is thus interested in finding the contradictions in the existing system.

According to Barab et al. (2002, p. 80), 'contradictions are best understood as the tension between components'. There are four types of contradiction, viz. primary contradiction (within each constituent component of the central activity); secondary contradiction (between the constituents of the central activity); tertiary contradiction (between the object of the dominant form of the central activity and the object of a culturally more advanced form of the central activity) and quaternary contradiction (between central activity and its neighbour central activity) as shown in Figure 3.6.

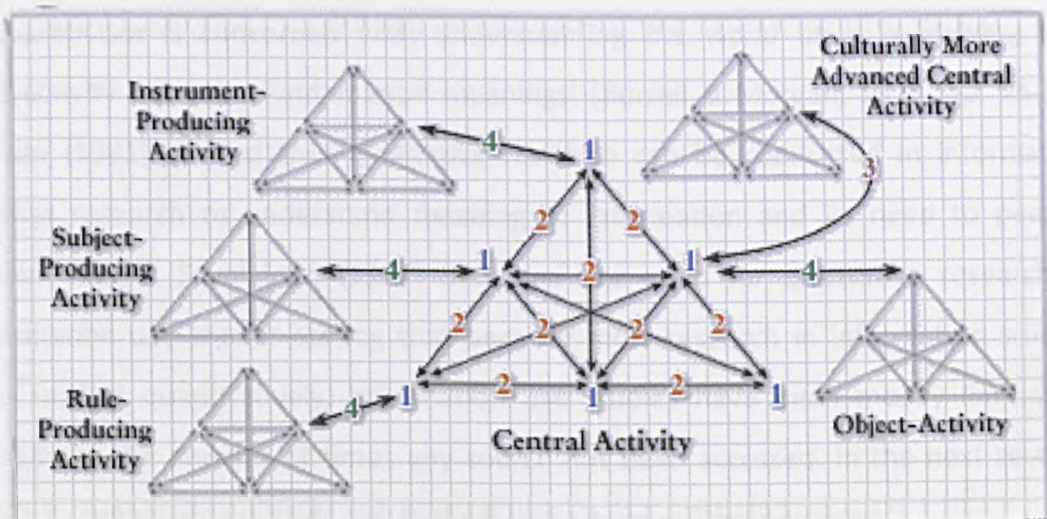


Figure 3.6 Four levels of contradictions in a network of human activity systems
(Engeström, 1987, p. 87)

Activity theory deals with collective activity and highlights coordination between actors having a common objective. The subject and the community undertake (and coordinate) the activity using tools such as information communication technology and the conduct of the activity is underpinned by social and cultural rules and norms and a division of labour (Korpela, Mursu, & Soriyan, 2002, pp. 113-114). Thus clearly activity theory has significant power to understand in detail collective activities.

Engeström (1999b, p. 380) also gave priority to team work stating that ‘human cognition and behaviour [are] embedded in collectively organised, artefact-mediated activity systems’.

3.3.3 Research Design

The aim of this research is to investigate in detail information use in time constrained, uncertain and complex environments. In order to obtain this in depth understanding and “thick description” a qualitative research approach is adopted. Qualitative research differs from its major other alternative, quantitative research as it is “contextual research” which seeks depth rather than breadth and concentrates on ‘in-depth and intimate information about a small group of persons rather than large samples (Ambert, Adler, Adler, & Detzner, 1995, p. 880). It can be used to investigate experience, behaviours, feeling, cultural phenomena and interactions (Strauss & Corbin, 1998) and most importantly to deal with the ‘context of discovery rather than verification’ Within the qualitative approach, an interpretivist approach is adopted. Interpretivism is concerned with understanding *the world as it is*, delving into ‘subjectivity ...for the fundamental meanings’ (Burrell & Morgan, 1979, pp. 28-31). Wilson (1981) posited that qualitative research can be conducted in information science research to understand meaning of information and its need to people. Tuominen and Savolainen (1997) indicated the need for qualitative research in information use studies stating that because most research in information science was studied quantitatively, information use studies have been mostly limited to identifying the number of times any source has been accessed. In the next section, the data collection methods and analysis techniques will be discussed.

3.3.4 Methods

In this research, data was collected using semi-structured interviews as ‘well suited for the exploration of the perceptions and opinions of respondents regarding complex and sometimes sensitive issues’(Barriball & While, 1994, p. 330). Interview questions were developed using activity theory as a methodological framework. Critical Incident Technique (CIT) was used to collect data (described in detail in section3.3.4.2). Collection of data in real time or observing real time incidents was

not possible due to which CIT was used to collect data retrospectively. Joint training and exercises of police, fire and rescue services, ambulance services, local authority, utility services, RAF¹² were also observed. To complement the data collection and for triangulation, government and practitioners' reports and other documents available online were also studied.

3.3.4.1 Design Interview Questions with Activity Theory

Following the guidelines set-out by Mwanza (2001) and Karanasios et al. (2011), activity theory was used to scaffold the design of the interview questions using two dominant approaches. First was the focus on "action". Since action is the smallest unit of analysis in activity theory it was used as a lens to focus on the actions followed by silver commanders. For instance, interview questions were framed as "what did you do with the information you obtained?" The second approach was to use components of activity theory as a framework to develop interview questions. For example, questions were developed to understand what were the "tools" used by silver commanders and how they used the tools. At times, questions were not asked directly using activity theory terms. For example, instead of asking what "norms" existed in practice, the question was framed as "what unspoken rules or informal rules existed" during a certain event.

3.3.4.2 Critical Incident Technique

CIT is a procedure for 'gathering certain important facts concerning behaviour in defined situation' (Flanagan, 1954, p. 335) and can be used in the 'collection and analysis of incidents' (Andersson & Nilsoon, 1964). It is a procedure to 'obtain valid information regarding truly critical requirements for success in a specific assignment' (Flanagan, 1954, pp. 328-329). Five general steps are advocated by Flanagan (1954, p. 336) in the CIT, viz. general aim, plans and specifications, collecting data, analyzing data, and interpreting and reporting. To use CIT, the observer should be familiar with the activity and preference should be given to observational data. However, retrospective data is acceptable too if the incident is a recent incident that can be recalled by the subject. In CIT, the interviewee should be allowed to do most of the

¹² Royal Air Force

talking in order to get an unbiased account. In CIT, rules are not rigid and can be modified to the need of different situations. CIT has a history of use amongst scholars as a data collection tool in information science (Chen, Sharman, Rao, & Upadhyaya, 2007; Sonnenwald & Pierce, 2000; Urquhart et al., 2003) and decision making research (Klein, Calderwood, & MacGregor, 1989).

3.3.4.3 Semi-Structured Interviews

Interviews are a 'verbal interchange where one person [interviewer] attempts to obtain information from another person by asking questions' (Longhurst, 2009, p. 580). In this research in-depth semi-structured interviews were conducted as it 'suits for the exploration of the perceptions and opinions of respondents regarding complex' issues (Barriball & While, 1994, p. 330). Longhurst (2009, p. 580) stated that in-depth semi-structured interviews, 'tend to unfold in a conversational manner where the interviewer does not keep a tight rein on the interview but instead allows the interviewee, through the use of open-ended questions, to explore the subject in as much depth and from as many angles as they please'. This is consistent with CIT where interviewees are asked to talk through an incident that they can easily recall. It was identified that using this method of interview, interviewees covered many questions that were meant to be discussed. Interviewees were allowed to talk through an incident they handled recently or one they recalled vividly. Whenever it was felt that conversation was deviating to irrelevant topics, open ended questions were posed by the interviewer. Thus ensuring all the interview questions was covered.

3.3.4.3.1 Data Collection Process

The director of the Emergency Planning College (EPC) was contacted who offered to send the request for an interview to practitioners (see Appendix 1 for request letter sent to possible interviewees). A one page statement of purpose was emailed to practitioners. Eight people agreed to be interviewed. A further 12 interviewees were contacted either by snowballing process or at persons level through the supervisor of this research. Altogether 20 interviews were conducted. Seven interviewees were from different police departments (ranging from North to South including Northern Ireland and Scotland), seven interviewees were from fire departments and six

interviewees were from ambulance services. Thus people from different geographical locations in the UK were interviewed which provided a broader view of the context. In May, 2009 the first interview was conducted and the whole process lasted for nearly three months. Interviews were undertaken mostly at the workplace of the interviewees. However, in some cases for the convenience of both researcher and interviewee, it was done at public places like a bookstore. The interviews ranged from a minimum of 40 minutes duration to a maximum 99 minutes, averaging 70 minutes. This duration is consistent with Longhurst (2009, p. 581) who stated that average time of in-depth semi-structured interview is one hour. During the interviews, handwritten notes were taken in addition to audio-recording as this provides 'detailed insight into the performance of both the respondent and the interviewer' (Barriball & While, 1994, p. 332). Permission was taken from interviewees to audio record the interviews and they were also told that they could ask the researcher to stop recording if they felt uncomfortable with it. Though the intention was to let the participants talk through a recent incident that s/he handled, during the interview it was sometimes hard to keep the conversation on track towards the interview question designed. So, at some point some of the interviewees were asked further questions which maintained the desired flow. In general, thus it was a mixed informal interview in many ways, whereby sometimes the interviewee led by describing the whole process and at other times it involved the interviewee directly answering the question posed.

After analysing the first three interviews notes taken during interview, some emerging themes were incorporated in interview questions. For example, location of silver commanders was not incorporated in the initial interview questions. However, after analysing the first several interviews it emerged as a common theme. In fact, it was found that location of silver commanders has a great impact on the way information is shared. It was also found that culture of an agency influence where silver commanders are located (discussed in detail in chapter 5). Different versions of interview questions are attached in Appendix 2. In addition to adding questions, after initial analysis it became clear that some of the questions were not necessary and thus removed.

3.3.4.4 Observation

In addition to the interviews more insight to the actual way in which silver commanders engage themselves at multi-agency level was gathered through the observation of a table top simulation exercises. Observation 'involves placing an observer in a social setting to observe all activities defined as of interest to the research' (Wilson & Streatfield, 1981, p. 175). For the observation to be as unobtrusive as possible, Ambert et al. (1995, p. 886) suggested that the observer should ensure that the situation is processed in a normal way. Observations have been used widely in information science research (Allard et al., 2009, p. 446; Wilson & Streatfield, 1981; Yoon & Nilan, 1999). Due to the sensitivity and the risk involved, observation of real time emergency management was not possible in the context of emergency management. However, fortunately it was possible to observe joint training and exercises of multi-agency emergency services (police, fire, ambulance, local authority, and utility services, army). A three full day tactical level training was observed and also a one full day table top exercise and three half-day joint exercises were observed. During observation, notes were taken and when permission was granted, audio/video recording was done too. However, due to the poor quality of recording (as exercises were done outside and due to wind, audio quality was poor), it was not transcribed. 3 full day training mentioned above was observed in the middle of the data collection, which helped in emphasising few interview questions and omitting a few interview questions that seemed quite obvious.

3.3.5 Analysis Process

In this section, how the data was coded, analysed and the precautions taken to maintain confidentiality will be discussed.

To maintain confidentiality, transcripts were anonymised. A list was made in Excel in which place name was replaced by Area1, Area2 and so on. Similarly, based on the number of the interview, interviewees' initials were replaced by identification number, I1¹³, I2.... I20. For the readers to get further insight into the real issues within all three agencies (police, fire and ambulance), however, the name of the agencies

¹³ I1: First Interviewee
I2: Second Interviewee

were not hidden. In total 346 (A4) pages of transcripts from 20 interviews were analysed.

3.3.5.1 Coding

Coding is a process which helps in categorising the data (Crittenden & Hill, 1971:1073). It is done to 'organise and make sense of textual data' and it allows researcher to 'communicate and connect with the data to facilitate the comprehension of the emerging phenomena' (Basit, 2003, p. 152). Handwritten notes were analysed, from which initial broad themes were identified. Later, the transcription was done of the voice file by the researcher and main comments, while transcribing, were noted. Based upon the relevance of the contents obtained from the interview, in the first phase, four interviews were chosen for coding with the aim of identifying emerging themes.

Coding, in this research, was done by using advanced qualitative data analysis techniques using an inductive framework. Open coding was done by reading word-by-word of the transcript and using constant comparative method as Strauss (1987, p. 28) suggested. Categories were also created based on the components of activity systems (such as rules, tools, division of labour). Contradictions, an essential part of an activity system, were also investigated and coded. Whenever possible, categories were grouped using *in vivo* coding (code names derived from interviewees' language) to reflect the language used in practice. Once the open coding was done, depending on the relationship found between different categories, axial coding (connection between categories) was done which aided in finding the major themes. After coding and analysing 11-12 interviews, it was found that new information or new categories were not emerging, thus most of the data was used not to create new themes but rather to confirm nodes already generated.. After coding and analysing the initial 20 interviews it was decided that a saturation point was reached as no new themes were emerging (Boeije, 2002, p. 393); therefore there was no need to conduct further interviews. Validation of the findings from the analysis was enhanced through triangulation (interviews, observation and documentary analysis).

3.3.5.1.1 Use of Computer Software (NVivo)

NVivo, is qualitative data analysis software which was used for analysis of the data. Using computers to analyse qualitative data speeds the analysis process, *freeing the researcher to explore numerous analytic question* (Silverman, 2005, p. 189). Though this is true, in this research, it was found that the software could have limited use only i.e. to sort out data and categorise them in open coding. An example of open codes (also called free nodes in NVivo), sorted in descending order of number of references, is shown in Table 3.1 below. In this table, only the open codes which were referred 14 times or more are shown.

Type	Name	Sources	References	Created On
Free_N	Technology	20	129	16/09/2009 12:58
Free_N	Communication and Problem	19	120	16/09/2009 13:55
Free_N	Silver Meetings	17	90	02/10/2009 14:50
Free_N	Information Sharing- Flow	20	89	17/09/2009 13:37
Free_N	Location of Silver	20	80	11/09/2009 12:48
Free_N	Decision Making	18	74	02/10/2009 15:38
Free_N	Information Source	19	69	15/09/2009 13:50
Free_N	Conflict- Disparity- Resolved	20	66	17/09/2009 13:56
Free_N	Trust- Knowing- Understanding	17	64	17/09/2009 13:54
Free_N	Experience	16	56	15/09/2009 15:42
Free_N	Information Problems	15	54	15/09/2009 15:23
Free_N	Time Factor	16	53	16/09/2009 16:27
Free_N	Quest for Resources	15	47	15/09/2009 16:05
Free_N	Collaborative Approach	13	47	18/09/2009 10:57
Free_N	Rules	20	43	16/09/2009 16:37
Free_N	Logging	14	39	15/09/2009 15:28
Free_N	Training	14	38	17/09/2009 16:38
Free_N	Assumption	13	35	15/09/2009 15:24
Free_N	Advisors or Experts	13	32	11/09/2009 12:23
Free_N	Information Quality	12	30	15/09/2009 15:21
Free_N	Confidentiality- Data Sharing Authority	12	30	18/09/2009 11:38
Free_N	Information Sought for and Available	14	28	15/09/2009 13:39
Free_N	Analyze Notification_cont	14	28	02/04/2010 22:53
Free_N	Common Operating Picture	12	27	02/10/2009 14:22
Free_N	Human Aspect-Individual Personality	4	24	17/09/2009 13:23
Free_N	Welfare	11	24	17/09/2009 13:41
Free_N	Quest for Situation- Situation Awareness	4	23	15/09/2009 16:05
Free_N	Information Processing	14	23	21/09/2009 13:56
Free_N	Decision Making-Analyze Option or Act	12	23	22/09/2009 12:25

	First			
Free_N	Structure in which they work	12	23	07/10/2009 12:43
Free_N	System in Place	8	22	17/09/2009 10:27
Free_N	Different Objectives for Different Agencies	10	22	08/03/2010 14:25
Free_N	Know other Organisation even Better	10	20	08/03/2010 12:07
Free_N	Information from Environment	11	18	02/10/2009 14:39
Free_N	Hierarchy	4	15	18/09/2009 10:17
Free_N	Exercise Together	9	15	21/09/2009 13:31
Free_N	Initial Information	10	14	21/09/2009 11:27
Free_N	Culture	10	14	21/09/2009 13:35

Table 3.1 Highly referred free nodes generated from open coding

The Memo, annotation and nodes description capabilities in NVivo were used extensively. Memo was used for noting down the links between emerging themes and the present-state-of-the-art. All the literature that these themes are related to directly or indirectly was noted for future reference. Furthermore, nodes description was extensively used as a reminder about what these free nodes (open codes) or tree nodes (axial codes) really mean and if they can be merged to each other in future. These facilities of NVivo were extremely useful for referencing.

Once the lists of open codes were generated, codes were re-visited to find out the relationship between different categories resulting into axial codes. Some of the codes were further divided into sub-categories while some of the codes were grouped together. Though NVivo has a function to draw models derived from the codes, in this research, mind mapping software- MindGenius was used to understand the emerging relationship between different codes as shown in Figure 3.7.

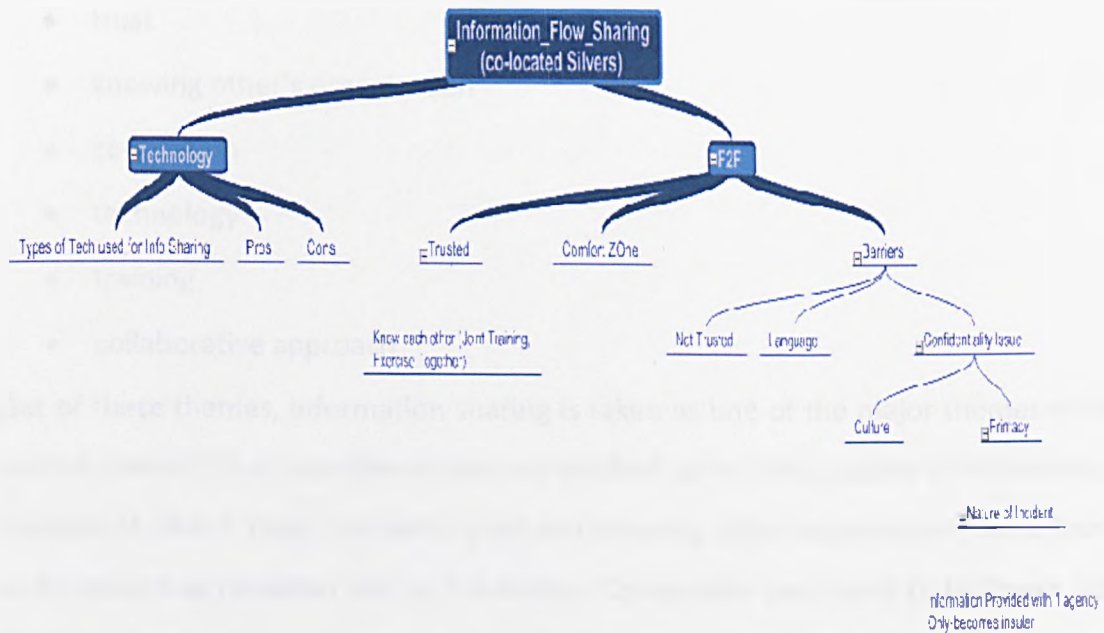


Figure 3.7 Use of MindGenius to establish the relationship between categories

The analysis was done in two phases. From the moment the silver commander is notified of the incident to the moment where he/she reaches the incident place, activities involved in these phases were analysed first. In this phase, several themes emerged such as:

- assumption (Assumption was found to be done very frequently by the commanders, however, as one interviewee pointed, this should be reduced)
- experience (If a silver commander is too experienced then they become insular they do not tend to share information with others. Moreover, they do not analyse options rather make decisions based on recognizing patterns)
- time factor (Time factor was found to be mostly referred too. Analysing options and seeking information depends on the time availability).
- pattern recognition
- trust
- information quality

It was found that the first four themes could be grouped together into the decision making criteria. So a thematic analysis is done for decision making. Similarly for the second phase of analysis, activities involved during the silver meeting were analysed. Several themes emerged from this phase of analysis such as:

- information sharing

- trust
- knowing other's organisation
- co-location
- technology
- training
- collaborative approach

Out of these themes, information sharing is taken as one of the major themes which involve several other sub-themes such as comfort zone, rules, quality of information, location of silvers, trust. Similarly, trust and knowing other organisations were found to be related as the latter add to the former. Co-location was found to be linked with trust so these two were grouped together to create a theme. In this way, several emerging themes were grouped depending on the relationship which was discovered from the data. Some of the themes were then added as sub-themes to the major themes.

3.4 Reliability and Validity

LeCompte and Goetz (1982, p. 32) pointed towards the mandatory need of addressing reliability and validity in qualitative research. They categorised reliability to be concerned with 'the replicability of scientific findings' which is internal as well as external, whereas validity is concerned with 'the accuracy of scientific findings'. According to Trochim (Construct Validity (n.d.)),

The judgement criteria in qualitative research include factors such as:

- credibility (internal validity) which involves establishing that the results are believable
- transferability (external validity) which shows the degree to which the results can be generalised
- dependability (reliability) which accounts towards the same kind of result and confirmability
- (objectivity) which refers to the level to which others can confirm the result

For credibility of data and reliability of findings, thick description is used (McKnight, 2007, p. 69). Thick description, description of a phenomena in detail, also leads to

external validation (Lincoln & Guba, 1985). Triangulation or multiple methods of data collection for the same study validate results (Silverman, 2005, p. 212) of *researcher's interpretations* (Ambert et al., 1995, p. 885), triangulation is used in this research as mentioned above. Similarly, for reliability, transparency is maintained as much as possible. Further, where verification on an item was needed interviewees were contacted.

Barriball and While (1994, p. 332) stated that if respondents are friendly then it affects the validity and reliability of the research. During the interviews conducted by the researcher, it was found that interviewees were friendly. They were very open and frank in discussing sensitive topics, provided anonymity was maintained.

3.5 Ethical Issues

This research followed the University of Leeds Code of Practice¹⁴ and information policy provided by the AIMTech research group. To gain access to certain police forces, formal approval was obtained and access was granted to internal reports. In this research confidentiality and anonymity was maintained which provides the base for ethics (Longhurst, 2009, p. 582). Since this research deals with police forces, fire services and other governmental agencies, data was handled with utmost confidentiality. To store data online securely MS SharePoint, a document management software tool provided by AIMTech and maintained by Leeds University Business School, was used. While contacting the participants, approval was obtained via email. Only the email id of people who volunteered to be interviewed was passed to the researcher. Interviewees were contacted by email and were given a copy of the interview questions so that before the interview they knew what questions were expected. This research also received approval from the faculty research ethics committee at the University of Leeds.

3.6 Conclusion

In this research, social constructivism is the meta-theoretical position adopted and practice theory is used to scaffold the research to understand practices. Activity

¹⁴ Code of Practice available at: http://www.leeds.ac.uk/secretariat/data_protection_code_of_practice.html

theory, which takes social constructivist viewpoint and compliments practice theory, is used as a methodological framework.

This chapter outlined how the use of an activity model approach can overcome limitations in account for context in information behaviour studies. Sonnenwald (1999, p. 180) stated that context consists of several situations which are activities, thus linking context to activities. Similarly, Allen et al. (2011, p. 783) stated that activity theory 'provides the scope to account for context that is relevant to the activity'. Activity theory is identified to be appropriate for this research as it provides a holistic approach to analysis and also can be used as a methodological framework.

This study relied on semi-structured interviews, observations and analysis of government and practitioner report. By relying on more than one approach, the shortcoming of any one approach is limited and validity increased. Ethical issues were minimised by following the University codes of practice and guidelines for qualitative research.

Chapter 4 Analysis using Activity Theory

4.1 Introduction

In this chapter the activities of silver commanders are described. In activity theory, activities, actions and operations are analysed to provide different levels of analysis. *There are various ways in which silver commanders may respond to an incident. For simplicity of understanding, activities are explained on a temporal basis. Four broad categories of activities are as shown in Figure 4.1.*

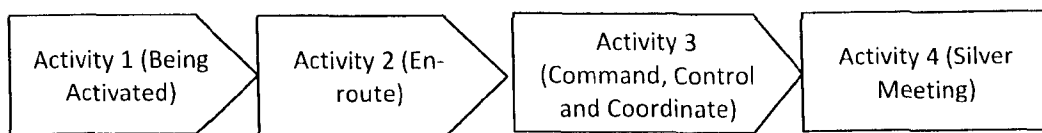


Figure 4.1 Chronological stages of silver commander in managing major incident

By the end of this chapter, the aim is to provide an understanding of tasks performed by silver commanders and outline the tensions that may lie within each activity. This chapter will start with a brief introduction to how emergency services work in the UK. This will be followed by analysis of activity models of these four main stages that silver commanders follow to manage a major incident. The chapter ends with a summary of different information practices and decision making found in each activity.

4.2 How Emergency Services Work

Whenever an incident happens, the main source of information is 999 calls from public. The 999 calls are generally received by the control room. The operator in the control room then tries to assimilate information regarding the nature of the incident, place where incident occurred, number of casualties' etc. The relevant emergency service is then notified depending on the nature of the incident. For example, if the incident is fire, the call is forwarded to the fire and rescue service; if it is a road accident, police forces are informed, and so on. However, it is worth mentioning here that the situation is often more chaotic initially. Calls will be coming from various

people and the information might not be congruent. It is very hard at that moment to make sense of what is happening. Thus, the concerned emergency service sends their bronze commanders to the incident ground to gather more information. Command and control (C&C) deploys the resources and the crew to the incident place. The first person on the incident ground then reports back to the C&C the 'standard report procedure' which generally includes further information on incident viz. where is the incident, what kind of incident is it, number of casualties, best route to the incident etcetera. For different incident types, different reporting procedures are generally available.

There are various activities ongoing when a major incident occurs. These activities may involve C&C, first supervisor on scene and other members of the public who inform about the incident. However, because the focus of this research is on silver commanders and the information practices they follow, only the activities in which silver commanders are involved will be investigated.

In the emergency services the command structure is mainly three tiered as shown in Figure 1.3. At the top level are gold commanders who are engaged in the strategic level. At the middle tier are silver commanders, who are responsible for tactical level tasks. At the bottom level are bronze commanders who work at the operational level managing the crew on ground and liaising with silver commanders. However, commanders are not allocated these roles based on seniority; rather it is based on the role they play in the incident management.

If the incident is found to be a bigger-scale based on the information provided in the report, silver commanders are notified by their own C&C. On some occasions, if it is a major incident, silver commander might be informed even before the C&C receives the report from the ground. Thus, the notification to silver commander depends on the size and nature of the incident. Only basic information, such as location or nature of the incident, resources deployed to the incident ground, is provided to silver commander at this point (these descriptions are based on the excerpts presented throughout this chapter). Based on this scant information, a silver commander then decides if s/he can wait for more information from the standard report or s/he should go to the control room or locate himself/herself on or near the incident ground. If the

silver commander decides to go to the incident ground, then s/he might be fed with information en-route via the control room. Various technologies (VHF/UHF/Airwave radios) are in place which helps commanders to hear everyone. Thus, from the information coming in, silver commander generally builds a picture of what is happening.

Once the commander reaches the ground, s/he tries to get as much information as possible to create a wider picture of what is happening. Visual information, geographical information, information from bronze commanders, information from C&C (via radio if silver commander is positioned near the incident place) is used to build situation awareness. The second major task is dynamic risk assessment. Silver commander tries to assess the risk of the incident to the general public; his/her own staff and the property. S/he will also have to think about the precaution measures that can be taken to prevent a new incident arising from the previous one. After assessing the situation, the silver commander will then take command of his/her staff and try to take control of the situation. If the situation escalates or s/he finds that other agencies must be involved too, the request is fed back to the control room and thus upon the arrival of other agencies, a multi-agency emergency response team is formed. However, in critical situations, other agencies might already be present on the incident ground in which case the silver commander must initiate a silver meeting. After silver commanders sort out their own agency tasks of command, control and staff deployment, they engage in coordination with other agencies. For this they request a meeting with silver commanders from other agencies involved. This meeting is called "silver meeting". It is necessary to have a silver meeting among the silver commanders involved so that they can set common aims and objectives. Each agency has its own set of objectives but in multi-agency situations, there needs to be a common aim and common set of objectives that should be mutually agreed by all agencies. Silver commanders need to fulfil the objectives set by gold level (known as SCG- Strategic Coordination Group) if there is one.

In this research the information practices followed by the silver commanders in emergency management is the focus of investigation. It is imperative to analyse the task of silver commanders from the moment they are notified of the incident until the

point that the incident is managed effectively. As mentioned in the methodology chapter, activity theory will be used as an analytical lens to understand the actions of silver commanders in terms of information practices. In this research, because the focus of the study is mostly on the activities of silver commanders, second generation activity theory will be used as an analytical framework.

Using activity theory as an analytical framework, major activities, actions and operations and contradictions therein are found to be as shown in Figure 4.2.

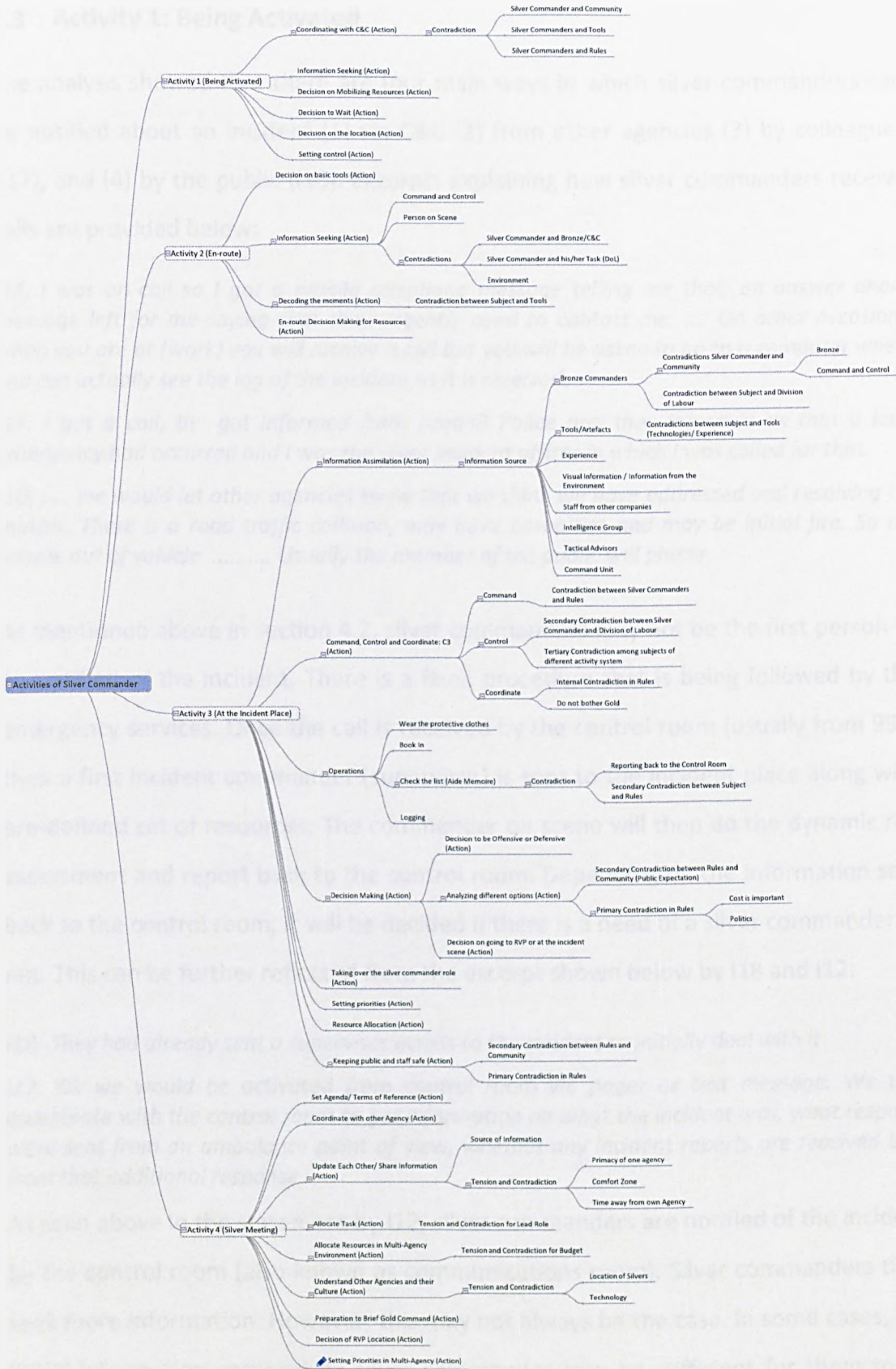


Figure 4.2 Different stages of activity and actions

4.3 Activity 1: Being Activated

The analysis showed that there are four main ways in which silver commanders can be notified about an incident (1) via C&C (2) from other agencies (3) by colleagues (I17), and (4) by the public (I10). Excerpts explaining how silver commanders receive calls are provided below:

I14: I was on call so I got a mobile telephone message telling me that, an answer phone message left for me saying that they urgently need to contact me. On other occasions, when you are at (work) you will receive a call but you will be asked to go to a computer where you can actually see the log of the incident as it is received.

I17: I got a call, be- got informed from Area43 Police and they informed us that a local emergency had occurred and I was the silver incident officer in which I was called for that.

I10: we would let other agencies know that we think we have addressed and resolving the matter. There is a road traffic collision, may have casualties and may be initial fire. So call people out of vehicle. Usually the member of the public will phone.

As mentioned above in section 4.2, silver commanders may not be the first person to be notified of the incident. There is a fixed procedure that is being followed by the emergency services. Once the call is received by the control room (usually from 999) then a first incident commander (supervisor) is sent to the incident place along with pre-defined set of resources. The commander on scene will then do the dynamic risk assessment and report back to the control room. Depending on the information sent back to the control room, it will be decided if there is a need of a silver commander or not. This can be further reflected from the excerpt shown below by I18 and I12:

I18: They had already sent a supervisor across to the incident to initially deal with it

I12: Ok we would be activated from control room via pager or text message. We then coordinate with the control room to get information on what the incident was, what response were sent from an ambulance point of view, whether any incident reports are received back from that additional response.

As seen above in the statement by I12, silver commanders are notified of the incident by the control room (also known as communications room). Silver commanders then seek more information. However, this may not always be the case. In some cases, the initial information received by silver commander may be sufficient for them to be activated as stated by I10 in the excerpt below.

I10: Well yeah, it depends what the person tells you. But basically it is somebody who calls you and saying, there is a traffic collision or may protect the road. That's enough for us to go.

Silver commander's main motivation for this activity (i.e. responding to the incident call) is to create a picture of the situation to make better and informed decisions. Based on the above excerpts, the activity system can be analysed as shown in Figure 4.3. Different types of tool and technology (VHF/UHF/ Airwave/pager) are used by silver commanders when they are notified of the incident. After analysing the initial information received the silver commander has three choices (1) to go to the incident place (2) be remote and manage the incident from C&C, or (3) to wait for more information from C&C before deciding their position.

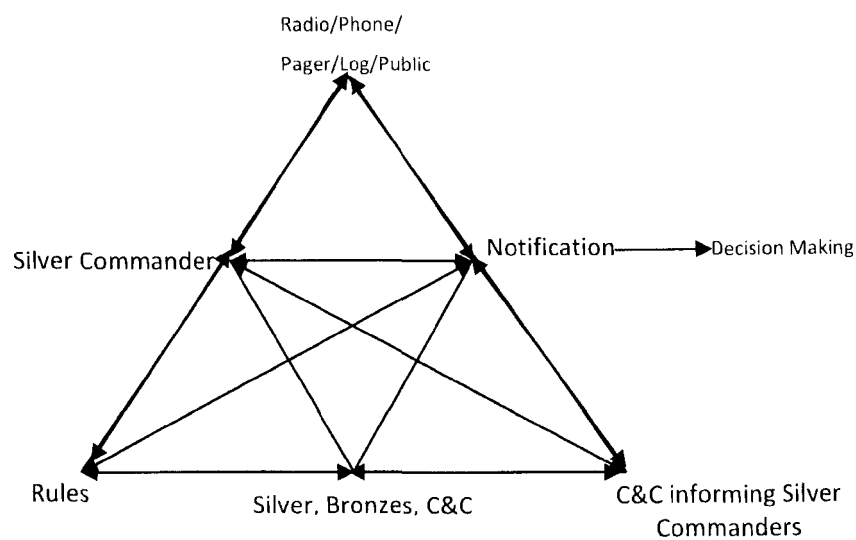


Figure 4.3 Activity system for getting informed

As stated by I1 and I8, the basic information provided to silver commander is about the location of the incident and the type of resources that has been already activated.

I1: Well given the route and the place to the incident site-and then as more information comes through then that would be coming via control or that will be incident at the time. That is mainly where the information comes from.

I8: And they told me what resources they had mobilised or send in this incident in the first place.

Different types of technologies are used by silver commanders for notification such as, fixed-telephony, mobile phone, pager, text messages. In some cases if the silver commander has access to the computer, s/he will be asked by the C&C to see the incident log on the computer too as I14 indicated.

I14: On other occasions, when you are at (work) you will receive a call but you will be asked to go to a computer where you can actually see the log of the incident as it is received.

The actions carried on within this activity were found to be (1) coordinating with C&C (2) seeking information (3) mobilising resources, and (4) deciding on the location. Each action is discussed in more detail in the following section.

4.3.1 Action 1: Coordinating with C&C

At this stage, information is provided by the C&C to the silver commander. However, information obtained at this initial stage is very scarce, such as location and nature of the incident. This information may not be sufficient for silver commander to build the picture of what is happening. As stated in 3.3.2.1 actions are goal directed (Kaptelinin & Nardi, 2006, p. 62). The main goal of this action is to understand what is happening as shown in Figure 4.4.

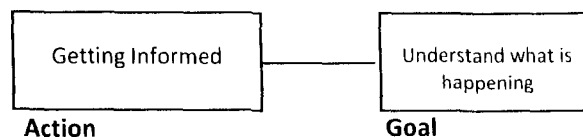


Figure 4.4 Action and goal

It should also be noted that for different emergency services, due to the variety of work performed, the need of information might vary. As delineated below by I13, the type of information obtained by silver commander might be related to the location of the incident, nature and situation on the incident ground. Similarly, the information provided to ambulance services may consist of pre-defined report such as CHALET¹⁵ or METHANE¹⁶ as I17 stated.

I13: The (pager) message would have given me the incident number, the Unicode – the identification number for the incident. It would have given me the address, it would have given me the geographical, the atlas reference – page number and grid reference. It would have given me the nature of the incident and it would have given me the station's ground so that the local station that would have been dealing with that incident- the local fire station.

I17: I got given a full METHANE report and a CHALET report. A METHANE report from the ambulance service and the CHALET report from the police about the incident and where they were going.Yes, they gave me a location; they gave me that they have got fire, that there was an evacuation and 400 metre cordon. They said that we were just on local emergency

¹⁵ CHALET, C: Casualties type and number, H: Hazards identified; A: Access for oncoming resources; L: Location of incident, E: Emergency Services on site or required, T: Type of Incident

¹⁶ METHANE: variant of CHALET (source: http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Publicationsandstatistics/Publication/PublicationsPolicyAndGuidance/Browsable/DH_5441783)

with the activation level rather than a major incident. They said that there was nobody injured, but there are people who are vulnerable within the area.

At this stage, as indicated by I18 and I9, rather than information seeking, information is being fed to the silver commanders because at the initial stage C&C hold access to information

I18: We were told that there had been a train derailment, we were told where it had happened but because it was quite rural and because the person at the scene was unable to find a visual reference it was a case of trying to work out where it was. So we were all coming in to a general area trying to pinpoint a single location.

I9: I got a call, be- got informed from Area43 Police and they informed us that a local emergency had occurred and I was the silver incident officer in which I was called for that

Analysing the excerpts above indicates that information generally given to or required by silver commanders is about the location of the incident, type of incident and things that has already been done regardless of the type of agency. The initial information provided by C&C might not be adequate for silver commanders to build a picture of what is happening as stated by I1 and I20. And often silver commanders are left with an incomplete picture of the incident and many questions unanswered

I1: Because obviously that first stage, information is very limited as you can imagine-very limited information at that stage so the respondent in those cases always with very basic picture of what is happening.

I20: All we knew at that time was that there was a train crash, we didn't know how many people were on board and we didn't know where it was going and we didn't know what sort of train it was.

4.3.1.1 Contradiction

Engeström (1999a) stated that activity theory directs toward the tension and contradiction among the elements within a system. In this activity several important contradictions are identified among components of activity system as outlined below.

In one of the situations, where I16 was also within the C&C room, it was found that information provided by the C&C was not accurate. This shows that information available to silver commanders may be prone to error. The excerpts suggested problem with initial information from C&C being not very accurate. The main reason for this as pointed by I16 may be due to human factor as people tend to *condense things down*.

I16: You paraphrase things but when you paraphrase you can lose the sense of that or the importance or the priority of that or you know the significance of it, so, you know, we do that-being human being tend to condense things down. If you are just an operator that takes phone calls, you have never been out there doing the job or you have never been a commander in that situation, you can't see the relevance

Another contradiction was identified between a silver commander and the tools used. In one incident reported by I15 presented below, the incident happened in the border of three counties. For this reason, the silver commander of one county was trying to call the C&C of its own county but the call was forwarded to the C&C of another county, thus arousing a contradiction between silver commander and the tools used as shown in Figure 4.5.

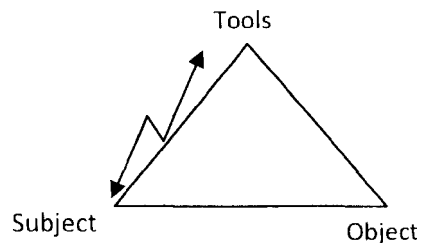


Figure 4.5 Contradiction between subject and tools used

I15: And, a communication was very difficult but- very difficult back to control room. So, we tried to liaise with fire and the police and we had a couple of silver coordinating group standing on

Silver commanders seek information from their C&C where initial information is generally available. However, as stated by I15, because the silver commander was unable to seek information from its own C&C, it was difficult to communicate and to obtain necessary information from the C&C.

In any critical incident the nature of the incident cannot be predicted. There might be situations where plans do not fit the type of incidents, which give rise to contradiction between rule¹⁷s and subject (silver commander) as indicated by I11.

I11: Especially when you get in an incident which is new kind of situation. But the plan is only a guide. It is not an absolute set of rules and you usually end up- almost in every incident you adjust the plans to suit the circumstance you find yourself in.

This statement shows that the information obtained from operating manuals (about how to respond and manage an incident), may not fit or may not be sufficient for

¹⁷ In emergency services, the term plans and policies are often used. However, in this research the term rules will be used as it is consistent to the terms used in activity theory

silver commanders to decide on what to do next. This leads them to seek more information.

4.3.2 Action 2: Information Seeking

Because the information provided to silver commanders may not be enough for them to make further decisions, they may seek more information to get a wider picture of what is happening. Thus as shown in Figure 4.6, the goal of this information seeking action is to obtain a wider picture.

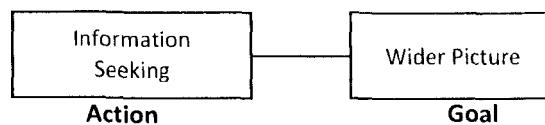


Figure 4.6 Action-goal for information seeking

Silver commanders undertake the quest for further information such as the availability of resources, the duration of incident (as stated by I13); this aids them in getting a wider picture of what is happening.

I13: I would ask them additional questions, so I would have asked them what was the time of the call for example so that I would know how long the incident had been running. I would ask them have any messages been sent back. It may be relevant to know what appliances are attending. So that I get an idea of who is in attendance and how long they have been there.

Because it is the initial phase of the incident, silver commanders do not have access to other sources of information. They may not know who the bronze commanders are at the scene. Information seeking at this stage is generally focused on the resources activated and on the supervisor sent to the scene, as indicated by I18 in the excerpt below.

I18: so I get the phone call from control, we need your attendance and to this fire, my question is then, which appliance did we send, who is in charge of those appliances? That, in many respects, determines what I start thinking about, if I know I have got experienced bronze commander in effect, turning up to that incident, I'm in less of a rush to get there

4.3.3 Action 3: Decision on Mobilising Resources

Depending on the nature of the incident, notification is provided to silver commanders at any stage. If the incident is considered large-scale, then silver commanders might be the first to be notified of the incident (*I12: So, we will always have a silver officer in from the start if it is a big incident.*) However if the incident

grows slowly then the first commander is sent to the incident (I2: *As a silver because obviously by the time I had become involved there was already things going on*).

As stated by I19 above, the types of resources dispatched have significant impact on the management of the incident. This in turn depends upon the information being received by silver commanders as reflected in the statement by I7 and I15. It can thus be interpreted that the initial information on the type of incident and nature of the incident influences the decision of mobilizing resources.

I19: So I mean, to me the first sort of ten fifteen minutes, the information that comes is critical on everything else that follows. If you get it right on first sort of ten fifteen minutes the resources that get sent to scene will probably be right.

I7: I need to be absolutely clear on the location, absolutely clear on the nature of the incident, which is coach crash and then any immediate requirements that I am getting from the scene, then I can liaise that with the headquarters. Put those in motion.

I15: If someone declares severe incident, it is 6 officers and 10 ambulances. It is 10 officers and 20 ambulances if somebody declares a major incident.

Furthermore availability of time helps silver commanders in their preparation for emergency management. As mentioned by I2, *maybe coming in for 48 hours, so you were able to pre plan to some extent of how, pre plan is the wrong word, prepare yourself for the event*, a silver commander was activated only sometime after the incident happened due to which s/he was able to prepare for the incident.

4.3.4 Action 4: Decision to Wait

There are situations in which silver commanders may have to make the decision not to act. As depicted by I4 after being informed about the incident, a silver commander might decide not to go to either the incident place or be remote silver, but rather to wait.

I4: And I listened to all that information and decided at that time, I wouldn't actually go to the incident and I asked the control room to update me once they got some further factual information from my crews on scene. So, that was the first action.

The main reason for not doing anything at that moment is because of the lack of information. In this excerpt, the silver commander was notified of the incident by the C&C, but the information provided was very basic regarding the fire somewhere. This

information might not be enough for the silver commander to decide what to do next as stated below by I4. Also, if people are at a higher level they might have more time to spend on decisions as I4 stated:

I4: So, that would be the only information that I had and it was Fire and Explosion. And that's all we knew at that time..... Then from my perspective as a supervising officer, I could then afford the time to wait on that information to wait until the crews arrive to give me their formal assessment of what is happening

The decision to wait also depends on the distance of the incident place from the place of activation of the resources.

I4: I felt it appropriate for me to wait for the 5 to 6 minutes it would take to get my crews on scene, to have a formal fire service situation report. And then I would base my judgement on what they told me.

If the silver commander is notified of the incident immediately after the C&C is notified, then the decision to wait also depends on the distance between the place from where crew will be dispatched and the incident place. As shown in above excerpt, a silver commander decided to wait for the information from his/her commanders because s/he had the information that it would only take 5 to 6 minutes for them to reach the incident ground.

4.3.5 Action 5: Decision on the Location

Engeström (1999) argued that the overall activity can only be understood by learning about its actions and operations. At this stage, one of the major task/ action performed by the silver commander is to decide on his/her location (as shown in Figure 4.7 below), whether to be based near the incident, remotely at a nearby headquarters or, as noted, to wait for more information.

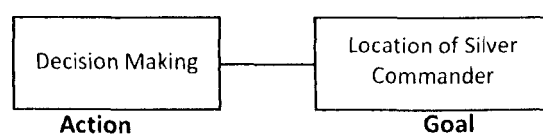


Figure 4.7 Decision making as an action for location

During the notification, the information provided by command and control may not be sufficient for the silver commanders to understand what is happening as reflected

in the excerpt by I1.

I1: Because obviously that first stage, information is very limited as you can imagine-very limited information at that stage so the respondent in those cases always with very basic picture of what is happening.

Thus to get a more detailed account of the incident silver commanders need to make a decision concerning where they will be located in order to effectively manage the incident. They can either decide to be “remote silver” or to position themselves at the incident site. The main goal of this action is to make a decision concerning the best location to control and coordinate the major incident.

As noted earlier, silver commanders can be activated for the incident at different stages of the incident. If the incident is a major one, then the silver commander is notified and activated immediately. However, if the incident starts as a minor incident which escalates, then the silver commander will be notified only after the bronze commander on scene sends the incident report to the C&C requesting the need for a silver commander.

If the silver group is already formed before the silver commander of a particular agency is notified, s/he will be directed to the specific location (*I18: They told me where the silver command was going to be situated and asked me to attend there*). If the silver commander is not directed to certain specific location, then the decision regarding the location of the position is up to the discretion of the commander as delineated below by I5.

I5: I quickly recognised that the area I worked was going to be a major receiving hospital. So I made that executive decision to actually stand back and start to develop the response for the casualty bureau and manage the information flow in order to make that work.

On the contrary, I12 states that silver commanders are generally asked to report to the C&C (*I12: Although they are supposed to report to the control room because that is just standing back from it a little bit*).

It is worthwhile noting here that this action is not short-lived. Rather, this action of choosing location has significant influence on the overall activity and information sharing among silver commanders from different ad-hoc multi-agency services. This will be further discussed in chapter 5 and 6.

The main reason for making the location decision for the silver commander is the availability of information, highlighting the critical role of information at this stage, as delineated below by I12. There are advantages and disadvantages to the location decision. For instance, in the control room there are different technologies which help in getting information easily such as CCTV¹⁸, screens for video print and GIS equipment. On the other hand, at the incident location a silver commander can interact with silver commanders from other agencies (usually fire and ambulance) who prefer to be on scene and thus more information can be obtained directly.

I12: I was going to initially the control room to see what the incident was, whether- you get the information in the control room- you can see pictures and – CCTV so you can see what is happening on the platform and they have got screen which shows the information that- the train down- where is it struck on, what is it impacting on the incident that you are working on. Occasionally we are put to platform level but..... And sometimes, you have to go down the as that is where the other silvers are reported in

I3: Because traditionally, when we have silvers in police, we tend to get in control room and manage it from there. Because the job we silver manage have to be fire arms silver where you need access to intelligence sometime.

I2: at the fire headquarters, I had all the information I needed in terms of the GIS systems, I could see on the screens where our resources were located. We had sky television and things; we could see pictures of fires burning in the city, on the phones and the radios and everything so it was a good place to be because everything was coming in. And it was only occasionally there had to be some kind of intervention with the tackle was co-ordinated.

The excerpts above also highlight the importance of visual information. Thus, in short it can be interpreted in this context that location of silver commanders is influenced by the availability of information. From excerpt I12 below, it can also be seen that the rules influence the subject ('supposed to report to the control room'). This rule can be seen as being influenced by the task (rule to report to the control is because silver will then stand back from the incident a little bit).

4.4 Activity 2: En-route

En-route in this research is defined as the time period from the moment silver commanders are notified of the incident till the moment they reach either the incident ground or the C&C room. Motivation at this stage is building the picture of what is happening.

¹⁸ CCTV stands for closed circuit television

At this stage, the subject is the silver commander who is desperately looking for more information. They seek information from the C&C using either VHF (very high frequency) radio or phone. In some instances, they may not even ask for particular information but will listen to the information provided by the bronze commanders to the C&C. The main purpose of information seeking at this stage can be considered to be for building a wider picture of what is happening, as mentioned above. Due to the lack of information in the notification stage, it is difficult for the silver commander to decide on what tasks need to be done. Thus, if more information is provided en-route, silver commanders may be able to build a picture of what is happening which helps in the management of the chaotic situation of a major incident.

It should also be noted here that the activities are sometimes overlapping. The path chosen always depends on the availability of information. If more information is available to silver commanders while they are en-route, then dynamic risk assessment can also be done and resource allocation can be done as shown in Figure 4.8 below.

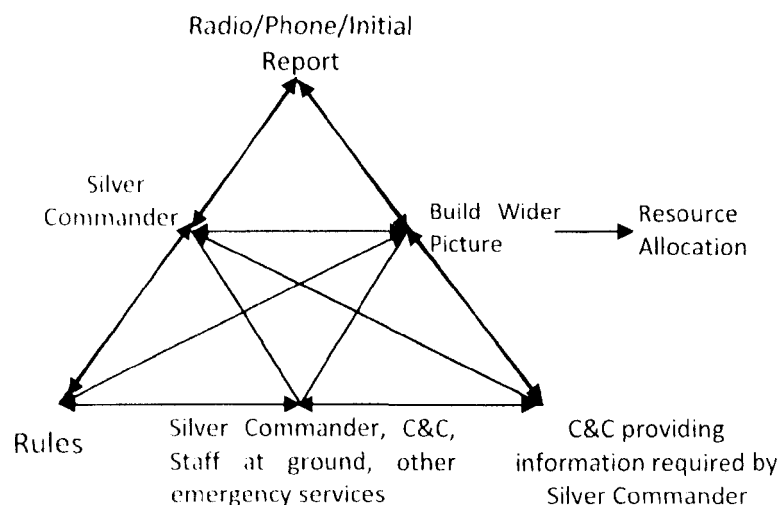


Figure 4.8 Activity system while silver commander is en-route

4.4.1 Action 1: Information Seeking

As Engeström (2001) stated, the same action can be carried on in different activities. In this case, information seeking as an action is a continuous process which was seen during activity 1. The main goal of seeking information at this stage is to be updated about the incident as shown in Figure 4.9. Because incidents are generally dynamic in nature, the silver commander needs to get as recent information as possible

regarding the incident. The silver commander might be informed about many available information sources (such as who is the person on scene) by this stage. This up to date information might help them to build wider picture of what is happening.

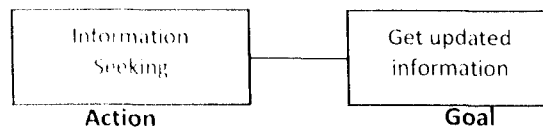


Figure 4.9 Information seeking for being informed

After silver commanders decide about their location en-route they might seek further information from different sources as delineated in the following sections.

4.4.1.1 Command and Control (C&C)

Silver commanders seek information from C&C. Thus as I7 pointed out, information obtained by silver commanders is second-hand, which is why it is necessary for the silver commanders to validate information obtained from various sources as I2 stated, *I then check the incident report, familiarise myself and am now actually on my way to the incident.*

I7: Well at that time it was actually second hand. So, information comes into the control room, control then briefs me.

4.4.1.2 Person on Scene

By this time, silver commanders might get more information regarding crew members and bronze commanders on scene, from C&C. They can also get information about other sources such as incident commander of the company¹⁹ where the incident took place, or the silver commander of other emergency services. By making a call to people on the ground, they may be able to get any updates of the incident as reflected by the statement from I18. The main goal of information seeking is to be informed, which is required for situation awareness.

I18: So I then set off to go to the silver, on the way to the silver, I rung the supervisor to see if they had got on scene and if they could give me any update of what was happening.

¹⁹ Each company may appoint an incident commander who is responsible to coordinate emergency services when an incident occurs in the company

4.4.1.2.1 Contradiction

In this task of seeking information, several contradictions were found. Silver commanders would like to get more information from the C&C but because they may not have up-to-date information, there might be a delay which creates a contradiction. Similarly, silver commanders at times seek information from the bronze commanders. As can be noted in the excerpt below, silver commanders do not consider the information from bronzes of much importance.

I3: So all the time you are getting what you think is best information from the people on the ground except in the fact that they are all bronze level people. So, it wouldn't stand up all that well.

One of the reasons reflected in excerpt of I16 might be the lack of holistic view. Because the task of bronze commanders is not as broad as silver commanders, and because it is more of an operational level, they might not have the wider understanding of what is happening, thus "bronzes" might not be able to provide the information that silver are looking for.

I16: Likewise my officers have their own perception- they only have a small perspective on the situation- haven't got the holistic view that you have got_and that's when you are getting lot of information in and lot of them may be misinformation you know, it's not really information it's just its dressed up with information

Silver commanders have to multi-task, including driving, listening to the communication of the community around (C&C and bronze commanders), and at times talking with a particular person while en-route. This might reduce efficiency and lead to distractions from their main task, thus creating a tension.

I18: ... because I was driving I couldn't write anything down, so I said once I got to the silver I would ring her back and write down more information as and when I got there.

I3: No partly practical reasons because we are never hands free

4.4.1.3 Environment

The actual environment is also considered as an important source of information. One of the main factors in making the decision to be situated at the incident is because of the availability of live information from the incident. As shown in the excerpt below by I8, a silver commander is able to build a picture of what is happening by looking at the "plume of smoke". This information en-route helps the silver commander to decide on his/her next step of action.

I8: as I am driving towards it I can see the plume of smoke rising from a long way away so I'm thinking, this is a big job

4.4.2 Action 2: Decoding the Moments

While the information available en-route may not be enough for the silver commander to get a clear picture of what is happening it is very useful for understanding if the situation is escalating or not, as stated by I11. Thus the main goal of this action is considered to be to know about the escalation, and therefore the extent of the incident, as shown in Figure 4.10.

I11: What it tells me the most is the escalation of an incident. Wouldn't tell me the physical detail but will tell me the escalation or other sides of the incident. Things are very quite on the way then may not be escalation. That is the true picture coz that can get big all of a sudden. Usually incident will escalate in incremental stages.

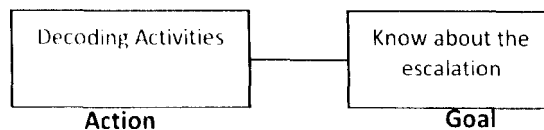


Figure 4.10 Decoding activities to know about situation of the incident

While en-route to the incident the silver commander attempts to make sense of the information that is being passed amongst different people on the radio.

I8: Yes because obviously as I am driving to the incident I have my radio on so the crews getting in attendance whilst I am getting there, I'm picking up the messages back from them

4.4.2.1 Contradiction between Subjects and Tools

While the excerpt above shows that the silver commander is listening to “chatter”, the excerpt below (by I3) contradicts the above statement, of decoding from the activities, stating that there are situations where no information seeking is done because they are busy driving and focusing on directions and may not be able to use technologies easily to seek information. Thus a contradiction between the tools used and subject emerges.

I3: No. No partly practical reasons because we are never hands free. So, the information I get is before I started and obviously when I arrived at the scene.

4.4.3 Action 3: Decision Making for Resources

On the way to the incident, silver commanders also make decisions whilst building the picture of what is happening as stated by I20 and I8.

I20: On the way I was then talking to the local ambulance station at Area38, I spoke to their station officer to start bringing his staff in.

I8: So I knew I was going to have to make, what we call make pumps up. Ask for more appliances to come on so we could just get more water off the appliances so on the way there again that is one of my thoughts

The main goal of this action can be interpreted as for the quest for resources as shown in the Figure 4.11.

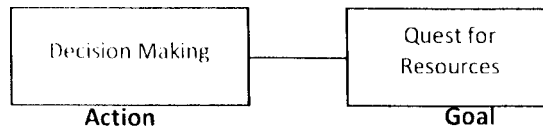


Figure 4.11 Quest for resources

Decision making at this stage is largely dependent on previous experience. As I8 pointed, people may use their past experience to anticipate what might happen, which then helps them in deciding their next action and the resources needed.

I8: Again, previous experience I knew that we were going to have a problem with the asbestos that was in that building because it was a, you know I could see this plume of smoke rising from well away so I'm thinking that's got asbestos in it, it's going to land everywhere

In this excerpt (I8), it can be seen that if the silver commander is familiar with the location, then it helps him/her to analyse the options so that s/he can determine the next action. Also, it can be suggested that the previous knowledge helps silver commanders in the decision making process. However as will be explained in the discussion chapter, experience has a mixed result in terms of decision making.

It is important to note however, the decision making process in en-route is not always straight forward and can be affected by the environmental conditions surrounding the actual incident, as pointed out by I20.

I20: The driving was hazardous because it was dark and it was snowing heavily. With the snow the blue lights of my car was causing the snow to look even worse than it was, if you like, so driving was quite hazardous

Because the weather was poor, the operation (driving) became time consuming due to which more information could not be sought. On the contrary, there are situations where the silver commander may not get any information at all while en-route as stated by I13 and I17.

I13: While I was on route there was no further information.

117: No, once I had got the information I just moved. You know to the scene and the other information became apparent when I got there but it was as we got told

Therefore the information received and sought en-route, as mentioned above, is conditional upon several unpredictable factors.

13: No. No partly practical reasons because we are never hands free. So, the information I get is before I started and obviously when I arrived at the scene.

4.5 Activity 3: At the Incident Place

When the silver commanders reach the incident place (if they plan to go to the scene instead of being remote), they will try to absorb more information from the environment. This is required for the dynamic risk assessment which helps in evaluating the resource needs (man power or other appliances) and to gain situational awareness as stated below.

110: Is to try and assess the incident, the scale, who will be needed and what will be needed. And, try to assess how many casualties there are, if there is any health and safety issue and what impact it will have on the wider context in terms of affecting the community.

When the silver commanders reach the incident; they are engaged in their own agency task. So this phase can be analysed as shown in the Figure 4.12. However, there are still circumstances such as large-scale incidents where a multi-agency approach is taken from the beginning. But in the majority of cases, the analysis indicates that the first tactic is to setup and control one's own agency activities before engaging in multi-agency activities.

The task of silver commander becomes even more complex once they reach the incident. Visual information seeking starts even before the commanders are on scene. Other ways of assimilating information is by asking bronze commanders and also by looking at the incident log, as mentioned in section 4.3. From an activity theory perspective, as shown in Figure 4.12, the main subject is the silver commander who uses various means such as face-to-face communication and visual inspection to gather information to inform him/ her of the situation. Another very important tool in this stage is the use of log books. It was found that log books aid silver commanders in thinking systematically and thus can trigger certain information needs.

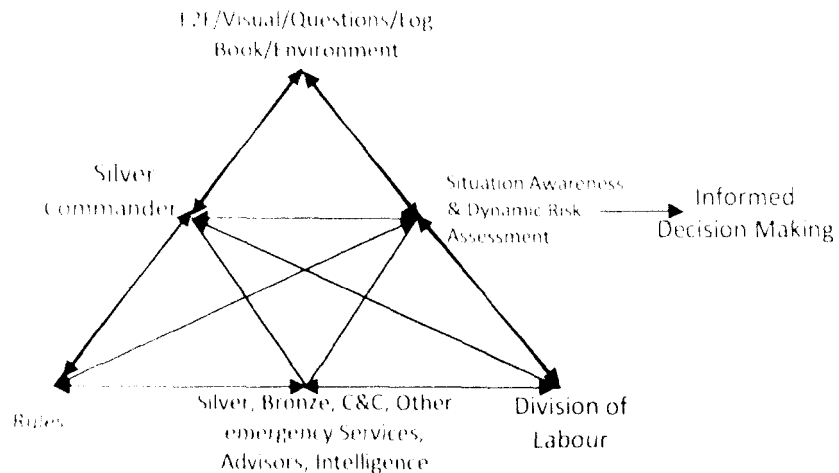


Figure 4.12 Activity system of silver commander on arrival to the incident ground

4.5.1 Action 1: Information Assimilation

For making sense of the incident, silver commanders need to assimilate information from various sources as will be described in the following sections.

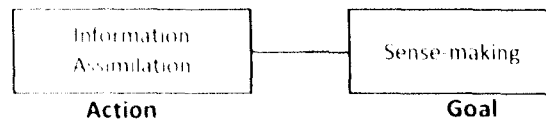


Figure 4.13 Information assimilation for sense-making

As shown in the excerpt by I2 and I20, when silver commanders reach the incident ground, there are different information sources that they rely on. Thus information will be coming from different directions, requiring them to act fast and assimilate information they are receiving for sense-making, as can be seen in Figure 4.13. The information received at this stage can also decide the next steps for the silver commander.

I2: So the information comes in bits really. I mean mainly from our own control and whether it is police, medics or fire, that would be information for the main channel from their own crews would come through and they would build a picture of what is happening over a large area and they would recognise from the information they have got to put in the controls

I20: So once we got to the scene, I then got an update from the people that were on scene; the first crew that were there and there was already two or three ambulances starting to turn up. We had organised a casualty clearing area in a barn, which was – that worked very well.

The statement by I3, shows that before the silver commander reached the incident ground there was no coordination. This is because, as observed, the role of a bronze commander is usually at the operational level. Thus one of the main tasks for silver

commanders once they reach the incident ground is to coordinate different activities. For this silver commanders need to understand the situation. Excerpt below by I11 shows that visual information is very useful to understand the environment.

I3: I spoke to the bronze- police bronze who would be my first contact anyway. I mean, these commands were telling me what they had and what to find which was particularly good. So, I think I went to the police bronze who then briefed me as to what he found when he arrived at the scene, what he was doing at the moment which was very bronze level stuff.

I11: Take a minute or two to look around me and see what is going on. Again, I am trying to gather information and basically what I am trying to do- where are the fire appliances- the size of the plume smoke- colour of the smoke- the noise- what are the fire fighters doing. What is the public doing- is there a cordon, is there the water tank intact and all those issues. I am trying to take that in the first couple of minutes when I got there.

However, one of the major problems with the information that is provided to silver commanders is regarding accuracy and reliability. In the fast paced situation, silver commanders may not be able to confirm the accuracy of information. One of the ways to confirm the accuracy of information is by calling C&C as stated by I3.

I3: Writing everything down and going back to what information we have got out, how about trying to add the information by ringing to the prison to actually get confirmed.

4.5.1.1 Information Source

At the incident site, silver commanders may gather information from various sources to understand the situation as highlighted by I11. So far, several types of information sources have been discussed. In this section the information sources will be discussed in detail.

I11: Again, I am trying to gather information and basically what I am trying to do- where are the fire appliances- the size of the plume smoke- colour of the smoke- the noise- what are the fire fighters doing. What is the public doing- is there a cordon, is there the water tank intact and all those issues. I am trying to take that in the first couple of minutes when I got there.

As observed, one of the major sources of information for silver commanders is the bronze officers or other supervisors at the scene, as stated below by I11. Here again the experience of the bronze commander seems to be an important factor. If bronze commanders are experienced, it significantly aids silver commanders in managing incidents, as highlighted by I8. I8 stated that, if crew members are familiar with the location of the incident, then it helps in the assessment process too.

I11: Well, hopefully the officer in charge will be well trained enough to brief you when you arrive. And of course, you will then ask questions- gaps for what you see as the information you need- you will ask questions. Probably you will not have all the information you want, for example, they might have done risk assessment, they might be waiting for the specific information from the building owner to say what is in the building.

I8: Um.... from the bronze commander whose area that was in so he knew the building quite well and he had attended the previous incidents as well.

4.5.1.2 Contradiction Subject and Community/Division of Labour

In the above sections, bronze commanders were found to be a very important source of information. As expressed by I16 below on many occasions the information provided by junior level staff is not considered important. I16 further stated that this may be because junior level staff may not have the same level of understanding as the silver commanders.

I16: Likewise my officers have their own perception- they only have a small perspective on the situation- haven't got the holistic view that you have got and that's when you are getting lot of information in and lot of them may be misinformation you know, it's not really information it's just its dressed up with information.

Similarly as pointed by I14, the information obtained from the C&C may not be accurate. This is because when they record something they do so according to their interpretation of what is important which may be different from an experienced silver commander.

I14: You will have access to that sequence of events now you have got to remember, of course, that it is as interpreted by someone who is putting the entry into the log. So, you may not find that it is as complete as you would wish.

In a major incident, "tactical advisors" are appointed to advise tactical commanders. However, as shown in the excerpt below, tactical advisors may get seriously involved in an incident thus creating a tension in the work force.

I14: I have had to pull back tactical firearms advisors before because they have said right we are going to do this and I have said, whoa you tell me what the options are and I will make the decision because it always comes down to the silver commander. In fact, I have almost certainly agreed with that person because they know what they are talking about and they do this advice day in day out but that's the formal process and there are certain legislative requirements and there is certain working practice requirement that you refer back to.

As I8 pointed out I just thought I was working on the best information I had got and..., silver commanders may not even think that the information they are provided is

incomplete. In fact, they just consider the information provided to be accurate and act upon it accordingly.

4.5.1.3 Tools and Artefacts

There are various tools and technologies that silver commanders use to gather information such as pagers, mobile phones, various websites, log books, CCTV coverage and mainstream media. As stated by I16, s/he never runs an incident without the media (TV, radio etc) running. Similarly I14 below states that s/he accessed the log for the incident via the computer, which was very important source to get information regarding the incident itself.

I16: I've never run an incident without sky news running because sky you know- constantly given you update information and there is so much published on the internet from people who have taken photograph of the incident on the internet.

I14: That will tell you, that will have the full history of; right then, that will have the full history for that particular log

These excerpts show the importance of technology in emergency management. Technology is considered as one of the major mediums to seek for information. Moreover, as stated by I12 below, visual information is preferred over voice or data.

I12: I was going to initially the control room to see what the incident was, whether- you get the information in the control room- you can see pictures and – CCTV so you can see what is happening on the platform and they have got screen which shows the information

4.5.1.4 Contradiction between Subjects and Tools

Technology is an important element in emergency management. As emphasised by several interviewees, its use is getting more popular every day. However, some issues are still lingering concerning the use of technology.

Excerpts from I12 and I18 highlight problems regarding the familiarity with the technology. There are so many technologies implemented in emergency services and new ones are constantly being promoted. However, due to the lack of proper training, commanders might face difficulty in using these technologies. Furthermore, I18 and I14 raised the issue of reliability of technology. From these excerpts it can be interpreted that silver commanders are still dubious of the capability of technology in extreme conditions.

The task of a silver commander is huge in that they need to manage concurrent events. In such a scenario, as I12 stated of unfamiliar technologies being used then another level of complexity is added.

I12: The radios can be difficult if you are not familiar with them. So, for other staff who are not familiar with them- sometimes different radios, put a lot of channel and say well this is how to contact us- and they struggle with this

The excerpt from I18 shows that silver commanders are not considering technology as one of the trustworthy artefact to seek for information.

I18: It (technology) does when it works, it's alright having all these gadgets but they have got to work and there's lots of gadgets out there gathering information and IT software and so on that are brilliant and GIS's mapping and putting overlays on and things like that but I say, it is good if it works..... It's good as well if you can understand how to use that piece of equipment.

I14: So there may be more than one log, usually they try and consolidate them quite quickly because if they don't you get confusion with different entries or different logs

4.5.1.5 Experience

Experience is also found to be one of the sources of information. If a silver commander is experienced, then s/he might recognise a pattern which might help him/her seek for information or to make quicker decisions. However, as can be seen from the excerpts below, by I3 and I16, having a lot of experience or a lack of experience can create problems.

I16: There is a danger- two dangers really-inexperience and too much experience really because if you are too experienced, you can try to fill the gaps with I know what is going to happen here- you know in your thinking. This is the way it is going to turn out.

I3: Multi-agency or single agency all have got people who are sort of have not been exposed to that sort of situation (inconsistency in the role of silver commanders) and doesn't understand what their role is.

As stated by Kaptelinin and Nardi (2006, p. 62) in section 3.3.2.1, an activity system contains actions which are always goal oriented and operations which are routine. In this research, the same action can be either an operation for an experienced silver commander or can be an action for inexperienced silver commander. For example, the excerpt by I16 below, shows that because the silver commander was experienced, s/he knew that there wouldn't be any evidence in the building because everything was burnt, so s/he didn't pursue the matter further, which following activity theory can be considered as an operation. However, if the silver commander would have been inexperienced, s/he may have attempted to find non-existent evidence.

I16: Lets go back there won't be any evidence here (as people usually have found that there is no evidence in burnt houses).

4.5.1.6 Visual Information

As mentioned by I8, information can be collected from the environment through observation. In this excerpt, when I8 reached the incident site the first step was to locate cues which might aid in situation awareness and dynamic risk assessment.

I8: Right, at that point I had, when I arrive on scene and most fire officers, will do a 360 degree look around, walk around the scene itself. Yes and I did on this occasion, right this is what we have got and at that point, ideally what you are going to do is, when you know you have this command structure in place and you have got this resource, you need to step back and move away from that.

4.5.1.7 Incident Commander from Other Companies

If there is any emergency service staff appointed by the company where the incident took place, then silver commanders get information from them also, as I8 pointed out.

I8: I spoke to the security officer from the demolition company who were close by.... The security guy assured there was nobody in. It then takes a little bit of pressure off us that we, well we were fairly comfortable that there was no-one inside

4.5.1.8 Intelligence Group

Typically, to gather more information, silver commanders may form an "intelligence group". Sometimes the intelligence group is already pre-defined and there is no need to assign the jobs however, at times it is necessary to assign the jobs within the intelligence group.

I5: Sure, recognising the need for information it is pretty easy to task somebody to actually form like a little intelligence cell. You only need one or two people and you say, that's your job, I need you to go away and find out for me as much specific detail as you can and what I want are facts.

4.5.1.9 Command Unit

The command unit²⁰ is also a source of information for silver commanders. As I13 stated, s/he gets further information from the command unit. This also illustrates that silver commanders do not only get information at the beginning of the notification stage but can also demand information at any stage of the emergency. This was also

²⁰Control Unit: Command and Control consists of FCC (Force Communications Centre) and Command Unit. It is generally set for silver commanders

observed in the multi-agency exercise where, when silver commanders realised that they did not have particular information which might help them in making sense of the situation, they contacted the C&C with a request for that information.

I13: I will gather information from the command unit. If it's possible then I can improve my understanding of the incident without interrupting the incident commander's duty

4.5.2 Action 2: Command, Control and Coordinate (C3)

Before silver commanders reach the incident ground, there is no command and control in place due to which among the first few tasks for silver commanders is to set up a command and coordinate the incident. Silver commanders engage themselves in their own agency task of commanding and controlling as explained below by I8 and I3.

I8: But I turned up perhaps 15 or 20 minutes later. Starting to put a command structure in place because at the moment, at that time, although there was, because the first three appliances were there, they were busy getting water into the hydrant, getting ready to fight the fire

I3: ... what he was doing at the moment which was very bronze level stuff. But on one did the part of silver level stuff.

4.5.2.1 Command

A major task for a silver commander after the basic routine check is to deploy their own crew members by putting a proper command structure in place as stated below by several interviewees.

I8: ... because I asked to mobilise the resources to response to the fire arms teams. I then asked for an inspector to take control and put cordons on that house.

I16: Once you sent the officers to the scene to take command at that bronze level, if you like, you get feedback quite quickly

I11: Then I will decide if I am taking on the incident or not. And allocate a task to the previous officer in charge.

4.5.2.2 Contradiction between Silver Commanders and Rule

There is a contradiction between the rules and the action followed by silver commanders. In the excerpt below, the crew member wanted to jump in the water to save the person who was about to commit suicide by jumping into a river. The rule is that silver commanders cannot jeopardise the lives of their crew members but because the crew member was familiar with the area and was confident enough, the silver commander went against the rule by giving his permission.

I16: You know they shouldn't but you let them do it.

I16: one of the things that used to very often be a problem is the police officer attendance of fire and instincts are, if fire services are not there and somebody is trapped, police officer goes in, policy is you're not going in. So they know that going in is not in the policy because they are not trained and the fire service are the experts

4.5.2.3 Control

It is also necessary for silver commanders to be able to control the situation which is very unstable and chaotic as indicated by I3 and I2.

I3: And that's- if I think there is always going to- principally- you got that chaos phase to start with and you can't- despite what you throw at it, it's up to the managers and say: get the chaos under control

I2: ...and they would recognise from the information they have got to put in the controls

4.5.2.4 Secondary Contradiction between Subject and Division of Labour

Because of different objectives and priorities of each agency, the conflict can be seen in the division of labour across silver commanders from different agencies. The following excerpt by I2 suggests that silver commanders from the fire service wanted to extinguish the fire, whereas silver commander from police wanted to preserve the fire scene as evidence. This can be explained on the basis of agencies having their own individual missions. They are all doing their own job. This also suggests that a multi-agency approach is required to minimise the conflict.

I2: Well, the most obvious one is where there is a belief a fire was called deliberately and the fire, this is a small decision, good tip for example is that the fire commander wants to make sure that the fire is out and then you clear all the building out so that any burning materials is taken home. As far as the police commander is concerned, that's evidence and he wants the fire to be put out and everything left and they will go through it bit by bit over the next week or month or what have you and we had that situation a year ago in

4.5.2.5 Coordinate

Another major task of silver commanders after they reach the incident ground is to allocate task to team members as I3 stated.

I3:I'd be standing there, bear in mind I have got a team in front of me. I'd stand there saying, fine OK, I've got the prison thing, you ring the prison, I want you to get down such and such thing- I don't want you to deal with it yet but just get down to that point. So, I guess I'd adopt the situation, as the situation develops, and if I have...

4.5.2.6 Internal Contradiction in Rule

Several contradictions emerged within rules and social norms. For illustration, as stated by different interviewees, gold commanders are not to be bothered. Gold commanders are generally available in a major incident where they define the main aims and objectives for the overall incident. Silver commanders generally do not have full authority to implement resources. Also if further resources are required then gold command needs to arrange this. However, as shown in the excerpts below by I16 and I20, the norm is for silver commanders to avoid bothering gold commanders.

I16: The one with gold is, don't bother me with anything unless I really need to be bothered with, you know, just get on with it, and only come to me....

I20: Yes, let's not bother with gold. Silver can deal with it.

4.5.2.7 Quaternary Contradiction among subjects of different systems

Often contradictions can be found among the silver commanders of different agencies. As shown in the excerpt below by I12, the silver commander from the police force asked the silver commander of the ambulance service to leave the premises, which they refused to do, aggravating tension between the two groups.

I12: It was a civil disorder Area40 and the police were very keen on us leaving and we could see that- that wasn't the right course of action so we didn't leave and he got a bit upset with us coz we stood to the ground but again it was proved that we were need to because things had escalated.

4.5.3 Operations

Several actions which if required to be done in every incident become routine for silver commanders such as wearing protective clothes, "booking-in" in when they reach the incident place, following a check list (aide memoire) and keeping a log. The quotes below show some of the routinised behaviours of the silver commanders.

Whenever an incident happens and silver commanders are on call and on scene they are required to wear the PPE for their own safety.

I11: When I get to a job, I will step out of the car; take my time to put my protective clothing on.

Information about the availability of a certain person can be obtained from the book-in form. When a silver commander, or a commander at any other level, arrives at an incident site, they need to book in attendance which may be done directly with

control, either by telephone conversation, over a radio or through booking in with the command unit to say that they are in attendance as I13 stated.

I13: we actually handover a plastic role board that says "I'm here". So there's a comprehensive list of everybody who is at the incident, so if there's an accident within the resolution of the incident, we can search for everybody and make sure we have got everyone. So, okay the first job is to book in and that will be with the command support personnel not with the incident commander, okay.

I8: logging and un-logging people out so that's it, from our point of view we know from emergency services who is on that incident ground.

Silver commanders have a command bag in which there is an aide memoir. One of the tasks performed by silver commander is to go through the list. The aide memoire helps silver commanders to list the task that they may forget due to time pressure or due to the complexity of the incident.

I17: after the ten minutes, you open it up and quickly go down the list (of aide memoire). There's one side of A4 so literally you are just going down making sure that you have done everything and a couple of times I have missed stuff out and I think that most of us will hold our hands up and say, yes we are not perfect and we have forgot things, and when we go through that list that is part of the reason that they are there – to make sure we don't miss anything out.

Logging of the incident needs to be done by a silver commander no matter how busy s/he is. Sometimes, as indicated by I16, someone can be allocated to do that task. If there is no help available the logging can be done at a later stage.

I16: ... ask him to be the person who does the typing up and always got a volunteer

Logging also helps the silver commanders in debriefing and thus to justify their own work. As stated below by I16.

I16: I tend to log awful lot of stuff about who told me what so that at the later time when I'll make decision, I'll actually say- well I actually made that decision on the ground of this is what I'd been told by xyz. It's found to be wrong or inaccurate, the...

The paragraph below by I12 shows that options are really analysed in decision making.

I12: Um, I think I always take couple of moments. It might not be very long, but I would always take breath almost and think of the options available. And we encourage to keep decision logs so I need to make a decision about this. I have these options which option I have chosen- I have chosen this because-

Moreover, logging helps in justifying oneself if everything is recorded as indicated by I3.

I3: ...well I actually made that decision on the ground of this is what I'd been told by xyz. It's found to be wrong or inaccurate, the least I could say: well, I based it on that information. And of course, half an hour that information changes isn't it?

4.5.3.1 Contradiction within Operations

It can be seen that the aide memoir might not be used if the situation is moving very fast as mentioned by I14.

I14: But broadly speaking, there is a formal QA process for formal intelligence. The problem with fast moving events is sometimes you are reacting to rapidly changing information that doesn't go through that process so you have to make a judgment call

4.5.3.2 Reporting Back to the Control Room

Once the dynamic risk assessment is done and further resources required identified, the C&C is notified as indicated by I15.

I15: Your first duty when you get there (incident place) is to do quick visual inspection and report back to control room and that's formal-fairly standard template that most Ambulance Services use either SALY or METHANE.

4.5.3.3 Secondary Contradiction between Subjects and Rule

I16: ...when you get that level of focus on the words you write- it tends to make you think about how you will frame the answers in the future so again the experience of being cross-examined on your decisions makes you think how will I explain this.

From this excerpt, it can be seen that because logging is a post hoc process, silver commanders may not log what should have been done but only the work that has been done and justification for that.

I14: absolutely yes, you will make an intuitive decision and then in retrospect you will justify that decision and funny enough I think the decision logs encourage that because I think it's hard to actually show the input and thought process followed by decision. It is easy to make the decision and then show the reasons for it. So yes, yes you do. I do, and I know others do

I15: ok at what the problem is: the start of any decision and you need to assess what your options are. We pretty much need to be able to justify our decision. You know you need to be able to justify the decision like why you did that so you need to tick the at least a few points so that you can have alternatives and then select the best

A solution might be to appoint a loggist²¹ who would be logging the action of the silver commander and can also maintain a log while the silver commander can think aloud.

I17: Well actually at the time I had been told by and had the reasons and I chose C because and that is one of the main things and I do the notes as I am doing them or if I have a loggist who will do the notes for me.

I19: will write it up because we have sort of incident reports, I will write it up after the incident

4.5.4 Action 3: Decision Making

As the name, tactical suggests, there are various tactical decisions that need to be taken even at this stage by silver (tactical) commanders which is outlined below.

4.5.5 Action 4: Taking over the Silver Commander Role

As stated by I11, there may be other commanders handling the incident before the silver commander reaches the incident place. Thus a silver commander needs to decide if they are taking the management of the incident which is a formal process. Based on an analysis of the information received the silver commander analyses the options, assess the situation and makes a decision.

I11: Next thing I do is, I will go to the officer in charge if he is already there saying, whether I am taking over or not. Because there should be formal handover, you would say, formally I am taking over the incident. You may not; you may select that officer to be in charge. Then I will walk around the incident. I will get him or her to come with me, talk me through it and show me the incident.

In some cases, if the first commander on the scene is managing the incident efficiently then the silver commander may decide the best course of action is to be located at C&C.

I13: So once I had looked around I thought that the best position for me was the incident commander, I left the watch manager in charge of the operations.... so that that watch manager continued with the specifics of actually resolving the operation

²¹ Loggists are people who help commanders to log down the steps followed and options analysed in managing an incident

4.5.6 Action 5: Decision to be Offensive or Defensive

As I13 highlighted, decisions need to be taken regarding the mode in which silver commanders manage major incidents. As stated in the excerpt, there are two different modes in which an incident can be handled. They are (1) offensive, and (2) defensive. This decision is made by silver commanders.

I13: But whether or not we send a message back based on our observations and our risk assessment we will make a decision whether or not the incident is in offensive mode or defensive mode, if it's offensive then we will allow people in controlled conditions to enter into the hazard area to perform their tasks, in defensive mode nobody is allowed into the defensive area and so on this occasion we were on defensive mode so that tells me that we have got nobody inside the hazard area.

4.5.7 Action 6: Analyse Different Options

Due to the sensitivity of the whole situation, silver commanders need to analyse all the options available before taking the decision.

I3: The actual wind or content of the smoke as far as we are concerned the content isn't that dangerous or how did you know that it's not that dangerous. Well, because of the chemicals that had been burned or how did you know what chemicals have been burned or we don't? So, let's revisit the content of the smoke, shall we? In order that you have to do and it's only through the experience that you gain confidence to actually challenge as, I suppose, to taking things on face value.

4.5.7.1 Secondary Contradiction between Rules and Community

A contradiction that existed between the activity rules and the community is the distinction between the training provided to the silver commanders (activity norms), which typically focuses on assessing the situation before acting, and the public's expectation that emergency responders act.

In this excerpt, the silver commander actually decided to wait for more information before making any important decision. However, s/he was under the pressure of the public. In this case the public were aggravated by the lack of urgency from the emergency responders.

I8: ... you stand back and say well I need some more information and we are not doing anything until we got all the resources there that I am going to need to do this safely but the moral pressure when you are in that situation is that you are quite different because the theory sounds fantastic but you have got pressures from members of the public.

4.5.7.2 Primary Contradictions in Rule

Several other contradictions surfaced during the analysis. For instance, although cost should not be a major factor during an emergency situation, the data analysis revealed that it is an important factor in the decision making process.

I16: How much is this all costing? No one would ever say that the cost is important but it is implied for everything nearly.

Further, while emergency response should be an unbiased activity, the data analysis also revealed underlying political dimensions, as highlighted by I16.

I16: then it causes a political dimension which is, how is this going to play out with the politicians ... what does the politicians say about this, what the media may say about this- so, there is a lot of unwritten things there.

4.5.8 Action 7: Setting Priorities

Because of the dynamic nature of an incident, there are various things going on at the same point in time. Thus it is the responsibility of a silver commander to set priorities and deal with most critical task first.

I16: ... And you need to be thinking, OK I need you to stop that one, burglary can wait – you are nervous and that's- you know- the goal is you know- if you can't step up and get the drill around the body then you can't do the job.

I16: I am looking to find out who is at risk, the school is the clear one. The occupants of other houses, there is a shopping centre nearby. So, can't let out, prioritise the school first, house next, shopping centre next coz that's around....

4.5.9 Action 8: Resource Allocation

As shown in Figure 4.2, one of the main tasks for the silver commander when s/he reaches the ground is to assess the situation as mentioned earlier such that resource allocation can be done.

I1: at that point nearly would assess what is required, what is taking place. Obviously, there is always limited information in that first response

4.5.10 Action 9: Keeping Public and Staff Safe

The main aim of any emergency service is to save lives and minimise damage. Thus a silver commander needs to take into consideration the welfare of public while performing any task as stated by I16 and I3.

I16: So, this guy is a criminal, he is in a house, he's armed himself and he wants to kill himself. And the issue is, first and foremost, public safety. So, I want to keep him there and I want to maintain the safety of my officers.

I3: And then I would go through a visible police type of approach where- you know, save life, where this station was, find again, close roads, leave my bear at this position you know, as long as you know other members of the public are not affected by what he is doing. I'll speak with him fine. Then start thinking...

In addition, silver commanders need to think of the safety of their own staff, which adds another important task they have to handle, as I2 explains.

I2: making sure that they (staff) do come back to centres for refresh and maintenance and re-cooperation, things in between, that we do change the crews over so it is not the same ones exposed all the time and also for giving them regular updates and more information so that they are better equipped when they go out next time, that kind of situation

4.5.10.1 Secondary Contradiction between Rules and Community

As observed, protecting the public is the major objective in emergency response; however as indicated by I16, silver commanders are faced with a range of operational and personal imperatives.

I16: Um I think um there is a lot more about us both individuals and organisations then there is about public lot of time. I think it's more about- what this means for us and in terms of costs and time, welfare, staff and reputation, all of these things are more important than actually the one thing that we are all supposed to be here to be saying is public safety

4.5.10.2 Primary Contradiction in Rules

Silver commanders need to perform their task until the incident is over or their shift ends. The statement below shows the importance of "sorting" out the incident in as short time as possible, as they still have commitments to their everyday roles.

I16: Fast is better. Otherwise get it sorted quicker than and as quickly as possible because at the end, they are all going back to the day job.

4.6 Activity 4: Silver Meeting

Once command, control and coordination is done for their own agencies, silver commanders' request a silver meeting, which is to set common objectives. Silver meetings are imperative. As I2 indicated, because different agencies task may be related to each other and they require help from each other, they need to meet to discuss.

I12: Very much so because, um, the actions of one agency might affect the action of other agencies. If the fire brigade are unable to contain the fire, there is a need to hospital and we

need to know that they can't contained it because we might then have to advice to the hospital. They may be thinking about moving some of the wards or evacuating part of their hospital or moving part of their hospital to some other area for example.

Similarly I13 stated that in silver meeting silver commanders from police forces, fire services, ambulance services are involved along with NHS representative, utilities representatives, local authority, environmental agencies, companies representatives. They need to discuss primary goals and how to achieve the target for set objectives.

I13: Once we have established those people we will arrange a formal meeting, we call it a silver meeting. We will get everyone together and discuss our own arrangements, what hazards what risks, what our primary goals are, what activities we have got carrying on at that time and we will include in that anyone else that is actually involved with the resolution of the incident.

The frequency of meeting as delineated by I18 depends on the nature of the incident. After the silver meeting, commanders disperse to their own tasks and to fulfil common objectives. In the next silver meeting, they will all provide information discussed as required during the meeting. This information, they might have collected from many sources (bronze commanders, C&C etc.) so that they will be able to brief the whole team about their own agencies tasks.

I18: It depends on the incident but normally we might agree a time so we might, if there's a lot going on and I say right every 15 minutes or every half an hour, if it's a prolonged one where there is not much going on we might say right we will make it every hour. It just depends on the incident and on how busy things are as to how often we have to brief and we will all agree on a time scale

In the silver meeting although each agency has its own aims and objectives, agencies will have a shared aim and objective too which is either directed by the strategic group or jointly made by all. In such situations, 3rd generation activity theory model developed by Engeström (2001, p. 133) can be used to micro-analyse multi-agency team working. As illustrated in Figure 4.14, each agency (for example, police forces, fire and rescue, and ambulance services) will have its own objectives to fulfil. However, they need to work together to fulfil the shared objective (common objective set by gold commanders, which is mostly about saving lives and property).

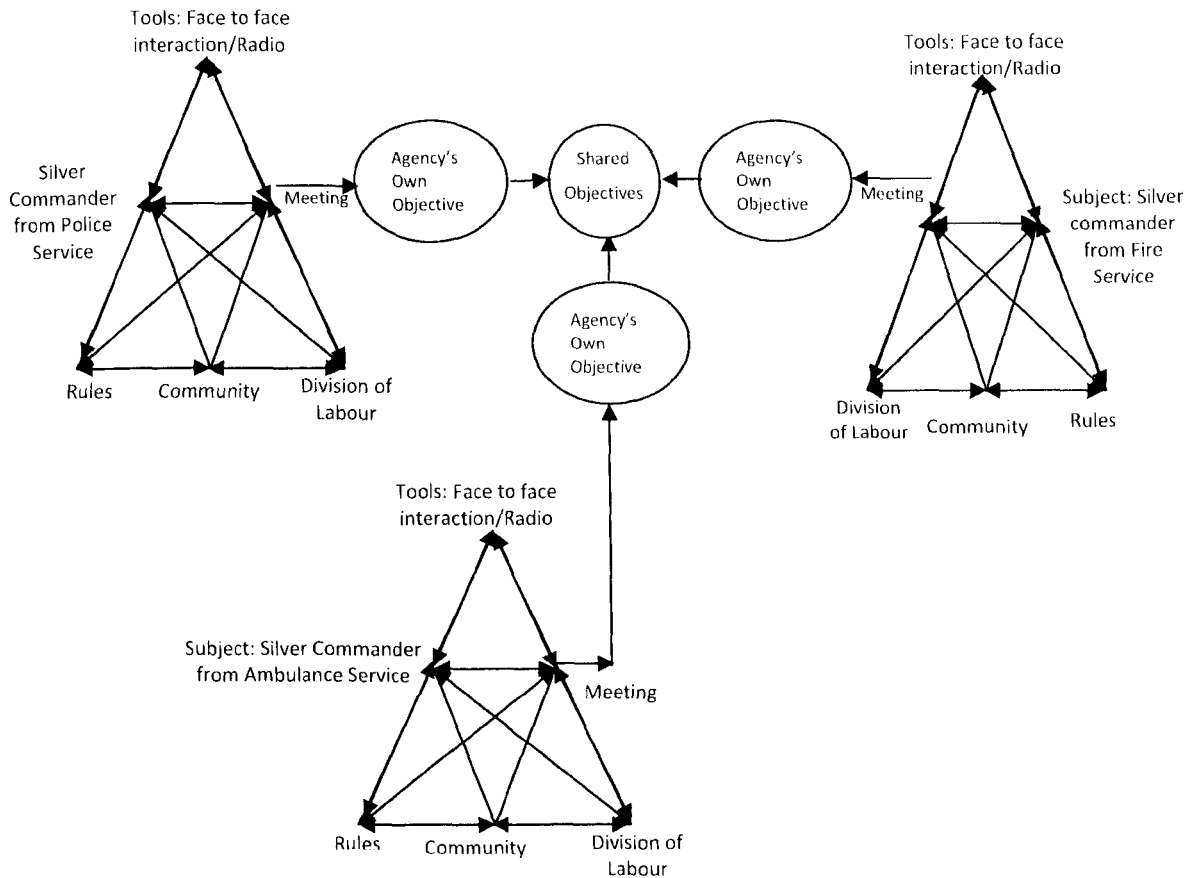


Figure 4.14 Activity system for co-located silver commanders

During the silver meeting, these agencies work together using various mediating tools such as their own intelligence system and resources in order to achieve the shared objective. For micro analysis, and also to make work visible, this activity of silver meeting can be sub-divided into various actions, which will be explained in the following paragraphs.

4.6.1 Action 1: Set Agenda/Terms of Reference

As mentioned above, each agency has its own objectives; however to work together people need to have *common objectives*. Thus, the first task in any silver meeting is to set an agenda or terms of reference (as can be seen in the excerpt by I3), which is targeted towards coordination (as I4 stated). This is illustrated in Figure 4.15.

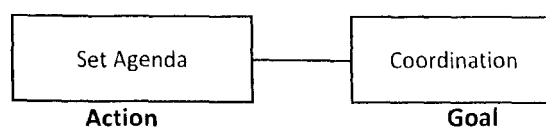


Figure 4.15 Action and goal for setting agenda

I3: In silver, it's very much a- how you are doing- well first of all it is an agenda which is so lay down. We now- where would we like to be, what policies we got to agree etc. Then coming down to process say, fine these are the policies, what will be the strategies and so on.

I4: So, the first meeting of that tactical group will set the terms of reference: fire service- you are responsible for this. Yes! Right- the health, you will be responsible for this. Police, we will be responsible to do this. The company involved, you will do that. The local authority these are your areas. In that way, everybody is absolutely clear what...

As indicated by I4, setting agendas and dividing tasks might aid in coordination so that agencies don't duplicate work

4.6.2 Action 2: Coordinating with Other Agencies

Major incidents are generally multi-agency in nature. Because of the way the information is kept with each agency, it is very difficult for any agency to work individually. The only way to effectively manage the incident is by proper coordination among different agencies involved.

As mentioned in the above section, all agencies in emergency services are inter-related. Thus the motive of this coordination is to help achieving those objectives as stated by I6 and as shown in Figure 4.16.

I6: Our first discussions are to get to know each other, working out what we want to achieve as a group and helping each other to obtain those objectives.

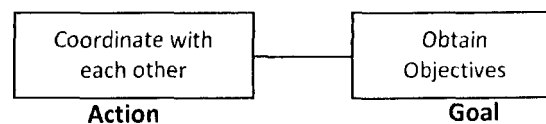


Figure 4.16 Action and goal for coordination

Moreover, as stated by I4, coordination can also help in working in systematic order such that everyone will not end up doing the same thing.

I4: Yes. An unequivocal YES!!! Without it, we would all be doing our own thing. We would not be coordinated approach. One thing that coordinated approach do is very-very best for those who are trying to help. If you don't coordinate, there is a danger that we will all do the same things- other jobs will get messed, get lost.

4.6.3 Action 3: Share Information

During the silver meeting, silver commanders share their analysis of the event which informs the dynamic risk assessment, as stated by I4 and I11. Therefore, the main

goal of sharing information is for the dynamic risk assessment, as shown in Figure 4.17.

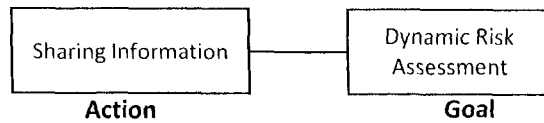


Figure 4.17 Action and goal for updating

I4: We then need to get into the tactical meeting again to get advice from the engineers for what had possibly happened, why it has happened, will it happen again, what can we do to prevent it. So, again it is very detailed dynamic risk assessment, following the change in circumstances

I11: So, the incident commander part of the process is to liaise with the police about what is happening, what is your information, the company or whoever it may be where the incident is. Trying to find out which information ... essentially people getting together and doing the dynamic assessment of the incident at that point

4.6.3.1 Source of Information

As stated by I10, because each agency is responsible for managing only parts of the incident, individual agencies have only a small part of information and may lack the full picture. However, in a multi-agency situation, it is helpful for agencies to share information and build a more complete picture of what is happening so that more informed decisions can be made.

I10: what the fire service can do is to advice the police in terms of the type of hazards on the site.

I18: I will speak to other colleagues in the police and the fire to see if they have got information that my person at the front end may not have been pivotal to and gather as much information from the various sources

I20: I would be extremely nervous and unhappy if I couldn't speak to the police or fire service or whoever else was there. I would want a senior person from the Gas Board there, same with the water, same with electricity or whatever. You have got to have the experts around to make the ultimate decisions that you are making. You are making decisions in isolation then the decisions aren't going to be accurate

4.6.3.2 Tensions and Contradictions

Although it was found that updating silver commanders from different agencies is an important task, silver commanders can find themselves confined if they have more information (excerpt below: I15). A similar type of isolation can happen if they are the coordinator (excerpt I14).

I15: It was a sergeant who was left at the RVP²² at JESCC²³ and if she was aware of it- she didn't share with us....

I14: And, so the sergeant tried to find out what is going on, but this silver inspector was- in charge and had all the fact because he was forward- this was evacuated and we didn't know quite what was going on

Silver commanders should meet at certain regular intervals for the silver meeting. However, a tension is aggravated when a silver commander engages herself/himself in the bronze level and focuses only on bronze level aspects.

I14: So there was a conflict, he saw his role as a bronze officer and he was then dealing with investigation and doing forward role rather than coordinating the activity at top level-

Although the silver meeting is a major part of the effective emergency management, silver commanders may consider this as an "extra job", as stated by I15.

I15: I am not doing my job then(during silver meetings)- I am not focusing on what's going on in the incident and making sure that my bronzes and operational staff are being supported with better equipment and supplies and everything else they need

This is because silver commanders are judged by the work they perform in their own agency. Multi-agency achievements are not examined for the purpose of judging the silver commander. This leads to the commanders thinking more about themselves than about the group.

4.6.4 Action 4: Allocate Tasks

To prevent duplication of efforts amongst silver commanders' task allocation is very important. This also ensures coordination among the commanders; thus the goal of allocating tasks to coordinate among multi-agency emergency services, as shown in Figure 4.18.

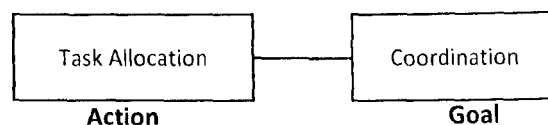


Figure 4.18 Action and goal for task allocation

²² RVP: Rendezvous Point

²³ JESCC stands for Joint Emergency Services Communications Centre

In the following excerpt by I18, it can be seen that each agency was allocated a task each to avoid duplication.

I18: We agreed with the fire service that they would deal with the actual incident on site with the gas cylinder, the police would put the cordon on and control it and we would just be on standby in case anything happened

I7: ensuring what it needs to be done is done. So like cordoning the area somebody needs to be responsible for that. So, it's allocating those kinds of responsibilities.

4.6.4.1 Tension and Contradiction for Lead Role

A silver coordinator's job is not assigned by any rule. The norm, however, is dependent on the nature of the incident. That is the silver commander whose task is more dominating will be the silver coordinator. For instance, during one of the observations, it was found that when there was a flood warning, representatives from the local authority took the lead. When the situation escalated, silver commanders from police took the lead. However, there are situations where tension arises among the commanders, as indicated by I5.

I5: Yes, we would, you would expect a silver commander to assert their authority at the scene and for people to respect that but what we actually got there was almost a fighting over the scene, it was our job, no it's our job...

4.6.5 Action 5: Allocate Resources in Multi-Agency Environment

Resource management becomes very difficult in chaotic situations like major incidents. Depending on the situation, there might be shortages of resources (physical or man power). Effective management of major incidents becomes possible by sharing resources among the agencies.

I11: Well, it's not just about the information. It is also about resources and capability. For an instance, if I have 200 people who need emergency housing, I don't have the resource for that. But the local authority does, so I have the local authority emergency planning officer on my command group.

I8: So I requested further police resources for the cordon We requested the local authority to attend, for a liaison officer

4.6.5.1 Tension and Contradiction for Budget

During the action of allocating resources, it was found that most resources are shared by the agencies. However, the budget is based on an individual agency basis.

I9: Yes, all the decisions we made were joint decisions, subject to the caveat that the agencies didn't share budgets. So they had separate budgets.

There might be situations where a tension may arise regarding the budget. In an observation of a flood scenario, it was found that there was a need for a helicopter; however costs for helicopters are very high. In these situations, the agency that would absorb the cost of the helicopter is unclear.

4.6.6 Action 6: Understand other Agencies and their Culture

Because each organisation has its own culture and working environment, in multi-agency situations it is imperative for silver commanders to understand each other's culture such that they can all work together. This leads to the possibility of thinking ahead and understanding the actions of another agency, as stated by I16.

I16: So, you have to change your approach when dealing with those organisations based on their culture and how their cultural respond to your request... so you build up the relationships

4.6.6.1 Contradictions between Subject and Rules

Several tensions emerged in the analysis. It was found that there is a discrepancy among the subjects and the base location. Silver commanders from police often prefer their own headquarters for the silver location, whereas fire and ambulance prefer to be near the scene. This creates hurdles in the objective of understanding other agencies.

I17: we stayed at the scene and the fire silver was at the scene and ambulance silver was but the police silver ended up going up to gold and just leaving a bronze at the incident scene and that's I think it is the inter-operability of the organisations roles and the police don't understand that ambulance and fire need to be at the scene and not in an office- number of miles away.

The analysis revealed that technology is important especially in the situations where silver commanders are not on the same location. At the same time, it was found that different agencies use different technologies and that poor interoperability mean that in some situations, radio communication was not possible.

I13: All emergency services had Airwave and so did LA (local authority) but environmental agency didn't have

4.6.7 Action 7: Preparation to Brief Gold Command

One of the tasks for silver commander is to prepare update briefing to gold level commanders aka SCG (strategic coordinating group). During silver meetings, commanders need to discuss among themselves what specific things they want to update the gold commander on. As was seen in the observation, silver commanders decide among themselves what additional resources they might need to manage the incident. Because silver commanders may not be in the position to allocate resources, they need to brief SCG about resources they might need. Thus the main goal of this action is to update gold commanders and seek more resources, as shown in Figure 4.19.

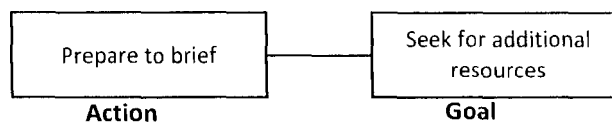


Figure 4.19 Action and goal to prepare for briefing gold

4.6.8 Action 8: Decision of RVP Location

Silver commanders need to decide on a safe rendezvous point, as indicated by I16.

I16: I am looking for proximity which is safe because we don't know, it depends on the nature of hazards we are talking about, but – people got to know where it (RVP) is. But also, having a field in the middle of nowhere

I17: Then we go to ambulance personal and ask/say so where is the ambulances' rendezvous point- where is that going to be.

4.6.9 Action 9: Setting Priorities in Multi-Agency Teams

Once a rendezvous point is set, silver commanders proceed to set priorities. The priorities will depend on the aims and objectives set by gold commanders.

So, that was the important part. Again, silver to get it to say what have we got!! What potentially we could have and then what are the priority issues, how we would get fire to, what are the community issues, we need to have that taken and decide if we need gold or not (I3).

4.6.10 Action 10: Decision on Setting Gold Command

I3: What I think is, deciding whether to expect it from gold or manage by themselves. If they can manage themselves then they've got to set the policies and strategies themselves and decide how many bronzes [it will take to] do the management side of thing I suppose to the individual actions by traffic management really and etc. etc. So, its look at the whole process of getting to the-you know)

In short, the main objective of the silver meeting is to share information among the silver commanders so that they can create a full picture of what is happening. Moreover, because these agencies are working in a multi-agency scenario, it is imperative for them to set common objectives and allocate tasks. This ensures that agencies are not doing the same task and are also not interfering with the tasks allocated.

Another major reason for the silver meeting is for resource sharing. Depending on the size of the incident, each agency may not be always capable of handling the situation; in such situations help can be obtained from other agencies. Moreover, the silver meeting also helps commanders to understand the individual, and the culture of the organisation that individual belongs to. Using activity theory, a few tensions and contradictions emerged, which need to be investigated further.

4.7 Information Practices and Decision Making at Different Stages

Based on the above description, information practices such as information need, information seeking and information use are shown in Table 4.1, Table 4.2 and Table 4.3. Decision making, which is a part of information use, is, however, tabulated in a separate column to highlight the importance of different types of decisions that silver commanders have to make.

4.7.1 Notification Stage and En-Route

Information Practice	Decision Making
<p>Information Seeking</p> <ol style="list-style-type: none"> 1. Information seeking from C&C, Bronze commanders on scene, computer log 2. Media <p>Information Provided:</p> <ol style="list-style-type: none"> 1. Location (Atlas reference number) 2. Nature of incident (for example, fire or road accident) 3. May be further details, such as information on cordon and evacuation 4. Number of casualties, if known 5. Full METHANE or CHALET report 6. If silver is notified later in the incident then the information on RVP is given so that silver commanders can go and immediately talk with commanders from other agencies 	<ol style="list-style-type: none"> 1. Decision of locations near scene or at headquarters 2. Decision is to be made on the number of resources to be sent to the scene (generally it is pre-defined, but depending on the nature of incident, silver commanders will have to make a judgement) 3. Should call other agencies or not (sometimes other agencies will already be informed by the C&C, but if not then it is the decision of the silver commander)

Table 4.1 Information practices and decisions made at Stage 1 and Stage 2

4.7.2 At the Incident Place

Information Practice	Decision Making
<p>Information Need</p> <ol style="list-style-type: none"> 1. Number of staff on scene and their location 2. Information of what staffs are doing 3. What is the risk for public and staff 4. Number of resources on the ground/ or deployed resources <p>Information Seeking</p> <ol style="list-style-type: none"> 1. Information sought from bronze commanders 2. Visual Information (CCTV, sky news, incident scene) 3. Using technologies such as computer logs, radios 4. Log book on the incident place 5. Intelligence group 6. Tactical Advisors 	<ol style="list-style-type: none"> 1. Decision to take over the silver commander's role 2. Setting strategy for own agency 3. Decision of where to take the resources and if more resource is needed 4. Decision of accepting/ using information provided from various sources 5. Prioritizing task- because so many things might be happening, it is necessary to decide which task needs to be solved/tackled with first 6. Decision on welfare of staff and public and property <p>Information Used to decide</p> <ol style="list-style-type: none"> 1. Welfare of staff and public 2. Number of resources required 3. Need of other agencies 4. To complete the log book

Table 4.2 Information practices and decisions made at Stage 3 (incident place)

4.7.3 During the Silver Meeting (Ideal case of co-location)

Information Practice	Decision Making
<p>Information Need</p> <ol style="list-style-type: none"> 1. Common Operating Picture 2. Coordination 3. Dynamic Risk Assessment <p>Information Sharing</p> <ol style="list-style-type: none"> 1. Silver commanders of different agencies however, at this stage, if trusted, silver commanders volunteer to give information 2. Sharing information related to what is happening in their own agency, sharing information that they might have which silver commanders from other agencies might have sought for <p>Information Use</p> <ol style="list-style-type: none"> 1. To make different decisions such as set common goals and objectives 2. Decide on the role of each silver commander silver agencies 3. Availability of resources/ or resources that other agencies can provide 4. Update other silver commanders 	<ol style="list-style-type: none"> 1. Time of silver meetings 2. Silver coordinator 3. Set goals and objectives 4. Role of each silver commander 5. Deciding which information to share (as I11 said, some agencies classify their information, meaning they do not share the information as they consider it to be very confidential) 6. Decision of how to and who will deal with the media 7. Decision of Declaring a Major Incident 8. Decision of Evacuation 9. Decision of having Gold set up 10. Decision of RVP 11. Location of silver meeting 12. Resource Allocation

Table 4.3 Information practices and decisions made at Stage 4 (silver meeting)

4.8 Conclusion

In this chapter, activities performed by the silver commanders were illustrated on a temporal basis. To conclude, as seen in the analysis using activity theory, many contradictions among the components of the activity system emerged. According to Engeström (2001), tensions and contradictions are the main source of transformation and result in the development of the overall system. Contradiction keeps the system unstable but is also a source of innovation. Thus contradictions in the system need to be focused on. In chapter 5 and 7, contradictions related to information use issues specially on information sharing and decision making will be considered.

Chapter 5 Findings: Information Sharing

5.1 Introduction

In section 4.6, activity theory helped to elicit various tensions and contradictions that affect information sharing during silver meetings such as:

- location of silver commanders (as stated in section 4.3.5)
- lack of information sharing due to confidentiality issues
- people may not trust the information if shared using technology due to the inability to see who sent that particular information

These tensions must be addressed in order to understand how emergency services work in multi-agency environments. In this chapter, the contradictions that emerged after using activity theory to analyse the different actions of silver commanders to share information (as stated in 4.6.3.2) will be addressed. In chapter 1, it was identified that a common operating picture is necessary for the emergency responders of multi-agency teams to coordinate. One of the ways in which the common operating picture can be formed is by sharing information. In this chapter, the need for information sharing will be addressed, followed by the issues within information sharing. The factors and components affecting information sharing are:

- personal (such as experience of a person, individual factor)
- organisational (rules and norms),
- social (cultural, language, trust)
- spatial (space, distance between commanders, place of incident),
- temporal (time of the day, concise communication, information on time)
- technological factors (accessibility, familiarity, interoperability)

These issues will be explained in this chapter based on the structure shown in Figure 5.1.

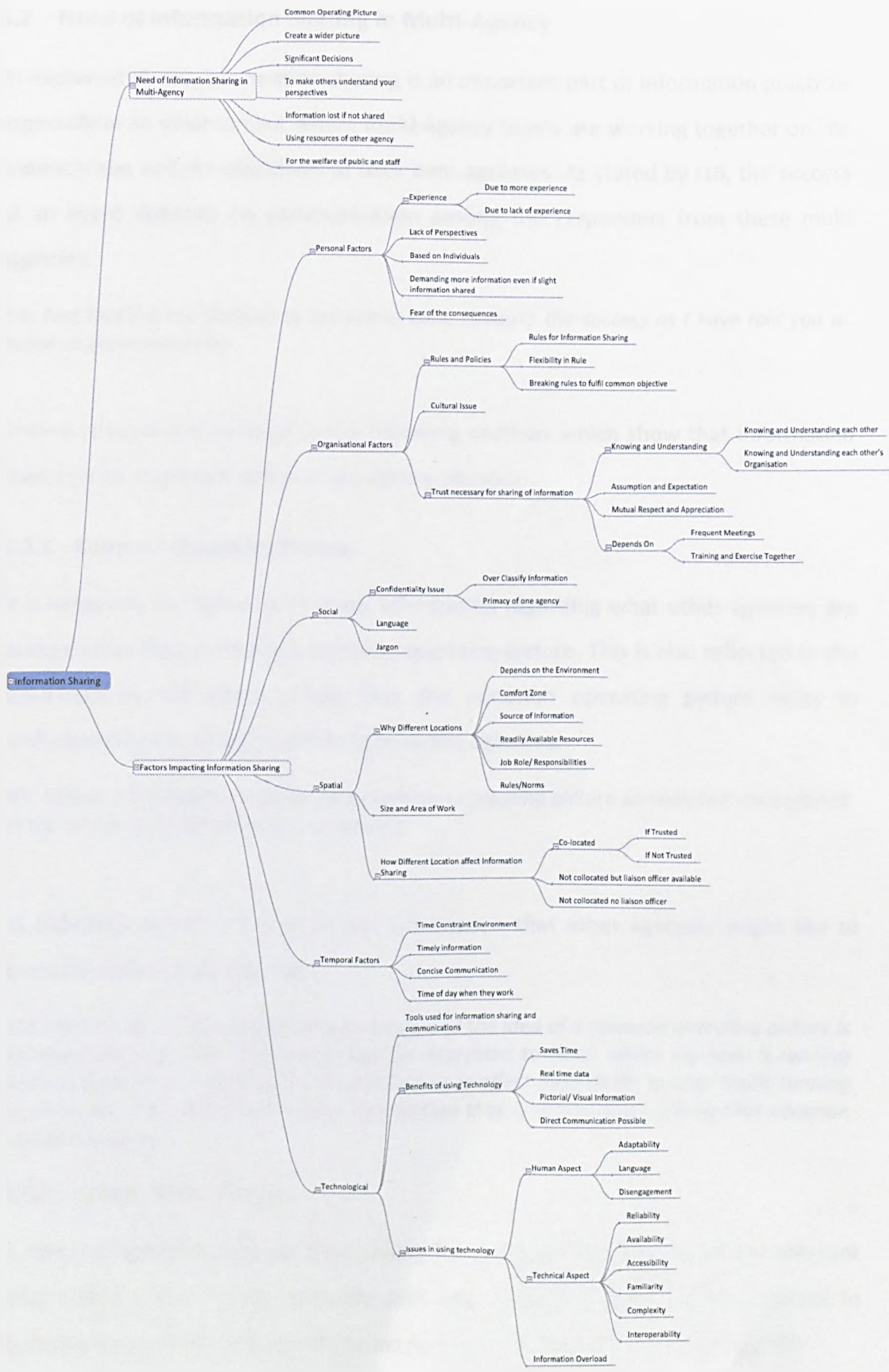


Figure 5.1 Findings: sharing as information use

5.2 Need of Information Sharing in Multi-Agency

As explained above, information sharing is an important part of information practices especially in an environment where multi-agency teams are working together on the common aim and the objectives of their own agencies. As stated by I16, the success of an event depends on communication among the responders from these multi agencies.

I16: And that's a key decision in the whole thing because the success as I have told you is based on communication.

Several reasons are outlined in the following sections which show that information sharing is an important task in multi-agency situation.

5.2.1 Common Operating Picture

It is necessary for agencies to share information regarding what other agencies are doing so that they can have a common operating picture. This is also reflected in the statement by I15 which shows that the common operating picture helps in understanding the situation similarly by all the agencies.

I15: Um, well ultimately it is developing common operating picture so everyone understands as the similar understanding of one incident.

As indicated by I13, there is certain information that other agencies might like to know to process their own task.

I13: Well it's an amalgamation of everything, and the idea of a common operating picture is an important one.... So - the police may be interested to know where my hose is running because if my hose is blocking the road it's going to affect their ability to keep traffic running. So there are elements of everyone's information that is of use and building that common operating picture

5.2.2 Create Wider Picture

A common operating picture is necessary for creating a full picture. All the relevant information is not readily available with one agency for which it is necessary to communicate and share information across multiple-agency, as indicated by I20.

I20: It is sharing of information....You are just seeing a little bit of the picture until you get the whole team together whoever that team may be. Then, that's the point at which you see the full picture.

The need of creating the wider picture is also reflected in the statement by I12.

I12: I might not have considered the evacuation of hospital priority, but fire brigade might be telling me that that is going to happen, for me that is a balance ... you got the wider picture...

5.2.3 Significant Decisions

If a common operating picture is formed among the silver commanders during the silver meeting, they all know what roles they need to perform and where to look for more information. Moreover, they will all have a common understanding of a situation, which helps them in making decisions easily as stated by I20.

I20: we (silver commanders from multi-agency) will make a decision between us on how we actually deal with that until we get the full information.

5.2.4 To Make Others Understand Your Perspective

Because of the limited time available, silver commanders mostly share information in the silver meeting only. This time is used to put forward own perspectives. This helps commanders from other agencies to understand the limitation of each agency and can also help them to understand how much help they can expect from others.

I2: It's about the rules of the game really, the information itself you have got to provide enough so that they understand what your perspective is and they have got to give you enough sometimes,

5.2.5 Information Lost if not shared

Another important reason for sharing information is to preserve the information. A silver commander is made available with different types of information but because of concurrent events happening the commanders may be busy working with other issues and not able to share it. In such a scenario, if the commander does not share information with other commanders, there is a risk of losing that information as indicated by I15.

I15: And this was a concurrent resignation because he didn't come up and didn't share that information. Didn't share that to the people coordinating- that information was lost.

5.2.6 Using Resources of Other Agencies

Another very important reason to share information among the silver commanders is to share/use resources from other agencies. In a major incident, the resources available with one agency may not be enough to handle the incident effectively, in such circumstances; resources of other agencies can be utilised. This is only possible if the concern with resources is shared among the commanders during the silver meeting. For example, the excerpt by I16 shows that fire and rescue services asked ambulance service for a person who can respond to a dangerous situation and go with them inside a building. Thus sharing information about the need can help agencies to get resources from each other.

I16: So, we (fire services) would start question can we get your (ambulance) people that are trained to respond to fires arm situation

Also, as indicated by I15, different agencies have different tools and technologies which can be used to gather information. This helps other agencies to get more information from each other so that a wider picture of what is happening can be formed.

I15: Um, the police and firemen have different intelligence and gathering tools and different networks for the information and the fact that any responder commander has got unique knowledge within that community. And it is only by understanding and sharing that information; we actually get a full picture of what is happening in that environment and within that incidence.

5.2.7 For the Welfare of Public and Staff

The main aim of any emergency service is to save lives and limit damage to property. By sharing information, commanders can get a wider picture of what is happening (as shown in section 5.2.2), this helps in managing the incident. As stated by I17, emergency services need to share information amongst them to protect public and their own staff.

I17: It was in the public interest. If we didn't people could come to harm and that is the bottom line with health, if we don't share the data and don't give the other services the information they may become, they may be at risk and that's what we don't want

I9: When I talked about getting real time intelligence to my staff who were facing the danger on the street that...

The foregoing discussion showed that information sharing is needed by the multi-

agency silver commanders to create a common operating picture, to make significant decisions and for the welfare of the public and response staff. In the next section factors impacting information sharing will be outlined.

5.3 Information Sharing Issues

In this research several factors were identified to affect information sharing. These are outlined below.

5.3.1 Personal Factors

Personal factors were identified as affecting information sharing. During a major incident, silver commanders from each agency assimilate information from their own bronze commanders and their command and control. They then share the information with silver commanders from other agencies during the silver meeting. In these circumstances, due to human error in communicating, information shared may not be accurate. Several consequences are highlighted in this research which makes information sharing difficult due to human factor.

As indicated by I19, information gets changed because there are many people involved along the communication line. I3 highlighted that people may interpret the information differently; I5 adds that information can be exaggerated and enlarged and at times, lead to information missing.

I19: ... that's probably one of the reasons why maybe, communication is probably not as good, if you like because it is going through different people, you know the message gets changed, doesn't it?

I3: I read to you X and you write to me Y.... I send that information to use, as a controller; you then interpret and send it out to the car. The car then interpret it in the size they want to which probably didn't do what you told them to do- and that's where the information flow gets wrong.

I5: Particularly it gets exaggerated and enlarged and sometimes the necessary detail is missing. So I am always a little bit suspicious until I have had chance to confirm it.

I8: it was a case of verbally giving all that information over to someone else coming over and therefore things got missed, inevitably. And you probably couldn't do it in a logical manner, you know

5.3.1.1 Experience

Experience in this research is identified as a factor having great impact on information sharing. If a commander is very experienced then s/he will be overly self-sufficient to

share information. This is because s/he draw largely on his/her own experience. I12 explained that:

I12: if the person is the experienced or familiar with dealing with bigger incidents, the information is very sparse and they tend to become very insular

However, as stated by I16, experience has positive impact on information sharing and not negative impact.

I16: You should verify, check and you know- actually have that conversation with key people. What are the key issues- you need to have a conversation about that and that is where experience kicks in.

On the other hand, if the commander is less-experienced then again difficulty in information sharing arises. For instance, if a commander is not experienced, s/he may not have enough time to share information with others. S/he will be busy reacting to the incident due to which there is difficulty in sharing information with other commanders. In this exemplar by I11, the commander was with a less experienced person so s/he didn't know what was happening due to which s/he was unable to share information.

I11: People who are not experienced in this kind of working may have some difficulty with it. ... But it was quite a learning curve for them. It wasn't a case of them holding the information, just that they didn't understand how everything works ... And they did have problems with the listening information because of that shared holder value

Thus experience in this research is identified as having a mixed influence on information sharing. If a person is experienced s/he might locate key information sources for information. On the other hand, the experienced person can be insular because s/he is able to handle the incident efficiently by himself/herself thus not participating in the information sharing process.

5.3.1.2 Lack of Perspectives

As indicated by I16, because different people have different perceptions the information they think is important may not be important to others but still passed on which may then overload the commanders.

I16: paramedics or fire officers on the ground have their own perceptions of what's going on. Likewise my officers have their own perception- they only have a small perspective on the situation- haven't got the holistic view that you have got and that's when you are getting lot

of information in and lot of them may be misinformation you know, it's not really information it's just its dressed up with information.

Information sharing may become difficult if some commanders have a tendency not to share information, and keep it to themselves. As shown in the excerpt I9, one commander tended not to share information with other agencies but only use it for the welfare of their own staff. This creates difficulties with other commanders as they may not be aware of precautions required for the safety of their own staff too.

I9: No I tended not to share it with other agencies. I think in this operation to be fair I largely used it for my staff to ensure that their work was intelligent and safe but I didn't share it, what we call sharing intelligence with other agencies, no.

Excerpt from I11 shows that there is a tension amongst individuals due to the lack of sharing information. This can also be seen in the statement by I15, which shows that there were commanders who did not share information to other silver commanders though it was major information about the incident.

I11: ... certainly there will be someone who will not share the information, I expect it and challenge them. ... There might be tension, but information is key. You need as much information to make right decision.

I15: And, again that 7/7, there was report of bus crash, but we hadn't had that confirmed by police or fire at that stage and since it was centred theme with that incident.

I9: They might be prepared to share information with you, as a senior officer, but not want me to share it any further so that was always a challenge in that major incident...

5.3.1.3 Demanding More Information even if Little Information Shared

As stated by I19, one of the problems with information sharing is that people tend to ask more and more questions if some initial information is given to them and this leads to a disturbance.

I19: The trouble is, when you do that and they get thirsty for information, you know what I mean, so you tell them a bit and then actually sometimes they get in the way because they start phoning you back asking how many casualties, how long are you going to be, what sort of injuries? And if we had had that information originally we would have told them. You know what I mean; we are not keeping it a secret sort of thing

5.3.1.4 Fear of the Consequences

One of the reasons information may not be shared is because of the concerns about breaching data protection regulations. If a silver commander of one agency share information with the silver commander of another agency, s/he may fear that others

might know that they shared confidential information, which might lead to breaking the data protection law.

I9: I think bits of both. A. It was confidential and B. there was a risk if you shared it, you couldn't be sure that the information would remain secure and it wouldn't get into the wrong hands there are information sharing protocols but professionals, in my experience, still find it difficult to share information with other agencies because they fear that they might be breaking data protection, etc, etc, there might be consequences for them

Thus as can be seen several factors related to individual person and his/her perception impacts information sharing such as demanding more information if little information is shared, lack of perspectives, fear of consequences etc.

5.3.2 Organisational Dimension

Several organisational issues have emerged which affect information sharing as will be discussed in this section.

5.3.2.1 Cultural Issues

Sharing of information depends on the culture of an organisation to which each commander belongs. For example, ambulance services do not tend to share much information because the information they hold is personal information about patients. Similarly, police may not share information because they generally deal with very serious information related to terrorism and major crimes. This is reflected in the excerpt below by I9, I15 and I20.

I9: I mean sharing information is both explicit and implicit in it but if you have got some elements, some of the information sharers ... their culture is not to share information then that becomes quite a challenge and I think that remains a major challenge in major incidents or terrorists in a major crime are an element to it.... I think that the different organisational culture will play a part in that. I think that there are certainly experienced tensions

I15: Um, culturally, it is - I think that a lot of people protect the information because they think they have got an inter-protected or confidentiality whether it is confidentiality for personal information or confidentiality from security perspectives. And for an incident- you know, to manage an incident safely, all the facts need to be known- certainly at the silver level.

I20: I think it is possibly organisational reputation,- it's not wanting to share the full picture really which is a shame

The above excerpts suggest that organisational culture factors surround the confidentiality of information. As was mentioned by I9, it is the culture of some

agencies not to share information.

5.3.2.2 Rules and Policies

In the above section it was highlighted that due to several factors characteristics information sharing may not take place among commanders during a silver meeting. Also, from the analysis in chapter 4, it was found that there is a contradiction in plans and policies. Thus it seems imperative to look further at the rules and policies regarding information sharing to understand the exact information sharing protocols.

5.3.2.2.1 Rules for Information Sharing

As explained by I14, during major incidents, information sharing/exchange is allowable, whereas, I12 stated that for ambulance services, patient information is classified as confidential and is not shared. I15 indicated that there is no formal information sharing policies. The first two statements by I14 and I12 contradict each other and show that rules and policies vary from one agency to another whilst statement by I15 suggests that there are no guidelines. This reveals underlying issues and inconsistencies across agencies.

I15: Um, well it is LESLP defence as joining together and working together but the lesson are formal as far as I am aware, there is no formal information sharing policy

I14: Right, there is a, there is a piece of guideline. Well there's all the legislative controls and it's data protection, there's freedom of information and there is the guidance given by Hannigan and Deloitte but there's also quite a useful piece about exchanging information through the emergency services ... short version is that if you are exchanging information at major event for public safety reasons to save life and property it's a comfortable process, it's allowable. So the constraints are not too onerous when it comes to, when you are dealing with major events.

I12: the sort of policy is that we don't share the confidential patient's information. For example, the police want to get confidential information they need to go through the process to secure that format and they need to specify why they need it and what for.

5.3.2.2.2 Flexibility in Rule

Excerpts below by I4 and I9 indicate that information sharing rules are flexible when it comes to saving lives and properties. Incidents are always unique in nature, it can never be predicted. It is a good practice to make rules and policies by learning from the past. However, because of the unique nature of the context, rules should not be made rigid. In this research it was found that silver commanders do have flexibility in

the rules for information sharing. As indicated below, when welfare of public and properties is concerned, then rules can be made flexible.

I4: I guess that most important thing is data protection act, although having- when it comes to emergency response; the data protection act is quite flexible in allowing people to share sensitive information. If in doing so, people save far more suffering.

I9: It's a civil protection duty to share information if that will help to save lives and protect the public and there are certainly exceptions around information which would damage the national interest, etc. but the presumption is to be in favour of sharing information So there is, in the civil protection arena, following the civil protection act, there is some in favour of sharing information.

5.3.2.2.3 Breaking Rules to Fulfil Common Objectives

While the statements below highlight a level of flexibility amongst the information sharing rules, some statements contradicted this notion of flexibility. For instance, in the above paragraph, it was found that policies are designed to be flexible so that they can be adapted to the unique nature of each event. As indicated by I4, even where rules are set in place, the high-level of trust amongst commanders leads to the neglect of these rules in order to “accomplish the task”. At the same time, if rules are sufficiently flexible then there shouldn't be any breaking of rules or policies.

I4: There is an awful lot of trust whereby you will work with officers across different agencies and once you work with several times, there is awful lot of- well let's do it this way. I know we shouldn't but let's do it this way..... So, there are times certainly when I've been made preview to pieces of information that perhaps the person who is sharing with me was breaking rules of confidentiality. But we have to do- to accomplish the task

5.3.2.3 Trust

Trust plays a significant role in information sharing. If people trust each other then as stated above, people can break rules for sharing information. As stated by I11, silver commanders may not need to ask for information; rather it may be shared readily.

I11: I usually don't have to ask (information) to them (silver commanders from other agencies) because we are all so used to working with each other. It is very rare- you have to actually try and extract the information. It is all usually offered up- we are used to working together so much.

I18: say with the police, say it's a terrorist incident or an incident where there is some secrecy about it because you may know a police officer, better than others, that police officer may give you more information than he should to help you.... because you might have a good working relationship with them, they may pass you more information than they should do because they know that you won't divulge it any further but it will assist me in what I am doing.

If people trust each other, then as indicated by I16, they know where to get the information from, which leads to more direct communication.

I16: I need to have that direct conversation and not Chinese whispers - things get diluted and stuff if they go through the third person- people don't quite get that. Also you don't know whom you talking with on phone, it could be anybody. Will he understand what I am saying?

5.3.2.4 Knowing Each Other and Each Other's Organisations

It was also identified that it is essential for responders to know and understand each other in a multi-agency environment. Moreover, an emerging concept was a requirement of understanding "the home" organisation of members of multi-agency on top of understanding the individuals. These elements of trust as a social factor are delineated below with excerpts.

5.3.2.4.1 Knowing and Understanding Each Other

In multi-agency environment, it was identified that knowing each other helps the commanders build trust as indicated by I17 and I16.

I17: it is having that mutual trust which can only develop after you have known somebody for a while.

I16: because you have knowledge of people, skills and experience and capability, I suppose.

Moreover, as indicated by the excerpt below, people feel comfortable interacting with someone they are familiar with.

I5: you always want to talk to people that you know because there is that element of trust and understanding, there's always a bit of a risk talking to somebody that you don't know

I20: That helps because there's nothing worse than walking into a room and not knowing anybody and then you are then starting from scratch

I18: Early on, if the silvers can all agree what each other is going to be doing, I think that makes the incident run smoother then because you all, you have all got defined areas and you can all understand what you are supposed to be doing.

5.3.2.4.2 Knowing and Understanding Each Other's Organisation

While being familiar with different silver commanders is important for sharing information; it is not the whole picture. As indicated from excerpts below by I2, I3 and I17, it is necessary that silver commanders know and *understand* each other's organisation and culture too. This helps commanders in knowing what other

organisations can provide in terms of resources. It also helps in maintaining their expectations and limitations.

I2: The next stage is understanding your partner agency's mission and purpose so that when the police feel that they have got to put a cordon up or detain someone or get evidence you don't fall out about it. Because you know that is what they have got to do that particular time and it's important to them.

I3: It is effective when people understand each other roles, understands each other's organisations and their limitations.

5.3.2.5 Assumption and Expectation

Knowing each other and each other's organisation is helpful for the commanders in their expectations too. If there is an understanding of the capabilities of the organisation then this helps in setting expectations.

I3: So the presumption that it's up to environmental agency to scan the cloud and tell me what's the smoke content. When they turn around, they will say that: Well we don't have that equipment.

I19: It's knowing what people can, you know people just assume things will happen and it is not always like that

5.3.2.6 Mutual Respect and Appreciation

Adding to the above point of assumption and expectation, it was also identified that mutual respect and appreciation of each other's position and each other's organisation is very important. This is possible only when the multi-agency team member and their organisation are known and understood and trust is developed, as interpreted from the excerpt by I7 and I17.

I7: ... it is about understanding each other's position because what usually makes an effective team is mutual respect between the key players and mutual appreciation of the position of different authorities.

I17: You have got to be a good communicator and they have got to have a knowledge of their organisation but also at the same time, a respect from their organisation because you are asking people to do something which is not normal to be done faster with less resources and in a stressful situation.

A conclusion can be drawn from the above findings that trust is a very important factor which enhances information sharing. It is necessary to understand and know the team members of multi-agency and also each other's organisation so that over expectation can be avoided and mutual respect can be formed. In order to achieve

this, as shown below frequent interaction/meeting and training and exercising together are few important factors.

5.3.2.7 Frequent Meetings

As noted below according to I2, when people meet frequently they start understanding each other which leads to better knowledge of each other and each other's organisation. This in turn strengthens trust among commanders. A similar view is shared by I20 and I17, as shown in the excerpts below.

I2: Yes, that is correct and it is something about just human relations. Your second meeting is always better than your first

I20: Knowing your people, it's very important to know the staff that you are going to be dealing with in those situations and this is as the LRF (Local Resilience Forum) comes, you are meeting these people around the table in ordinary social settings or meeting settings and that sort of thing. So you are getting to know the people that would be your colleagues within a major incident.....

I17: You have already opened the door to them, they know your name and they know that you have got a wicked sense of humour or that sort of thing and that side of things, so it's that communication and that knowledge that you have already built credibility with that person, you don't need to fight your way into it

5.3.2.8 Training and Exercise Together

Training and exercising promotes frequent interaction which is required for understanding and knowing each other. This also gives an idea to the silver commanders about what the other agency can provide to them, thus setting expectations.

I20: and this goes back to our original training, I know then ongoing training under emergency preparedness is that you seek out the senior fire and the senior police person and then you have regular conversations, what can we do to make this scene safer and how do we move the people we have got on the ground, casualties how do we move that on.

I19: It is about knowing what they have got and what their capabilities are and the only way to do that is by training and letting people you know, fire service coming and talking to our lot, police, but we used to do a lot of that, especially in Area27.

Although training and exercise is important for sharing information, as indicated by I4, it is not the only thing. Commanders need to take some time out to understand each other. This reflects an extra effort that commanders need to invest, thus indicating the personal factor within the cultural factor that needs to be improved.

I4: It is not always, going out on an exercise and actually doing physical task. To get people to take time out and sit out and discuss what the organisational requirements and problems are and to get people to understand each other's view point really does help in emergency management.

5.3.3 Social Dimension

Cultural issues, language barriers, confidentiality issues and trust emerged as important social factors that impacted information sharing. These are described below.

5.3.3.1 Confidentiality Issue

There is an issue of confidentiality when information is to be shared. As noted in the excerpt below by I11, I3, silver commanders hesitate in sharing information because they over classify information or when there is primacy of any one agency as will be explained below.

I11: Or, on occasion people may not want to tell you things because they find that it is confidential. As far as they are concerned, they wanna cover with the boxes- and say can I tell these people...

I3: But at the moment, it is very much..... the information we tend to have is all held by us for data protection reasons and not shared.

5.3.3.2 Over Classification of Information

Information obtained by silver commanders needs to be classified based on the importance. However, a problem emerges when as described by I11, commanders over classify information. That is, if they consider information to be very confidential they do not share that information.

I11 : We tend to over classify. So sometimes in the case of the police and the military, they classify information so strongly and they are not able to share it and I think that is not helpful for the combined response. So, I think we need to be very very careful about how we classify the information because the ethos should be we share it.

It is also worthwhile noting here that there is no mandatory rule for information sharing as stated in section 5.3.2.2. Practitioners over classify information and thus hesitate to share it with others. As pointed by I9 in the statement below, no matter what type of information is available with agencies, they should not over classify it and should share the information.

I9: The fact that, you had got elements, that you were working with, that weren't into open sharing of information and that is one of the biggest challenges in any major incident which

has either got a heavy criminal or terrorist element to it, sharing information because you know, it's great for the emergency management

5.3.3.3 Primacy of One Agency

Another factor hindering information sharing is when there is a primacy of one agency during multi-agency incident. For example, if the incident is a big fire, then fire and rescue services will be more involved. However, there is a need of other agencies. In this example of a fire incident, though fire services are mainly responsible for the management of emergency, there is a need for silver commanders from police forces and ambulance services to manage traffic and casualties respectively. However, it was found that if one agency's role is dominant, and if that agency has sufficient information to manage the emergency, the dominant agency may not feel the need of information from other agencies due to which they may not engage in information sharing with others. Nonetheless, silver commanders are required to share information in a silver meeting that is relevant to other agencies too (though there is no rule or rule book for that). Excerpt by I4 shows in most incidents the police service is the primary agency involved.

I4: Often the information is not necessarily shared by people in my position in fire service. But often it is police service trusting people in my position to deal with some information in order to get the job done.

Also as seen in the excerpt below by I15, silver commanders of the agency having the primacy (in this case police) did not share information with other silver commanders. Other silver commanders were not updated about the situation thus they demanded for a silver meeting.

I15: Certainly, we were demanding to speak to this guy for about an hour. You know, we eventually, we did actually demand- in fact it was the fire who demanded the return so we could have proper discussion with them.

5.3.3.4 Language

Each agency usually has its own set of languages or jargons as highlighted by I2.

I2: Well I think within any service, you develop your own language, that maybe sounds too grand but you have your own ways of codifying things.

However in sharing information, jargon can create some difficulties as indicated by I11. Also, I16 added that commanders generally assume that the other person with whom information is shared will understand the language. Thus language can create

a hindrance in sharing information as people may not be able to understand the information being communicated.

I11: People who are not experienced in this kind of working may have some difficulty with it. But it is the case of, you know, get with the program. It's not for all of us to change the language and then change it and get on board with everybody else. They find that very very quickly.

I16: So use of the language when we talk to other agencies is really really important. And one of the things that you need to talk about decision and you are thinking is: never assuming that the other person on the other end of the phone understands the jargon that you are using so, its converting it into um sort of jargon free language as possible

5.3.3.5 Jargon

Different agencies develop their own jargons which may create information sharing barriers. As I2 suggested, people should talk using less jargon so it is easier for people from other agencies to follow what they are saying. However, if training and exercises are done together, then it is often easier to understand people from different agencies.

I2: So, also rules, I suppose minimise jargon, that's the other very common one, you have got to speak in plain terms. Again it is not so much of a problem because the more as we are doing today, working together as you learn the main jargon of the other services as well. But that then tell you that you have got to put effort into doing that in advance and do exercises in advance and even help write

5.3.4 Spatial Dimension

The location of the commanders has a great impact on emergency management due to its impact on information sharing and communications.

It was found that fire and ambulance services prefer to be located near the incident whereas police silver commanders prefer a remote location to command, control and coordinate a major incident. Location of a silver commander may also depend on their own choice. This is further exemplified by the statement from I11, I13.

I11: I prefer all to be together and possibly as close as possible to the incident

I13: At that time, the best place for me would be at the incident to gather information

Furthermore, as stated by I17, some silver commanders, mostly from fire and ambulances, prefer to be near the scene because of the structure in which these services work. From this statement, it can be said that police has more organised

structure in terms of gold, silver and bronzes than other agencies. Thus structure of the organisation also affects location of commanders.

I17: There is a move by the police to actually take us away from scene and put us into police control rooms which from my side of health, it is going to cause us a lot more problems because we need to be at the scene because that is where we manage, even though there's a bronze. Their bronze is forward doing another job, we haven't got- we really need to be at scene, not remote

Several reasons surfaced for the choice of location by silver commanders during management of major incident such as nature of incident, the habit of doing things by commanders themselves and the availability of resources. These will be explained further in the section below.

5.3.4.1 Environment

Silver commanders can decide to be located either at remote places (such as nearby police headquarter) or at the scene. There are no mandatory rules for the location of silver commanders. In some cases, commanders make the decision of their location based on the nature of the incident. If the incident is easier to handle for which being nearby the scene is not that necessary then commander stay away from the scene as indicated by I18.

I18: In that situation, yes (was easier to handle it away from the scene). It was because it was quite a simple incident to deal with, some incidents I feel it is better if the incident commander is actually at the incident ground, then like you say, you can, they can take on, looking at the environment, what they are having to deal with. Rather than having to rely on the bronze commander trying to relay that picture back to them.

The decision to be located away from scene based upon the nature of incident is also supported by the excerpt by I2 which indicates that because of the riots, commanders tend to be located away from the scene. Thus safety of commanders can also be a factor for the silver commanders to be located away from the scene.

I2: The silver was, obviously, not on the scene you know because it is no point going out in to a riot scene so we were working more like the police and working together with the police

5.3.4.2 Comfort Zone

Excerpts show that silver commanders may not be able to resist handling the incident at the operational level. For example, if there is a fire, a silver commander from fire services may have an urge to put off the fire or to rescue someone who might be trapped. However, being at the silver or tactical level, they need to restrain themselves from operating at bronze level as mentioned by the excerpts below.

I14: There is a danger that as much as silvers should be quite tactical and there's always a temptation to drop into the operational arena and to start, you know, moving the chess pieces around the board in a way you probably shouldn't

I16: That's just a sense and my view is that, the other silver commanders tend to be very, almost super-bronzes rather than real silvers because, they then seem to set strategy or plan for things. They just respond and deal whereas we are trying to set up you know, here is strategies,

I3: And then biggest, biggest problem I've got is silver's doing bronze. Gold's doing silver

Moreover, the tendency of being in a comfort zone may hamper the silver meeting process and hence in turn, the whole information sharing process. As stated by I16 in the excerpt below, fire silver appeared very late in silver meetings because s/he was engaged in fighting the fire, which shows that the fire silver was working at a bronze rather than silver level.

I6: That is the forward control group, often than not, the only one who never turned up or is very very late is the fire silver, who is at scene fighting the fire. And we discussed it and discussed it and discussed it in the emergency planning meetings, multi-agency emergency planning meeting and they assured us that it would not happen again and it happened again and again and

5.3.4.3 Source of Information

The choice of being located at different places by silver commanders is also found to be dependent on the sources of information. In a fast moving scenario such as a major incident, information is vital to effective decision making. Thus silver commanders prefer a location where more information is readily available.

I3: At that time, the best place for me would be at the incident to gather information.

I12: I was going to initially the control room to see what the incident was, whether- you get the information in the control room- you can see pictures and – CCTV so you can see what is happening on the platform and they have got screen which shows the information that....

5.3.4.4 Readily Available Resources

Availability of resources is another reason for the silver commanders to choose their location. This again adds to the point made earlier about the source of information because resources also help in getting or gathering information relevant to the incident. As stated by I17, police silver commanders tend to be located at the police control room because they have several resources through which information can be gathered such as CCTV (I6), communication networks (I16).

I17: I'm really concerned over the way in which the police are moving silvers into the police stations. It's alright for them, they have got all the resources for them but the police stations do not accommodate themselves to the fire engine, the ambulance service, the local authority turning up unless they are actually going to put the equipment in for us into those control rooms, it is not going to work.

I6: So, technology is very useful and that's where we tend to have our police control up here, all of the CCTV systems are back to our headquarters across the county.

I16: what we are trying to resolve here and actually, being close doesn't always work for us, because our communication networks – um- so we have to take account of that difference.

Sources of information are easily available for police services in their control room or headquarters as indicated by I19, but this statement also holds true for ambulance and fire services. The main task of the ambulance service is to save and treat injured people; to do this the information they need, can be obtained by being near the scene. Similarly, fire silvers are more concerned with putting out fire and rescue persons; for them being near the scene gives them more information compared to being at some remote place. Thus it can be stated that availability of information leads to the preference of location for silver commanders.

I19: They have got all their technology at their fingertips so it is easier for them

5.3.4.5 Job Role/Responsibility

Nature of job role also affects the location of silver commanders. As illustrated by I13, the police silver commander's job is very wide compared to fire and ambulance silver. Fire and ambulance silver are more concerned with the fire, trapped and injured people or casualties. However, police silver needs to manage the overall emergency such as traffic management, or preserving evidence, which might need them to look

at the wider view. This is possible if the police silver is away from the scene and at police's command and control.

I13: ... it is my understanding that that police officer would have a larger responsibility than just that incident.

I16: they may have talked about flaws where the other two emergency services like to have their forward silvers, if you like, silver command quite close to the venue because the nature of their job, to rescue the people or to deal with casualty, means they want to be there. But for us, we want to be more strategic about, you know,

5.3.4.6 Rules and Norms Concerning Location

Several reasons are found for the location of silver commander which often depends on the nature of incident or availability of resources and information. It thus seems imperative to look further at what the rules say about the location. As seen in the excerpts below, it was found that there is no hard and fast rule for the location of silver commanders.

I13: No, the rules and regulations say that actually if there was a remote silver we may send a fire liaison officer. So the liaison officer may go to a silver commander and as the police silver to get the information but effectively...

I12: Although there (silver commanders) are supposed to report to the control room because that is just standing back from it a little bit.

I14: There is a real tension there because there is, in most of the literature, there is an expectation that police attend scene. If you look at the London emergency services liaison panel, LESLEP panel material it talks about the scene.

I11: I like to be eyes on. And- but I fully understand, that because of the modern requirements for the law being decision making, recording and policy logs and action logs and so on, you need an admin facility- but then you get around that by... The police have the tendency to going back and have the facility at the police station. It is almost the cultural thing.

5.3.4.7 Size and Area of Work

As indicated by I17, information sharing also depends on the people. If the size of the place where the silver commander is positioned is very small, the chances of the silver commander meeting other silver commanders is very high; this leads to building trust which, in turn, increases the chances of information sharing.

I17: Area43 is a small county and we all know each other. So the working relationship is quite nice.... I think if we get expanded more into these regional forces and stuff like the command network, you won't know who you are working with and I think it is very important that we actually have that knowledge and that local knowledge

I16: You can trust them a little bit more- I think that is the benefit of small force. You tend to know who these people are. Again, with the other services, because we are Small County, we tend to work with same fire senior officers. We all sit on the table at various planning

meetings and other things, so we know each other, we start pick up- Name1 I don't know what hell you are talking about.

5.3.4.8 How Different Locations Affect Information Sharing

In the above section, the location of silver commanders was identified to be dependent on various factors such as nature of incident, type of role etc. This difference in the location of silver commander has a great impact on information sharing also. Three scenarios are possible depending on where silver commanders position themselves for the command: (1) they may be collocated, (2) they may be not collocated but a liaison officer may be available, or (3) they may be not collocated and a liaison officer not available. These different situations can impact information sharing which will be addressed in this section.

5.3.4.8.1 Co-located and Trusted

One of the greatest advantages of being co-located is the possibility of face to face interaction. Silver commanders, as indicated by I5 and I15, prefer face-to-face communication wherever possible. Face-to-face interaction also builds personal relationships among the commanders which then lead to more sharing of information.

I15: but they (silver meetings) are irreplaceable. I don't think you can get better- and they are crucial to maintain that awareness and breaking barrier between the organisations whereas, when you are in that that face-to-face link, there's far more chance of sharing that information and what coordinating function.

I5: It's always radio, where it's a big distance and face to face if you can achieve it.

This, in most cases, is the ideal situation. Silver commanders from all agencies might be together near the incident scene. In such a case, face to face interaction is possible during the silver meeting. It is worthwhile to mention here that being co-located only is not the whole solution. Factors such as trust also impact information sharing even though silver commanders are co-located. In the following sections, scenarios such as collocated and trusted; collocated but not trusted will be delineated with excerpts from the data.

If commanders trust each other and are in the same location for silver meeting, then more than information seeking or sharing, information is given voluntarily. An analogy can be drawn between this process and a hotpot concept. Just like in hotpot,

silver commanders state all the information they have. Sometimes, information is also provided in the form of suggestion to other agencies. In the excerpt below, the silver commander puts forward the concern to the fire silver commander regarding the concern over flames that s/he had seen. This also shows that that particular information was given voluntarily. This also helps in providing wider perspective on any individual's task.

I12: If I can see that something can have impact on me, then I will make a decision that- so if I can see- I don't know- a fire, I tell the fire brigade that I can see smoke, I can see flames. And you know they might be dealing with a different scene of the fire so I will tell them what I have seen.... the information that I have to help have made my job better and if it is relevant to other people then I will share that.

5.3.4.8.2 If not Trusted: Trading/Negotiation

I13: ... We were able to negotiate a change to the cordon in that we opened up part of the dual carriageway. So through discussion with the police we actually reached agreement that they could reach their objective and we could maintain some safety at the site

I16: So when and where we are operating multi-agency there is a huge element of trust with that information.. if they thought, I was holding back stuff that endangered their operations, likewise I would try and not to tell

The following excerpt shows that information may not be readily shared by silver commanders because the role of the coordinator in this case seems to be to ask other silver commanders to share the information. It also shows that information sharing is very important but not readily done.

I9: I mean communication was the key to it all and I felt my job right at the centre of all this was to ensure that the information held by one party was communicated to another party who might have need of it. So I saw myself as a bit of a, what's the word, I guess a sort of conductor if you like, ensuring that everyone in this, all the specialist instruments

5.3.5 Temporal Dimension

In this section, the temporal issues highlighted by different interviewees will be delineated. Time constrained environment, time of day for working, concise communication and timely information are found to impact information sharing.

5.3.5.1 Time Constrained Environment

Silver commanders need to work in a very time critical environment. One of the main reasons which accounts for the difficulty in information sharing is due to fast moving situation and time pressure, as indicated by I16.

I16: So communication, no matter what technology we got, there is always going to be human element of communication and whilst that exists will always have the potential for error in fast time command and control situations.

5.3.5.2 Time of Day when Working

As indicated from the excerpt by I19, information sharing depends on the time of the day people work. Emergency personnel need to work at any time of the day, however, it was identified that if people work together at night, they are more receptive and hence information sharing is better.

I19: At night, right, people, for five or six nights, people chilled out they weren't so strict and everything else, they were like, they let their defences down and you got to know people a little bit better, you know, you got to know, got a rapport with them so next time you work with them, you know, oh hello Name17 how are you doing? Alright, what's happened?

5.3.5.3 Concise Communication

As stated in the excerpt below by I2, due to time critical situation, silver commanders need to communicate faster and quicker. However, a balance is needed because if jargons are used (as identified in section 5.3.3.5), it will be difficult for others to understand that particular information

I2: It's about the rules of the game really...recognizing sometimes that concise information can be a little bit bare and sometimes you do need to have a little bit more background or something but there again in a tight time frame you haven't got time for everybody to give you a full story about everything or the decision time has passed.

5.3.5.4 Timely Information

Information needs to be shared quickly to the right people during a silver meeting.

I16: ... who's got that information and how quickly can I get it-

However, as indicated by I11, during emergency situations, commanders may not wait for complete or accurate information. They work with the information that is available to them at that time.

I11: You make a decision with the information you got at that time. It is incomplete, you can choose to wait for some more information but that can be hazardous thing to do. You can't stand around; waiting for 100% information.... you make a decision based on the information you have at that time. If you have time pressure, you may have to proceed with the information you had at that time and pick up later on

5.3.6 Technological Dimension

In this research, the thesis regarding technology was identified to be very important. When silver commanders are not co-located they need different technologies to communicate and share information. Though, silver commanders do appreciate the advantages provided by technology as can be seen in excerpt from I11 and I15, they mentioned that technology is not the whole piece but only a part of solution and an aid.

I11: It (technology) helps. But it is not the whole piece.

I15: Facilitate technology is definitely going to help

In this section, the issue of technology related to information sharing will be investigated further. First, the tools and technologies used by silver commanders will be listed, followed by the benefits of using technology. Problems associated with technology and information sharing will be explained next, followed by the preferable features.

5.3.6.1 Tools used for Sharing Information

Though silver commanders prefer face-to-face communication, as indicated by various excerpts shown below, during situations when they are not collocated, they use different types of technologies such as mobile, radio (VHF/UHF/Tetra Airwave).

I13: That's face-to-face and radio... if we are looking for other ways I gain information, I use VHF radio which is our local radio

I7: that you don't physically be in the same location now but you can have teleconferencing, you can have video conferencing arrangements

I8: the only thing I have got in my own car is an airwave radio terminal and that's it, that's my contact, and a mobile phone obviously.

5.3.6.2 Benefits of using Tools

Several benefits of using technology surfaced such as:

5.3.6.2.1 Save Time

As can be seen from the excerpt by I8, because of technologies such as emails and internet, data transmission is quicker, thus saving time for the silver commanders.

I8: ...then again it is about, you know- the electronic transmission of data is quicker

5.3.6.2.2 Real time data

It was identified that technology is used to achieve real-time data as it facilitates wider picture of what is happening. As indicated by I7, people do not need to keep on guessing and waiting for information as it can be provided immediately.

I7: the chances are you turn the TV and see it on the media. So, in terms of guessing the picture, rather than relying on somebody to describe it to you over the radio or over the telephone, you are actually able to see

5.3.6.2.3 Pictorial/ Visual Information

The real time data is possible by sharing it on telephone or by looking at it in a pictorial form. Silver commanders stated that the importance of using visual information such as CCTV and media has emerged to be very useful.

I8: CCTV and remote camera access which we have got now on our command support vehicle, I could actually see what was happening and a picture paints a thousand words and it does literally, if you can see what's happening it's

I12: we can see the helicopter pictures, we can see transport of Area6 cameras, and we will get- to some degree we will see SKY news as well as they sometimes get advanced news compared to what we know.

I16: I've never run an incident without sky news running because sky you know- constantly given you update information and there is so much published on the internet from people who have taken photograph of the incident on the internet.

5.3.6.2.4 Direct Communication Possible

In the above section of personal factors, it was identified that human factors such as Chinese Whisper leads to error in sharing information. However, it emerged that by using technology such as pager or text messaging, commanders can get information where human factor errors such as 'Chinese whisper' or 'information distortion' can be reduced. As the excerpt by I5 illustrated, direct communication is possible using technology.

I5: Yes, face to face is good but not always possible. The radio now, the radio is the preferred means because you want to be able to talk directly without pulling somebody away from their work. It's always radio, where it's a big distance and face to face if you can achieve it.

Thus technology is found to be useful for the silver commanders. However, there are several issues identified associated with technology which need to be discussed.

5.3.6.3 Issues in using Technology

It was identified that while technology is useful, it can be problematic too. The problems are related to human and technical aspects as delineated below.

5.3.6.3.1 Human Aspect

Human aspects impact use of technologies and thus the sharing of information. As indicated by I19, while the technology (radio) is available with the silver commander, s/he may be busy working on some other task due to which s/he may not pick up the phone thus breaking the communication.

I19: You know, so that you are always in the loop, but you can't make decisions when you are on the phone or the radio and I have seen it happen too many times and this is why communication breaks down..... I'm saying the radios are working but the difference is that silver commander has got the radio in his pocket because he is busy doing things you know and is not answering because he can't hear it.

5.3.6.3.1.1 Adaptability

While investigating the use of technology in information sharing, it was identified that people are not willing to change. Face-to-face communication was preferable over using technology.

I9: Well I tried to communicate, on principle; the main method of communication was face to face because I don't think you can beat face to face communication in terms of getting the message across.

I13: The communication we are already been faced with, is face-to-face communication, we can't accept that it is going to change the way we work in its own right.

5.3.6.3.1.2 Language

As indicated by I16, while using technologies to share information, use of different languages and jargons can impact sharing of information.

I16: And one of things that you need to talk about decision and you are thinking is: never assuming that the other person on the other end of the phone understands the jargon that you are using so, its converting it into um sort of jargon free language as possible.

5.3.6.3.1.3 Disengagement

When technology is used, as stated in above sections, due to the development of different type of technologies, real time data can be obtained in the command room

by silver commanders which as stated by I17 may create the feeling of disengagement.

I17: you might as well be in gold and sitting in a room totally blind to the incident and that is how you feel at the silver currently at a police command centre. You feel blind because you are reliant on the bronze telling you and then you just pass that information to gold, you feel like a communications hub and you could do that from anywhere.

5.3.6.3.2 Technical Aspect

The problems do not only relate to the human aspects but technical aspects also. Several technical reasons emerged for the difficulty in using tools and technologies for information sharing as delineated with examples below.

5.3.6.3.2.1 Reliability

Technology is not found to be reliable by several practitioners being interviewed.

I20: we wouldn't use a mobile phone if possible because the mobile phone system will get possibly overwhelmed and switching off the cells for public use is a last resort really

5.3.6.3.2.2 Availability

When silver commanders are not collocated, they need technology to share information. As pointed by I7, Airwave Radio which is developed for sharing information is available only with Police Forces and not with other services.

I7: They still don't fully have the ability to communicate on the Airwave which is a communication system. ... Police have got it but LA (Local Authority), Ambulance, Fire isn't fully joined at the moment.

5.3.6.3.2.3 Accessibility

As delineated below by I5, technology can be sometimes difficult to access.

I5: I worked in one of the police forces that was, we took the call but the way that the telephony works is that if a call is made on a mobile phone it doesn't always go to the area that the accident has happened in. It goes to the place that gets the best signal. So the call was taken by Area15 Police, the incident was actually in Area20 police area, we all thought it was in Area39

5.3.6.3.2.4 Familiarity

During time critical situations, fast response is expected from the silver commanders. However, if the silver commander is not experienced with a particular technology, they may find it difficult to operate as stated by I12.

I12: The radios can be difficult if you are not familiar with them. So, for other staff who are not familiar with them, sometimes different radios put a lot of channel and say well this is how to contact us- and they struggle with this but for me no, because I am experienced so I don't have problems.

5.3.6.3.2.5 Complexity

The level of technical sophistication and complexity of a technology may also lead to issues in using it. For instance, sometimes, as stated by I2, the technology itself may be difficult to operate.

I2: Now they are not very good and the ones, you know the ones that scan between 3 or 4 channels, they pick up the active ones, you can't really manage an incident on that it is not very good, you pick up fragments and then you keep getting taken from one to another and keep losing bits so what you do is revert back to your channel of choice, right, that then means that you have got to restart the process of finding out what's going on of interest on the other channels and the same kind of thing is going to happen with talk groups

5.3.6.3.2.6 Interoperability

As indicated by I5 and I15, an issue with technology is the lack of compatibility and interoperability. Technology among the multi-agency should be compatible so that information can be shared.

I5: that was the principle source of confusion because information was going into one police force and was needed by another. We didn't have compatible radio channels, we were dealing with three fire brigades, we were dealing with three ambulance services – so I think you can see straight away, not only was there complication of the services not being able to talk to each other but then you had got three times three which made it even worse. Different operating procedures, different expectations, different levels of professionalism and it was quite a challenging experience.

I15: Facilitate technology is definitely going to help but ultimately it needs to be technology that is changeable with partners. You know buying systems that what can isolation because you don't raise issue because it is fantastic, its great but if you can actually take a picture of that and share it with your partners then you have not got a good system and certainly not a common operating picture.

5.3.6.3.2.7 Information Overload

The problem with technology is not only due to the human or technical factors but as stated by I5 and I20, it can also lead to information overload.

I5: Technology? Absolutely, but it has a reverse side in that too much information can come in and it can come in very, very quickly. That's brought about a different skill set, you know not so many years ago you could slow things down but now it's (clicks fingers) telephone, radio, pager, text message, news. Wow.

I20: It (technology) can be a hindrance, because mobile phones are ringing constantly, there's constant updates required from different organisations. You know back at headquarters, back at wherever, media pressures that sort of thing.

5.4 Conclusion

Information sharing is one of the most important information practices in multi-agency scenarios. When people from different agencies meet, they may not know each other; in those situations, sharing information results in obtaining a common operating picture. As explained earlier, it also aids in preserving information. Several factors emerged that affect information sharing such as personal, social, organisational, spatial, technological and temporal.

Analysing the personal factors, experience of a person was found to impact positively and negatively. Experience can help a person in locating information source and making decisions quickly however, as stated above, it can also hinder people from sharing information. Similarly, trust was identified as the most important factor which, if developed, yields voluntary provision of information.

Rules and social norms were another important element of organisational factor impacting information sharing. It emerged from this research that no compulsory rules are applied in the emergency services for sharing information. Due to the flexibility, people classify information which should be avoided.

Social factor such as language barriers are also an important issue that needs to be addressed. It was identified that sharing information depends on the culture of the person and his/her organisation.

Spatial factors such as location of silver commander have vital impact on information sharing. It was identified that face to face interaction is preferred by the silver commanders. However, due to the lack of resources for all agencies at the same place, or due to comfort zone, silver commanders are not always collocated. This results in an appointment of liaison silver commander for sharing information. In some cases, technologies are used to share information when silver commanders are not collocated.

Issues with reliability, availability and accessibility of technology, familiarity, complexity and interoperability are identified to be technical factors that hinder

information sharing. Human aspects, such as not willing to change and adopt new technologies in the work environment can also impact information sharing.

Time factors, such as the time of the day when incident happens (morning, day and night etc.), the timeliness of information and the way information is shared affects the process of information sharing too.

Research findings suggest several factors (POSSTT: physical, organisational, social, spatial, temporal and technological) impacting information sharing. Based upon these findings, information sharing model for ad-hoc multi-agency team can be proposed for time constrained, uncertain and complex environments as shown in Figure 5.2.

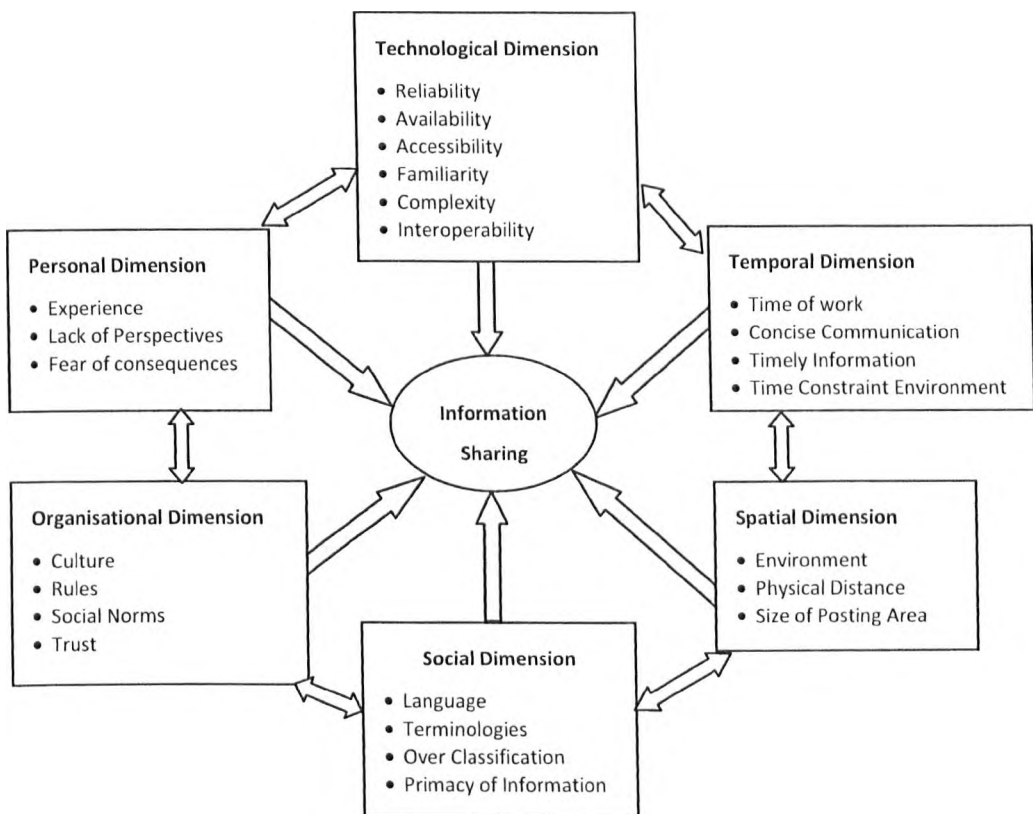


Figure 5.2 Proposed POSSTT model for information sharing in ad-hoc multi-agency team

The POSSTT model summarises the findings of this chapter. The findings suggested that information sharing can be affected by experience of a person. If a person is very experienced, s/he may have enough information to fulfil the objectives of his/her agency due to which s/he may not share information. Difference in perspectives also impacts the sharing of information. Some people may not be involved in sharing information because of the fear of the consequences.

Different organisational factors are found to impact information sharing viz. Culture of the organisation, rules and social norms. Trust is found to be very important for voluntarily sharing information. Trust alone may not be sufficient; people need to understand other agency's organisational culture, and the resources they can provide.

It was found that language, and difference in terminologies act as barriers to information sharing. Sometimes, people may over classify information due to which they may not share information.

Physical distance amongst members of ad-hoc multi-agency team hinders information sharing. In addition, size of the posting area influences the frequency of meeting commanders from different agencies which builds on trust and hence enhances information sharing.

Temporal factors such as time of day, time constrained environment, need of concise information also impact information sharing.

People in multi-agency teams often prefer face-to-face interaction; however technology is used for information sharing when members of the team are geographically dislocated. Various technical issues emerged which impacted upon information sharing such as availability and familiarity with certain technologies. Interoperability among technologies used by different agencies also impacted upon information sharing.

Thus, activity theory illuminated significant tensions and contradictions, and enabled to consider the different contextual factors. Using activity theory, different facets which impact upon information sharing (such as physical, organisational, social, spatial, temporal and technological dimensions) emerged from the interacting activity systems to influence information sharing. However, other approaches such as the constant comparative approach were also used for data analysis purposes. The combination of both approaches provided a potent and effective method for data analysis

Chapter 6 Discussion on Information Sharing

6.1 Introduction

In this chapter the first research question: “What issues influence information sharing during ad-hoc multi-agency team decision making?” will be discussed in the light of findings identified in chapter 5 and drawing upon the literature reviewed in chapter 2.

As stated in literature, section 2.5.1 and the findings in chapter 5, information sharing is identified to be central to multi-agency team coordination. It was also identified in section 2.3 that for holistic understanding of information practices, context should be considered. Literature also suggests that rather than focusing only on information or technology, research should focus on context (Johnson, 2009, p. 596). One of the ways in which context can be studied is by investigating the problem with multifaceted approach (Fisher et al., 2004; Pettigrew, 1999; Savolainen, 2009b). In this research, using activity theory, a POSSTT model (see Figure 6.1), which includes six different dimensions, is proposed for information sharing. This model can be used to understand information sharing within context.

The POSSTT model will be used as a framework to structure the contributions of this research to the current body of knowledge. Some of the findings are identified to be reinforcing existing literature, while some of the findings are novel and need more investigation. In section 6.2, the importance of context will be discussed. Addressing the personal dimension, it was found that experience of the person impacts on information sharing, which will be discussed in section 6.3, along with research gap and contributions of this research. In section 6.4 under the sub-heading of “organisational dimension”, trust and importance of knowing the organisation of members of an ad-hoc multi-agency team will be delineated. In section 6.5, organisation culture issues will be discussed. The difference between “place” and “space” and how this knowledge helps in designing systems will be highlighted in section 6.6 under the sub-heading of “spatial dimension”. In section 6.7, the temporal dimension and its relevance to the extant literature will be explored further, followed by the need of embedded technological and social issues in section 6.8. In section 6.9

main findings that are interesting and worth investigating further are outlined. In section 6.10, contribution of this research will be discussed followed by concluding remarks in section 6.11.

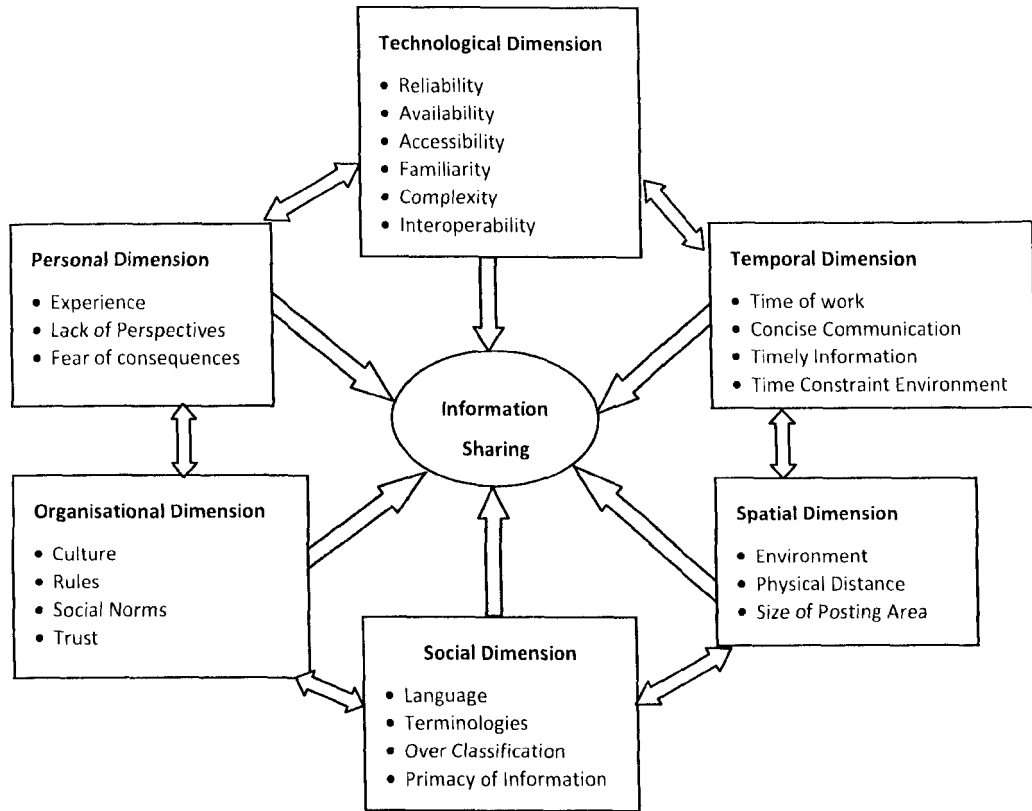


Figure 6.1 The proposed POSSTT model for information sharing in ad-hoc multi-agency team

6.2 Context

In section 2.3, it was identified that context should be studied to understand information practices issues. As Pettigrew et al. (2001, p. 47) stated many earlier models in user centred studies were context independent with the exception of sense-making approach (Dervin & Nilan, 1986) that 'clearly addresses all types of context'. They concluded that beyond the user-centred core, information practices research also 'emphasised the contextual interplay of cognitive, social, cultural, organisational, affective and linguistic factors' (ibid. p.67). However, in information practice research as some studies highlighted, one of the challenges is to 'identify important facets ...and understand how different methods can be best used to research these facets' (Sonnenwald & Iivonen, 1999, p. 429). Several studies have

been undertaken which used multifaceted approaches to study information practices and/or information technology in information science and information system research (McDermott, 1999; Solomon, 2002). McDermott (1999) used technical, personal, management and social dimensions to address information technology issues. Similarly, Solomon (2002) emphasised task, social and technical issues to understand the 'discovery of information in context'. Fidel et al. (2004) used cognitive, task, organisational (teamwork and cultural) dimensions to study collaborative information retrieval. Fisher et al. (2007a) used 'people related, place related and information related' factors to understand information flow and human interaction in everyday life environment. These studies used different frameworks to study multifaceted approaches to context. For example, Fisher et al. (2007) used information ground to understand the context, while Fidel et al. (2004) used cognitive work analysis framework to guide their study.

In this research, however, activity theory has been used as an analytical framework to study context of information sharing as it helps in studying context and has been used by several researchers (Allen et al., 2011; Solomon, 2002). Activity theory provides a holistic view to study different dimensions and has also been used to study various issues related to information and information systems. For example, Cassens and Kofod-Petersen (2006, p. 620) used activity theory to understand context such as environmental, personal, social, task, and spatio-temporal during the investigation of artificial intelligence for system design. Similarly, Engeström (1999, p. 354) used activity theory and different dimensions such as the socio-spatial, temporal and ethical to understand the context in which groups work. Allen et al. (2011) explored the technical and political dimensions to understand information practices. In this research more a holistic view is provided by using many different dimensions such as personal, organisational, social, spatial, temporal and technological to address the issues within information sharing which will be discussed in the following sections.

6.3 Personal Dimension: Experience and other Human Factors

The role of experience has been recognised within the information practice literature as a source of information. For example, Byström and Jarvelin (1995) (see section 2.3.3) stated that information needs depend on the experience and prior knowledge of the person performing the task. Similarly, while investigating the interdisciplinary nature of information behaviour, Wilson (1997, p. 558) cited various literatures from information science and psychology, and stated that, 'highly knowledgeable people may feel less need to search for more information' indicating experience as a source of information. Although the literature explicitly investigates the personal knowledge of people in information seeking, its impact on information sharing has not been investigated in depth. In this research it was found that if a person is experienced enough to manage the incident, s/he may not share information with others. This can be seen in the excerpt by I15 (restated from section 4.6.3.2):

it was a sergeant who was left at the RVP at JESCC and if she was aware of it- she didn't share with us....

On the contrary, Constant et al. (1994, p. 404), stated that with more experience and professional training, people learn the norms of sharing information in an organisation, thus indicating experience has positive impact on information sharing. Their statement is again contradictory to the statement by I12 (stated in section 5.3.1.1). In this statement I12 stated that although commanders might know the norms surrounding sharing information if they have enough information to manage their task effectively, they might not engage in sharing information.

if the person is the experienced or familiar with dealing with bigger incidents, the information is very sparse and they tend to become very insular

This may be attributed to the way information is distributed. For example, Gigone and Hastie (1993) identified that uneven distribution of information within a group leads to bias (see section 2.6). This indicates that if information is available unevenly among the people in a group, then it may affect information sharing.

This research finding (see section 5.3.1.2) also indicated that people at different levels have different perspectives and thus different levels of understanding. As stated by

interviewee 16 below, staff at a control room or the operational commander at the incident place may not be able to understand the information they obtain from the public or commanders at the incident site correctly, due to which the information they may see useful may not be useful to the others, which may delay the process of information sharing.

I16: paramedics or fire officers on the ground have their own perceptions of what's going on. Likewise my officers have their own perception- they only have a small perspective on the situation- haven't got the holistic view that you have got and that's when you are getting lot of information in and lot of them may be misinformation you know, it's not really information it's just its dressed up with information.

Acknowledging the difference in individual perspectives, Sonnenwald (1995, p. 859) added, people need to come to mutual agreements to have work understanding. This view is also shared by Choo et al. (2008) where they stated that individual perspectives affect information practices. In addition to difference in perspectives and personal experience, other human factors that affect information sharing is the information distortion such as “information dilution” and “Chinese whispers” as indicated by I16.

I16: I need to have that direct conversation and not Chinese whispers - things get diluted and stuff if they go through the third person- people don't quite get that

Thus research findings indicate that if people need to exchange (or share) information, then due to human factors information sharing may be affected. Similarly, people getting “thirsty” for information may be another issue in information sharing as highlighted by I19. When certain information is shared with group members, this starts a process whereby more information is demanded.

I19: The trouble is, when you do that and they get thirsty for information, you know what I mean, so you tell them a bit and then actually sometimes they get in the way because they start phoning you back asking how many casualties....

This often de-motivates group members from sharing information. Thus, in addition to the experience of the subject (Byström & Järvelin, 1995) and difference in perspectives (Sonnenwald, 1995, 2006), findings in this thesis suggests that human factors such as distortion in information (Chinese whispers or information dilution) and people's demand to know more even when a little information is shared, impacts information sharing at the personal level. Wilson (1997, p. 557) highlighted some of

the factors that affect information seeking such as, cognitive dissonance, selective exposure, emotional characteristics, educational and knowledge base, and demographic variables, however, information distortion due to “Chinese whisper” or information dilution is underexplored. Similarly, the desire of people wanting to know more when little is shared can impact information sharing vastly, which needs further investigation in information science research.

6.4 Organisational Dimension: Culture, Rules and Trust

Literature highlights information culture as a factor that contributes to the lack of information sharing. For example, Widén-Wulff (2000) stated that some organisations have open culture of sharing information and some have a closed culture. Thus the organisational culture needs to be understood to work in a collaborative manner. Widén-Wulff also acknowledged that to improve any company’s culture, training and teamwork plays an active role (ibid). In this section, factors of organisational context such as the organisation’s culture, rules and regulations (Courtright, 2007) and trust (Doney et al., 1998, p. 601) will be discussed based on the findings in chapter 5 and drawing from the literature.

Knowing the culture of other agencies can also contribute in addressing issues of other agency so that conflict can be minimised across multi-agency. Macintosh-Murray and Choo stated (2002) highlighted the need of considering culture to understand information use and flow. In line with their statement, in this research it was found (see the excerpt by I16 below) that when a multi-agency team needs to work together, if they understand the culture of each other’s organisation, it is easier to work.

I16: you have to change your approach when dealing with those organisations based on their culture and how their culture responds to your request.

Importance of rules is also advocated in the organisational literature. For example, Rosenbaum stated that there is a need to investigate organisational rules as they provide ‘considerable insight into organisational structure that focuses on’ information (Rosenbaum, 1996). In the emergency services in the UK, the Freedom of Information Act (HMSO, 2000) states that during emergency management, to save

lives and property, information sharing is allowable. In spite of that, the findings suggested that some agencies have a culture of not sharing information. This indicates that social norms and organisational cultures influence the rules and regulations too. Organisational rules will be further discussed in section 6.6 and chapter 8.

Furthermore, as illustrated in 4.6 and 5.3.3 and restated below, it was identified that people over-classify information which leads to difficulties in sharing information.

I11: We tend to over classify. So sometimes in the case of the police and the military, they classify information so strongly and they are not able to share it and I think that is not helpful for the combined response

This over-classification is underexplored in information science literature. One of the solutions provided by Atoji et al. (2000, p. 97) is to use computer support systems to classify information according to the rules and regulations.

It can be seen that although the rules do not hinder people from sharing information, due to the organisational culture and over-classification; silver commanders may not share information. However, the findings in section 5.3.2.3 and section 5.3.4.8 highlighted that if people trust each other they may share information. This can be reflected in statement by I11. This finding supports the statement by Doney et al. (1998, p. 601) who stated that, 'trust is a valuable contributor to many forms of exchange'.

I11: I usually don't have to ask (information) to them (silver commanders from other agencies) because we are all so used to working with each other. It is very rare- you have to actually try and extract the information.

For information sharing when Davenport's (1997, p. 87) definition is used as 'the voluntary act of making information available to others', the statement by I11 reflects that when people trust each other then information is shared as people do not have to ask for information and it is provided to them easily.

In addition to trust, personal relationships also facilitate information sharing. Fisher et al. (2007a) in their study of information ground, when asked students 'who they would turn to find something out', the students indicated a preference for people they have strong relationships with. Similar to their finding, in this research it was

identified (as stated by I5) that people may not want to talk to people whom they may not know as indicated by I11.

I5: people always want to talk to people that they (you) know because there is that element of trust and understanding, there's always a bit of a risk talking to somebody that they (you) don't know.

In the extant literature, mutual respect is also stated to be important in addition to trust and good personal relationship. For example, Weick (1993, p. 647) cited Eisenberg who emphasised the need for mutual respect over agreement for collective action. That is, to work as a group, people need to have mutual respect for each other. Findings (section 5.3.2.3) suggest that mutual respect is an important factor that affects information sharing. This is more pronounced in the multi-agency scenario as highlighted by I7:

I7: ... it is about understanding each other's position because what usually makes an effective team is mutual respect between the key players and mutual appreciation of the position of different authorities.

Only knowing each other (personal relationship), having trust and mutual respect for each other is not sufficient, however. As Heide (1989) stated one of the problems in multi-agency emergency management is that 'information needs of other organisations are not understood'. It can be stated from the findings of this thesis (and as stated by I3); team members also need to understand each other's organisation and their work environment as stated by I3.

I3: 'it is effective when people understand each other roles, understands each others' organisations and their limitations'.

The importance of understanding other organisations involved is reiterated by I2 as shown in the excerpt below. It can be seen that because the silver commander (I2) understood the mission of his/her partner (in this case police force) organisation, s/he let the police silver commander put the cordon.

I2: 'the next stage is understanding your partner agency's mission and purpose so that when the police feel that they have got to put a cordon up or detain someone or get evidence you don't fall out about it. Because you know that is what they have got to do that particular time and it's important to them.

Trust is also associated with expectancy in the literature (Doney et al., 1998; Gareth & Jennifer, 1998, p. 532; Mayer, Davis, & Schoorman, 1995). Whitener et al. (1998, p.

513) stated that if people trust each other then they expect each other to act benevolently. They further noted that 'the greater a manager's expectations are concerning an employee's willingness to reciprocate the greater the likelihood will be that the manager will engage in trustworthy behaviour, particularly sharing control and communicating openly' (ibid, p.521). However, in this research (section 5.3.2.5) it was identified that although people trust each other; they should not assume and have a lot of expectations. As stated by I19,

I19: it's knowing what people can, you know people just assume things will happen and it is not always like that

Findings also indicate that if people expect too much or start assuming too much then it leads to misunderstanding which has an adverse effect on trust. Engeström (1999, p. 352) stated that ad-hoc multi-agency working is a "fragile" situation as people within the team need to 'rely on fast accomplishment of intersubjective understanding ... who otherwise have relatively little to do with each other'. When members of a multi-agency emergency services team meet, their motivation is to fulfil their own agency objective. If there is no trust, people may not share information. In this research, similar to Levin and Cross (2004), it was found that trust and understanding should be higher among the members of a team, which then helps in fulfilling the common objectives.

Thus it can be stated that organisational factors such as culture, rules and social norms, trust impact information sharing. In addition, understanding the culture of the other organisations involved and knowing their work environment is also necessary for effective team coordination.

6.5 Social Dimension: Terminology, Confidentiality

In addition to difference in user's perspectives and organisational factors such as trust and culture of different organisations, difference in terminologies and language used may affect information sharing as stated in section 5.3.3. This will be further discussed here.

Literature highlights the importance of terminologies, language and emotions in information sharing. For example, Sonnenwald (2006) in her study of C&C illustrated how some Australian soldiers in a battalion died because the American personnel in

the control room were not able to understand the urgency in the language and tone used in a message sent by their foreign allies. Similarly, Manoj and Baker (2007) identified that language is a major social factor that creates barriers for information sharing among the members of the ad-hoc multi-agency team. Consistent with the findings in the literature, in this thesis it was found that because the commanders participating in silver meetings are from different agencies, terms and terminologies used may not be same which may lead to barriers to understanding each other. This can be illustrated using an excerpt from I3. As I3 stated, the same abbreviation may have different meaning to different agencies.

I3: 'Yes, even they have different terminology. SHA is strategic holding area (for fire and rescue services) or strategic housing authority (for local councils)'

Further illustration can be found in the previous chapter (see section 5.3.3.4). As stated by I2, each agency has its own way of codifying things which may lead to difference in understanding.

I2: Well I think within any service, you develop your own language, that maybe sounds too grand but you have your own ways of codifying things.

To this Sonnenwald (2006) adds misunderstanding emerges from the difference in language which is in line with this thesis finding.

Emergency services need to classify information they obtain (Atoji et al., 2000) to ensure confidentiality of secure information. However, as stated in section 5.3.3.2, some people may not share information because they might over classify. Thus confidentiality and over-classification is also found to hinder information sharing which can be seen in the statement by I15:

I15: Um, culturally, it is - I think that a lot of people protect the information because they think they have got an inter-protected or confidentiality whether it is confidentiality for personal information or confidentiality from security perspectives

Moreover, if the responsibility of one agency is far more than other agencies then the agency with more responsibility may get enough information to handle the incident themselves. As a consequence, they may not share information and become insular. For example, during a terrorist event, police forces are mainly responsible for the management of the incident and in the process they get more information from

intelligence and other sources. In such instances, police silver commanders may not share the information with other agency silver commanders. This finding can, again, be linked with information distribution discussed in earlier section (section 6.3). According to Stasser and Titus (1985) when information is unevenly distributed there is a bias in judgement. This finding is also supported by Mesmer-Magnus and DeChurch (2009) who stated that collectively utilising information resources is central to information sharing. To address this issue, a common information pool must be in place so that agencies may get access to the information from each other. The classification of information is mostly done for patient related information. However it was found that if commanders' trust each other; even highly confidential information is readily shared which again links to the importance of trust identified in the earlier section on organisational issues.

6.6 Spatial Dimension: Distant or Face-to-Face Interaction

The concept of space has been used in several studies that have considered context. For example, Chatman (1999) and Fisher et al. (2007a) used their concept of small world or information ground to investigate information practices issues. However, these studies are limited to the investigation of informal settings of everyday life information seeking. The findings in this thesis add to this by exploring information sharing issues in the work setting in the time constraints, uncertain and complex working environment of ad-hoc multi-agency teams. A further contribution is the distinction between the concept of space and place, which was urged by Fisher et al. (2007).

As stated by I15, commanders often prefer face-to-face interaction as it helps in building trust and sharing information.

I15: they (silver meetings) are irreplaceable. I don't think you can get better- and they are crucial to maintain that awareness and breaking barrier between the organisations

However, co-location may not always be possible and depends on the nature of the incident, job role, availability of resources as shown in 5.3.4.5. In such location distributed cases, commanders use the radio or other communication technologies to interact with each other, as I5 stated,

I5: It's always radio, where it's a big distance and face-to-face if you can achieve it.

In such circumstances, it is necessary for system designers to provide technologies that can provide similar experience as face-to-face interaction. For this, the concept of place within the space whereby commanders can achieve similar experiences even though distant located should be implemented. As seen in section 2.3.1.1, Kolb (2006) differentiated place from space (having no special significance) stating that place is the 'structure of social norms which gives special meaning to movement and actions'. People are located in space but they act in place (Harrison & Dourish, 1996). This difference in the concept of space and place led many researchers to design systems. However, the extant literature (Shami et al., 2011) focuses on the concept of place within the virtual space (by using internet). In this research the focus is not only on the internet or other computing systems as a medium to create place in the virtual space, but also highlights the need to consider voice telephony for providing virtual place in the space. Counts and Fisher (2010) used the information ground concept stated that when mobile messaging service is used, a place is created to exchange information in the informal setting of everyday life.

Literature reveals that components within spatial dimension can include ambient noise. Similar to Fisher et al. (2007) finding that ambient noise affects the information ground, in this research it was found that silver commanders typically work in very noisy environments, which might affect information sharing. In major incidents, the public might gather around the incident place. Police, Fire and Ambulance vehicles may use their sirens when transporting casualties. This may result in difficulty in hearing each other which affects information sharing. As I15 stated;

um, technically I have an instant where it's difficult often to hear because of the fire trucks, the sirens, those commotions, those you know general hubbub, noise of this sort of things- you know people under pressure, they don't hear the full picture.

Olson and Olson (2000) as stated in chapter 2, discussed the issue of distance. They stated that distance affects information sharing, which is also supported by this research's finding. As seen in chapter 5 section 5.3.4, it was found that emergency responders cannot always be co-located. When people are not co-located, information sharing among ad-hoc multi-agency team members is found to be affected. As delineated in the findings chapter, almost all the interviewees spoke in

favour of co-location as it facilitates face-to-face interaction which builds trust and hence leads to direct communication and in turn sharing of information. When commanders are not having face-to-face interaction it was found that either technology or a liaison officer is required for sharing information. The issue is further highlighted when members of the multi-agency team do not know each other. As stated above in section 6.4, if members trust each other then information sharing becomes easier. Co-location provides the environment of frequent face-to-face interaction which facilitates members to know each other and hence to build the trust required for sharing of information.

From the review of literature on information sharing, information exchange or knowledge sharing, Wilson (2010) proposed a relation between trust and proximity. Wilson emphasised that proximity 'is not a geographical concept but a measure of organisational distance'. However, in this research, it is found that proximity, as geographical distance, affects information sharing and thus should be considered as a factor for understanding spatial context while investigating information practices.

Spatial context does not only include physical location but also the size of the area where silver commanders are posted. Wellman (2006) emphasised the individual and his/her social network and concluded that social networks are preferable to group work. The findings suggest that trust is also impacted by the size of area where the silver commander is posted. If a silver commander belongs to a smaller area, the chances of meeting silver commander from other agencies is higher, leading to more frequent interactions which in turn establish personal relationships. Choice of location also depends on the availability of resources. For police silver commanders, most of the resources, such as different kinds of communication technologies, CCTV, media etc. are available in headquarters, so they prefer to be located in headquarters. For silver commanders from fire and ambulance services, the resources, in general, are available near the incident ground. For example, a silver commander from fire service needs to understand scale of the fire which s/he may know by looking around in the environment. Similarly, a silver commander from ambulance service will need to know about the number of casualties which can again be known by being located near the incident scene. Thus, there are variances in the choice of location for silver

commanders. The location of silver meeting is also dependent on the nature of the incident. It was found that the location for silver meeting is at a safe place for the commanders to work. If the incident is very big like big fire or chemical spill in the environment, the location of silver meeting cannot be near the incident place.

From the discussion above it is identified that the spatial dimension is very important which provides wider understanding of the information sharing issues. It was found that silver commanders prefer co-location and face-to-face interaction. However, co-location is not always possible as silver commanders decide their location depending on the resources available and the nature of the incident. However, when co-location is not possible, technologies are used for sharing information. It is thus imperative for the technology developers to design technologies that can provide place in the space where a sense of being together can be felt. At present, literature is restricted to web based technologies or text messaging via mobile devices, but there is an underlying need to develop voice telephony, which can provide place within the space when silver commanders are not co-located.

6.7 Temporal Dimension: Concise Communication

As stated in section 2.3.4 and 6.1, the temporal dimension has not been explicitly studied in the extant literature of information science with the exception of a few researchers (Allen, 2011; Choo, 2009; Savolainen, 2006; Sonnenwald & Pierce, 2000). However, the importance of the temporal dimension is often highlighted in the information systems and emergency management literature (Bharosa et al., 2010). Bharosa et al. (2010) stated that in a disaster situation, information may be *out-dated* i.e. it may be obtained after the decision or action has been taken. Although timely information is necessary, the research findings suggest that under time pressure, because commanders may need to act fast, they may not wait for information. This can be seen in the statement by I11, where s/he stated that

You can't stand around; waiting for 100% information.... you make a decision based on the information you have at that time. If you have time pressure, you may have to proceed with the information you had at that time and pick up later on

Although timely information is better for making effective decisions; emergency responders may not wait for more information to come. Silver commanders may make their decision based on the information available and may change the course of action once new information arrives as will be shown in section 7.6.5. This finding is similar to Weick's (1995) finding where he stated that plausibility rather than accuracy holds true in critical situations. Thus although literature highlights the need for timely information, silver commanders if under time pressure may not wait for timely and accurate information. They make their decision based upon the information available at that time.

Literature often states that if the environment is time critical, then information sharing is affected (Fisher & Kingma, 2001; Rietjens, Verlann, Brocades, & de Boer, 2009). This may be because; due to the lack of time people may not be able to share information. Leckie et al. (1996) stated if information is obtained either too early or too late then the 'impact of the information decreases'. One of the ways to overcome this difficulty may be by providing succinct information. However, Sonnenwald (2006) suggested that "overly succinct" information may lead to misunderstanding and a large volume of information may lead to information overload. Supporting the findings of Sonnenwald, it was found in this research (see section 5.3.5) that concise communication is imperative during information sharing. Silver commanders meet only for a limited period (20 minutes to 40 minutes), thus commanders need to assure that their message is passed to the other silver commanders quickly. They also need to assure that information sharing should not convert into elongated talks as highlighted by I2.

It's about the rules of the game really...recognizing sometimes that concise information can be a little bit bare and sometimes you do need to have a little bit more background or something but there again in a tight time frame you haven't got time for everybody to give you a full story about everything or the decision time has passed

Information sharing is also affected by the time of the day when people work. As was found in this research, section 5.3.5.2, if the incident needs to be managed at night then commanders are found to be relaxed and not working under pressure thus they readily share information as I19 stated.

I19: At night, right, people, for five or six nights, people chilled out they weren't so strict and everything else, they were like, they let their defences down and you got to know people a little bit better, you know, you got to know, got a rapport with them so next time you work with them, you know, oh hello Name17 how are you doing? Alright, what happened?

In short, while timeliness of information is considered important (Bharosa et al., 2010), in this research the findings suggest that people still make decisions with whatever information is at hand rather than waiting for more information. This may be explained on the basis of the public pressure to deal with incidents as fast as possible and the nature of some of incidents, which will be illustrated further in section 7.6.1. Moreover, it was found that although concise communication is investigated in the literature (Sonnenwald, 2006), time of work which also influences information sharing is underexplored.. This adds further insight to the much needed theories in temporal dimension as Pettigrew et al. (2001) highlighted.

6.8 Technological Dimension: Social and Technological Issues

Technology is an important part of information sharing; its use is more pronounced when information sharing takes place among people in geographically separate locations. Yuan et al. (2011, p. 537) stated that when employees of an organisation are distributed then web resources can be used for information seeking. In section 6.5 spatial factors highlighted the significance of technology for information sharing, more so if the responders are not co-located. It was found in section 5.3.6.1 that when silver commanders are not co-located they use different types of technologies such as airwave radio, mobile phone devices, pagers, satellite phones, laptops and other incident management systems for information sharing. However, the literature reveals the unreliability of technology. As Dawes et al. (2004) stated, in the 9/11 World Trade Centre attack communication infrastructure collapsed, due to which people do not consider technology as reliable. Lindell et al. (2002) highlighting unreliability of technology further, stated that emergency personnel still rely on paper maps and documents rather than internet and other web systems. Supporting this statement, in this research, as shown in section 5.3.6.3, interviewees expressed doubts in technology. As I20 stated,

We wouldn't use a mobile phone if possible because the mobile phone system will get possibly overwhelmed and switching off the cells for public use is a last resort really

This research emphasises the need of reliability, interoperability, accessibility, familiarity. These factors need to be addressed by the technology developers and system designers for effective information sharing among the silver commanders. Emergency services spend millions of pounds every year to buy technologies suitable to their use. Thus as identified in this research, technologies won't be useful until and unless they are considered as reliable for the use by the commanders.

Literature emphasises familiarity of technology as frequent use and experience makes it easier to operate technology (Gefen, Karahanna, & Straub, 2003; Lee & Kim, 2009). Olson and Olson (2000, p. 157) indicated, if a technology is used for a longer time period such as 2 to 3 years, then the disadvantage of technology will be adapted to. This is because when people use certain technology for a long time, they get used to that particular technology and hence do not find it difficult to use as I12 stated.

I12: The radios can be difficult if you are not familiar with them. So, for other staff who are not familiar with them, sometimes different radios put a lot of channel and say well this is how to contact us- and they struggle with this but for me no, because I am experienced so I don't have problems.

This research finding in section 5.3.6.3, supports the fact that if people are familiar with technology and if they are able to locate the information, technology aids in information sharing.

Literature also highlights the issue of interoperability between different technologies (Adam, Kozanoglu, Paliwal, & Shafiq, 2007; Chen et al., 2008a; Chen et al., 2007). However many of these literatures addressed web service for interoperability such as information systems model based on XML (Adam et al., 2007; Chen et al., 2008a) or development of architecture (Weiser, 2007).

Different types of information presentation voice (Sonnenwald, 2006), video (Söderholm et al., 2008; Sonnenwald et al., 2008) and text/web based resources (Yuan et al., 2011) have been investigated in extant literature. Supporting, Sonnenwald et al. (2008) finding, in this research, section 5.3.6.2, pictorial

information in particular was found to be very useful. As 18 stated a *picture paints a thousand words*; pictorial information may help commanders in the time constrained environment, it may also reduce the issues with human factor discussed in 6.3 which is urged to be addressed in literature (Chartrand, 1985). Data communication (text/pager/internet) can be very useful to avoid errors due to human factors such as Chinese whispers or information dilution. Clark and Brennan (1991) stated that when information is sent, it is necessary for a person to assure that it is understood correctly. Using text based communication, this may not be necessary, thus saving time. Olson and Olson (2000, p. 160) listed the characteristics of common ground (Clark & Brennan, 1991) to which this advantage of textual data i.e. availability can also be added.

Using technology different trust related factors need to be addressed. Yuan et al. (2011, p. 536) stated that information from unknown sources on the web is less credible and hence interpersonal relationship is more valuable by employees. Kelton et al. (2007, p. 363) urged towards the need of theory for trust in information practices research for the use of internet sources. The analysis shows that in multi-agency environments, if information is provided to the silver commander, via tools and technologies, and by a commander whom they don't know, then the information is taken with more doubt. Thus, when technology is used for information sharing only information from trusted sources may be used.

Literature in the information system studies highlighted the need for a holistic approach to understanding relationship of technology and social systems (Harrison et al., 2007; Orlikowski & Lacono, 2001), however, this feature is underexplored in information science studies. Analysing emergency managed by silver commanders through the lens of activity theory, it can be argued that 'tools' does not only include physical artefacts such as radios, pagers, decision support systems, but also intangible tools such as experience of a commander. In line with this view, Talja and Hansen (2006, p. 126), taking social practice theory guidelines, stated that technology and humans are intertwined and 'mutually shaping'.

Constant et al. (1994, p. 401) added further that when human information sharing takes place, humans decide how much information to share unlike in technological

(computer) information sharing where information is already available. Thus when a colleague does not share information, use of technology should be promoted (Constant et al., 1994). It can also be seen that extant literature has dichotomised information sharing in two different forms: (1) human, and (2) technology (computer/internet/web). However, some technologies such as radio, mobile have not been considered in detail.

There are several advantages of using technology. It was found that when members of the multi-agency team are not co-located, use of technology facilitates direct and faster communication. Olson and Olson (2000, p. 143) also predicted that technology in the future might be better in many ways than face-to-face interaction. Garcia et al. (2006, p. 394) stated two major issues when technology is incorporated into workplace,

- either a wrong choice of technology is made which does not fit the basic requirement or
- its integration in the workforce is not made correctly

Literature highlights mixed views of the use of technology. In this thesis too, different views are identified. Commanders often prefer face-to-face interaction but when they are not co-located then technology needs to be used. Different issues are highlighted in this thesis which needs to be addressed for effective information sharing among ad-hoc multi-agency teams.

6.9 Summary of Findings

The findings emerging from the investigation of the first research question are outlined below:

- I. Personal Factors:
 - a. If personal experience is sufficient to handle an incident, people may not be willing to get involved in information sharing.
 - b. Uneven information distribution is underexplored in the information science research. It was identified that primacy of information with any one agency has an adverse effect on information sharing.
- II. Organisational Factor:

This research supports the literature, which points to the significance trust plays in information sharing. In addition, it was identified in this research that trust alone among people in ad-hoc multi-agency group is not sufficient. People need to understand the culture of other organisations. Understanding the culture of organisations whose members are involved in an ad-hoc multi-agency team will minimise the assumptions and expectations people may have from each other and reduce conflict.

III. Social Factors:

Consistent with the extant literature, in this research difference in language among the multi-agency team was found to have an adverse effect on the information sharing. Similarly, confidentiality (or classification) of information is also found to affect the information sharing.

IV. Spatial Factor:

- a. There is an urge in the literature to study the nomenclature of terms such as space and place (Fisher et al, 2007). This research investigates these concepts further and explicates its need in the system design when information sharing among people at distant places is required.
- b. Few studies have investigated the concept of space (Chatman, 2001; Fisher et al., 2004; Yuan et al., 2011), typically focusing on informal information sharing in everyday life or information sharing within one organisation. The concept of space and place for ad-hoc multi-agency environment is underexplored. Thus the present research fills a gap in the literature of information sharing of ad-hoc multi-agency team.

V. Temporal Factors:

The temporal dimension has been studied explicitly by very few researchers in information science (Allen, 2011; Savolainen, 2006). However as Allen (2011, p. 2168) stated it is 'implicit within most models' (Byström & Järvelin, 1995; Kuhlthau, 1993) of information behaviour. According to Savolainen (2006), for the most part only time as context, time to access source and time to seek information are dealt with in the extant literature. By considering the temporal dimension as another facet to study context, in this research it was found that timeliness of information, need of concise communication and

time of the day are important temporal elements that affect information sharing. However, consideration of *time of day* is underdeveloped in the information science literature.

VI. Technological Issues:

Several technological issues such as familiarity (Lee & Kim, 2009), reliability (Dawes et al., 2004), interoperability (Chen et al., 2008a) have been studied in information science and information systems. However, technology as an embedded system within a social context is highlighted by very few (Orlikowski & Lacono, 2001, p. 126). This concept gives further insight into how society moulds technology to obtain its goals. Moreover, using activity theory as an analytical framework, it has been found that tools used by commanders on the ground are not only the physical tools but intangible tools too such as experience of a person or his/her knowledge about the geographical place. This provides a new insight into the technological dimension which should be considered for technology design.

6.10 Contribution 1: The POSSTT Model for Information Sharing

Literature states the significance of context (Johnson et al., 2006; Pettigrew et al., 2001). As Sonnenwald and Iivonen (1999, p. 429) stated, one of the challenges in information practices research is to identify important facets and methods to study these facets. As stated in section 2.3, this research supports the extant literature (Allen et al., 2011; Solomon, 2002) which suggests activity theory to be an analytical framework to study context. However, these papers have used activity theory with a limited scope in terms of the dimensions considered. For studying context, Allen et al. (2011) explored the technical and political dimensions to understand information practices. Similarly, Solomon (2002) considered task, social and technical issues to investigate how people discover information. In the present research, however, six different contextual dimensions (Personal, Organisational, Social, Spatial, Temporal and Technological) emerged impacting information sharing. Thus a wider understanding and holistic view of information sharing is obtained. One of the contributions of this thesis is the POSSTT model (Figure 6.1) which can be used as a

framework to understand the issues of information sharing in ad-hoc multi-agency team in time constraints, uncertain and complex environments.

6.11 Conclusion

In this research, using activity theory several dimensions are used to study information practices within a context, thus providing deeper analysis compared to the personal dimensions and technological dimensions that Savolainen (2009b) used or social, organisational and technological dimensions that Manoj and Baker (2007) used. In this research information sharing is analysed from physical, organisational, social, spatial, temporal and technological dimensions thus providing a holistic view of information practices.

Analysing information sharing from different dimensions, it was identified that activity theory may be used as an analytical framework to study context. Acquired information may be used as an information source which then may provide sufficient information, due to which commanders may not share information. Supporting the findings in extant literature (Sonnenwald, 2006), it was found that different perspectives may hinder information sharing. Also, human factors (such as Chinese whisper or information dilution) may degrade the quality of information shared.

From the organisations perspective, rules and social norms affect information sharing. Even though rules may restrict the sharing of information, if commanders trust each other they might share information. Thus trust is found to be an important aspect of information sharing thus supporting literature which signifies importance of trust (Chen, Chen, & Chu, 2008b; Doney et al., 1998). In addition to trust, knowing organisations of ad-hoc multi-agency team members also facilitate in information sharing. It helps in reducing expectations and assumptions which may be the cause of team conflict. This aspect is underexplored in information science research and needs to be further investigated.

From the social dimension, the findings support the literature in terms of difference in language as a barrier to information sharing. Also, confidentiality of information impacts information sharing. For this, rules and regulations must be re-visited which

should promote information sharing. Also, information can be pooled together so that primacy of information will not be with one particular agency.

From a spatial dimension, it can be concluded that there is a need to create a virtual place in the space if people are not co-located. Spatial dimension such as size of the work environment and noise also impact information sharing.

Extant literature identified timeliness of information (Bharosa et al., 2010) and concise communication (Sonnenwald, 2006) as important components of temporal dimension. In addition, in this research time of the day was also found to impact information sharing.

When people are distant, technology is very important to share information. Many components of technological dimensions have been discussed in the literature. However, while the need to integrate technological and social aspects is an established topic, system design and human information need is still mismatched. For example, in designing decision support system French et al. (2007) highlighted the overconfidence of humans in technology and not considering social aspects. In this research too, it was found that more than technological problem, social issues need to be addressed first. Different political (rules) issues have been raised by Allen et al. (2011) which need to be addressed.

In short, a model is proposed to address the information sharing issues. Several factors that are underexplored in information science research have been identified in this research which may provide new insights into information practices research. These factors provide fruitful areas for future inquiry.

Chapter 7 Findings in Information Use for Making Decisions

7.1 Introduction

In section 2.5.2.4, it was identified that in emergency services, type 2 (analytical) decision making is often preferred. However, using activity theory as an analytical framework, it was found in section 4.5.3.3 that silver commanders often make their decisions intuitively. Thus there is an underlying tension and contradiction in the way information is used for making decisions by the silver commanders. A difference was identified in the model of decision-making that practitioners use and the theoretical model suggested by the literature, which will be elaborated upon further. A model of how information is used in the decision-making process in time constrained, uncertain and complex environments is proposed. The rest of the chapter is structured as shown in Figure 7.1.

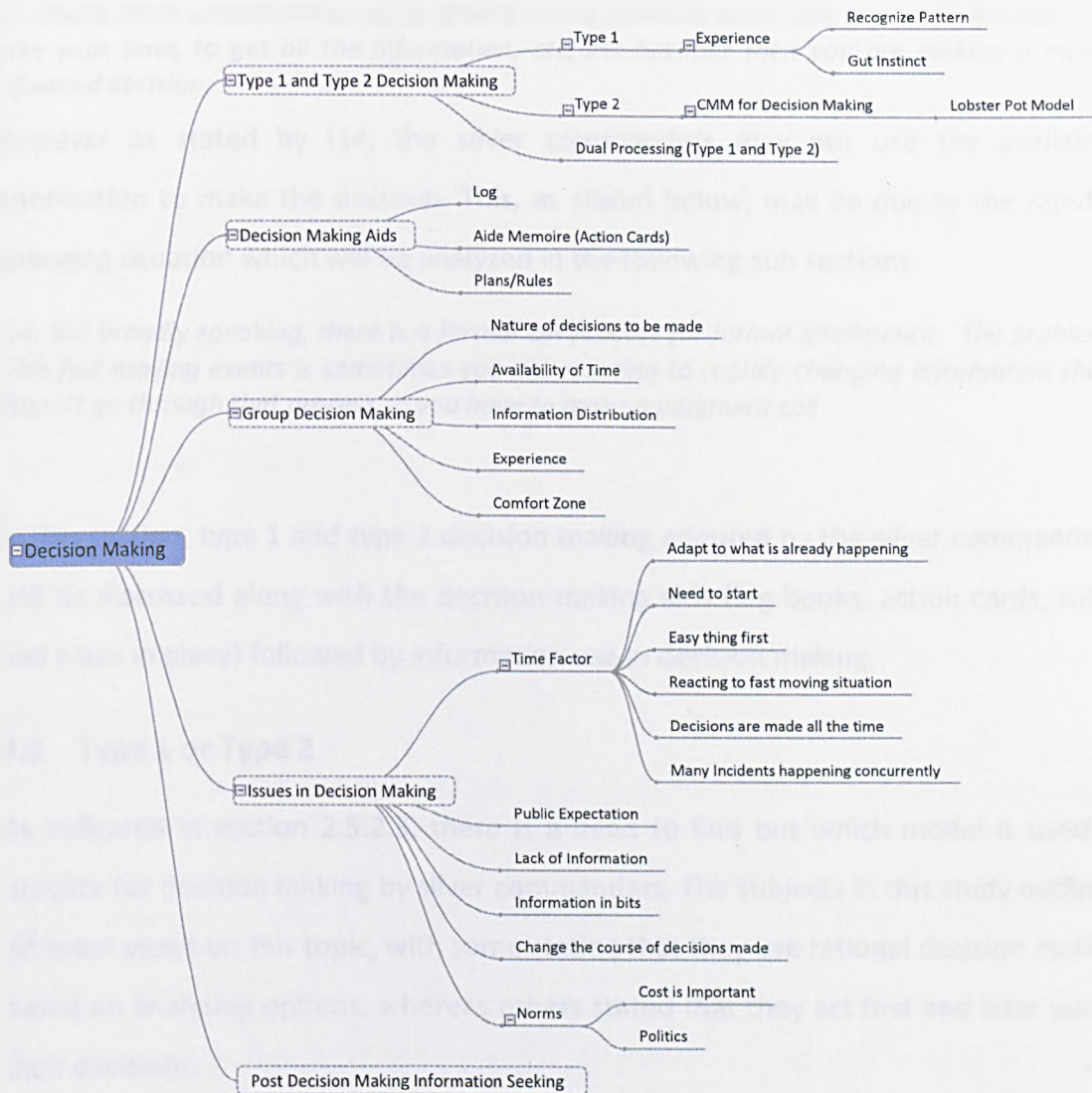


Figure 7.1 Structure of chapter 7

7.2 Decision Making

During a major incident, several decisions are to be made by silver commanders as indicated by I2.

I2: how many safety officers, how long can they work in a particular location before they have to be relieved and they are just operational decisions that are flowing in and out all the time. What kind of reliefs, where are the reliefs coming from, do we need national mutual assistance, if you have got national mutual assistance how is that coordinated, who is going to pay for it. These are the decisions that you are making all the time, minute by minute, what information do you give out to the press, who is in charge of the press releases – that's quite an important one now, because some years ago you would more or less deal with the press later now the press are part of it. Tensions arise around that, all the time.

Especially in emergency management, informed decision making is of the essence as stated by I8.

I8: Ideally, from a commander point of view you are always more comfortable being able to take your time, to get all the information, etc, etc because then you are making a more informed decision.

However as stated by I14, the silver commanders may not use the available information to make the decision. This, as stated below, may be due to the rapidly changing situation which will be analyzed in the following sub sections.

I14: But broadly speaking, there is a formal QA process for formal intelligence. The problem with fast moving events is sometimes you are reacting to rapidly changing information that doesn't go through that process so you have to make a judgment call

In this section, type 1 and type 2 decision making adopted by the silver commanders will be discussed along with the decision making aids (log books, action cards, rules and plans in place) followed by information use in decision making.

7.3 Type 1 or Type 2

As indicated in section 2.5.2.3, there is a need to find out which model is used in practice for decision making by silver commanders. The subjects in this study outlined different views on this topic, with some stating that they use rational decision making based on analysing options, whereas others stated that they act first and later justify their decisions.

Thus, in this research different views were found regarding the decision making process. Decisions are either made by analysing information obtained from various sources or are made without analysing any options or using a combination of both as I16 highlighted. Due to the research interest in decision making, it is imperative to examine in detail the type of decision making used by the silver commanders. In the following section this will be explored using the data collected.

7.3.1 Type 1

The excerpt below, by interviewee I16, shows that a silver commander had to make a decision within three seconds. Although it did not take a long time for the silver commander to decide s/he did think of the impact the decision will have on other people.

I16: A man and a girl kidnapped, taken to a hotel room. It was necessary to raid all the rooms that was checked in around the same time as those kidnapers but then public prestige-so decision was made.... in 3 seconds

7.3.1.1 Experience

It was identified in this research that decision making is closely associated with experience.

I17: because in those first ten minutes, you know what you need to do, you are so rehearsed at it

7.3.1.2 Recognise Pattern

Pattern recognition is also found to be used in making decisions by the silver commanders. If a silver commander is experienced then s/he may try to match the work with his/her previous work and then opt for similar type of decisions as was stated by I5 and I17.

I5: Once we had established that resources were going to the scene, I was able to recognise that one of the key processes that would follow would be a casualty bureau

I17: the more experienced silvers have probably been through ... I didn't ring the tactical advisor because I had done a few of them in my past so I knew what I needed to do

7.3.1.3 Gut Instinct

The statement below by I7 suggests that due to incomplete information or lack of information, a wider picture of what is happening may be not possible, thus decisions lack holistic view. In such situations, gut instinct might be used as commanders cannot wait for complete information which can aid in obtaining the full picture of what is happening.

I7: Generally I say that the decisions is 80% right. It is better than no decision. So sometime, it comes down to gut instinct and say that my experience says this is the right thing to do in this situation. I think it depends on the nature of decisions that needs to be taken. If it is a decision that is not necessarily life threatening, then that would be a strategy to make.

As seen from above discussion, silver commanders may not analyse options before making a decision. Several reasons are outlined above such as the lack of sufficient time, experience of silver commander which results in quick judgment of the situation or the lack of complete picture due to which gut instinct needs to be used. However, this has not been shown in the model used by the practitioners. Thus a model which

considers the practical working situation of silver commanders and utilises type 1 decision making can be drawn as shown in the Figure 7.2 below.

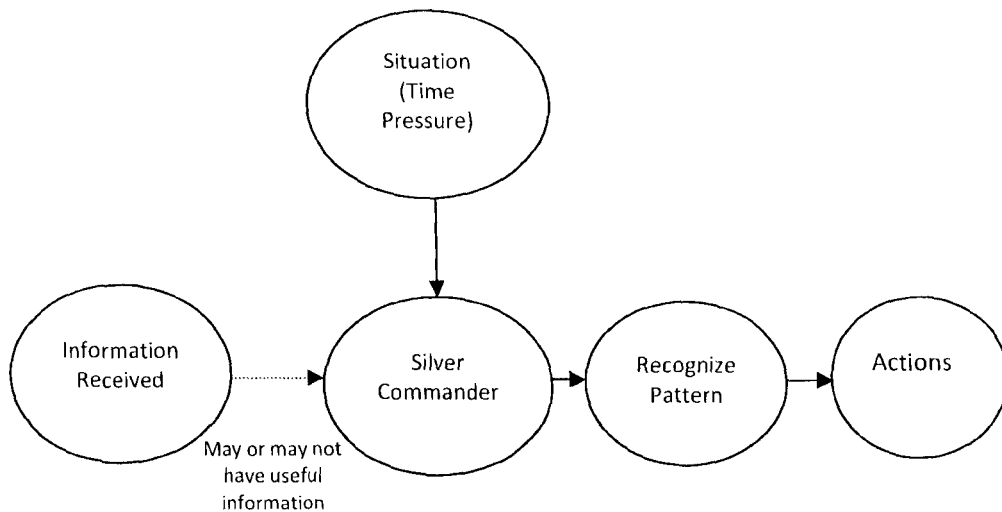


Figure 7.2 Process followed by silver commanders (contradicting CMM model)

7.3.2 Type 2

Analysis of the interviewed data also outlined the use of type 2 decision making. The statement below by I5 highlights that s/he analyses few options before making decisions.

I5: I like to try and think, I think that I look at alternatives, everybody wants a snap decision but I want time, I don't want to shoot from the hip, I want time to think. At least of one or two or three options, every time!

7.3.2.1 Conflict Management Model

It was identified from the literature that Conflict Management Model (CMM) is used as a framework for making decisions. The excerpt below by I17 is consistent with the conflict management model in which a silver commander analyses all the options and does the threat assessment of each option available.

I17. I then have to do the other options and there's a gold standard there's a silver standard and a bronze standard and which way have I got the resources to staff that. So if I have got a no option, I do nothing I need to say, that will cause death, if I go for bronze it might cause death, if I go for silver it will stop it but in three hours I am going to have to put more resources in and if I go gold I may say if I go gold on this one it will cause that other problem here so I am going for the silver and I will staff that other problem in three hours and that is how I need to justify things.

However, reflecting on the statement by I5 it can be interpreted that commanders are not following the model for decision making.

I5: We are concerned that not many people use it (CMM model) - they should be using it. It's there, it's for that purpose and we should consciously work through it.

7.3.2.2 Lobster Pot Decision Making Model

As I4 and I7 illustrated below, a “lobster pot model” aids in decision making as commanders get aware of possible options and then can choose the most suitable option.

I4: call it the lobster pot model. You know, when we sort of brainstorm what's going on and what our tactics might be, we get all sort of creative possibilities thrown our way. Somewhat-then the decisions come, we got to take those probably dozens of creative possibilities and refine them down to some feasible options that might work. And that we have to have resource to make them work. And from that then we have to say, OK, there are the three feasible options, knock one out so we are left with the choice. And that's how it is done ... we come out with one option that we go for.

I7: ... so basically you come down to this model, we just call this the Lobster model of decision making. So the first of all you know, nothing draw out-nothing draw in, we just say IDEAS-and that is where you come with all these ideas, you refine them and come with 2 out of 5 and – you say that it could be time consuming process, but it's not, that can happen very quickly.

This statement by I7 suggests that even type 2 decision making can be faster.

7.3.3 Dual Processing

From the discussion above, it was identified that the type of decision making adopted by silver commander varied between type 1 and type 2. However, as was stated by I17, it was identified that both types can be used at the same time.

I17: No, I try and do that at the same time.

Similarly, I19 expressed his/her view stating that the type of decision making can be either type 1 or type 2 depending on the situation.

I19: I think there's a bit of both but I think it depends, I mean there is a lot of pressure on you to make decisions sometimes and they have to be made quickly and sometimes you are going to make wrong decisions but I do think that people will act first and think afterwards, sometimes. It's difficult to say because it depends on what situation doesn't it?

The statement by I6 below illustrates that to some extent type 2 decision making is used and then the experience and knowledge and feeling kicks in. Therefore, both types can be used in making decision.

I6: There is a lot of information that you can't actually verify for yourself but going through a series of questions, you can actually drill it down, then I suppose you get it down to a judgement call. And, you will never find the situation where it is 100% correct or 100% wrong, there will be position between that based upon- your knowledge, your experience, your feelings for this type of incident, you will make decision one way or other.

According to the statement below by I14, due to experience, commanders are aware of the possible options due to which analysing options can become a sub-conscious process or an operation hence the formal CMM model may not be used but it is enacted.

I14: What's happening is because of your experience you are by passing the formal process but it is running sub-consciously behind everything else. So, you know, it's got what your legislation says, what are your options, you know, through that cycle, you are aware of what legislation says or you are seeking advice on it It's a sub-programme that is running behind your decision making, you are actually doing that without consciously ticking the boxes and saying does that, does that, does that because actually you are running those things behind

Thus, it can be identified that several views are presented by the participants on the type of decision making used. Some use type 2 (which is also encouraged by the policy makers), some use type 1 (if information is lacking or if the commander is more experienced) and some use a combination of type 1 and type 2 decision making.

In the statement below by I16, it can be seen that even after analysing the options for 5 to 10 minutes, the silver commander made his/her decision intuitively.

I16: but I took that decision with probably 5 to 10 minutes to think about, the various options. Of course this is all happening so fast time because, not only we got the murder investigation, we got her being rapped, we got the guy who was the other man being separated and he didn't know that he is going to be killed- so trying to make decisions about all those sort of things at the same time. So stretched in terms of my thinking, but I said yes GO. You set them off and then you sat and say, I hope that was right- a right decision. And then you have to write what happened and justify why you went through

7.4 Decision Making Aids

Although decisions are found to be made retrospectively, a few methods such as log books and aides memoire were found to be helpful to the silver commanders to analyse the option as delineated below.

7.4.1 Log

As stated by I17, because the log book is scrutinised by the debrief committee after the incident, commanders analyse the information seriously and fill the log.

I17: those action logs are noted because we know that we will be called to account why I had done that. Well actually at the time I had been told by and had the reasons and I chose C because and that is one of the main things and I do the notes as I am doing them or if I have a loggist who will do the notes for me.

A log book can also be used as the justification for the commanders as they write on what account the decision was made as stated by I18 and I19.

I18: or get a bit of information before I make that decision, I will try and do that. If I haven't got the time to make the decision then I will make it on what information I already have and I will log that to, so that in any subsequent enquiry or de-brief I can say well I did make that decision but it was on the back up I hadn't got any time to make any relevant information so the information I already had

I19: the information is always incomplete but you know as long as it's logged- you made the decision on the information you had at that time

However, as stated by I14 it was identified that log books are not always used for making decisions based on type 2 by analysing options but it can be helpful in making retrospective decisions.

I14: absolutely yes, you will make an intuitive decision and then in retrospect you will justify that decision and funny enough I think the decision logs encourage that

Generally, silver commanders fill the log book themselves due to which they prefer to act first and then make the decision. However, if a "loggist" is appointed to log the actions commanders will then stick to type 2 decision making as stated by I20.

I20: There used to be but in today's world no, you make a decision, you stick by the decision until it is proved to be either right or wrong. If it is wrong change it, it's logged, all our commanders now have a loggist sat by their side. The loggist is somebody who writes everything that is happening, so there is no real, there's no way of doing something without it actually being written down now

7.4.2 Action Cards

Action cards are provided to the silver commanders stating the major duties to be performed such as to establish emergency control room, to ensure that staff members are delegated to deal with the major incident, important contact numbers etc. This helps the silver commanders to make decisions. However, the action card does not have more than the basic tasks of managing the crew

I17: we do have a folder when you are on call with action and aide memoirs in so that's what you use.

I18: So they are the things I'm thinking about and we have a checklist that we have, that managers carry so obviously things are down so we can go along and start ticking, have I thought of that, yes done that, right what's the next one, done that oh I need to look at that and so on.

7.4.3 Plans/Rules

Plans and policies are helpful to the silver commanders in managing the incident as indicated by I2. However, because the incidents are fast moving, as stated by I20, commanders may not have time to follow the rules; they may be reacting to the situation.

I2: When you are fighting fires and you are trying to prevent an explosion you obviously have got to have plans in your mind for if you fail and if the explosion occurs. You know, in terms of placing your people and equipment and those from other services as well, getting this information into the other services so that they have got the same awareness as you have, they are all tactical immediate decisions.

I20: so, you know, we follow the rules really but having said that we react to the situation and the situation actually dictates how we move forward

However as indicated by I8, rules and plans are not considered seriously by the silver commanders. If in the debriefing process silver commanders can justify themselves, the system at the moment does not account for other details.

I8: if you can justify it (decisions) afterwards then you can more or less do whatever you think is right no matter what your policies and procedures say but it has to be justifiable and a lot will depend on the outcome of the incident. If it is a successful outcome, people are not that bothered, if it's not then everyone wants to get hold of you. Absolutely!

It was also identified that silver commanders may not stick to the rules because of the need to act fast.

15: You make that decision because you know that families want information, I don't feel it is right to sit back and not brief the press, knowing that that is going to brief families because a Chief Officer should do it. I'm there, I know, I'm confident, I'm capable. I'm going to do it because information gets out more quickly

7.5 Group Decision Making

In chapter 4, it was identified that silver commanders make their decision either by seeking advice from the advisors provided to them or in isolation by themselves. Silver commanders can also seek advice from the gold commander if needed. Moreover, in the silver meeting, tactical commanders engage in group decision making. Thus it seems imperative to look at how decisions are made, who is involved and what factors affect decision making.

16: Because they were there when the intelligence came in and I wasn't hiding anything from anybody. But I made a judgment to say, I can't speak or verify how good that intelligence is, but if it is in that good to divert a transit of flight, and it is that good to suggest the device on board or device beyond the board, I am now not going to abandon this operation half way through, are you happy with my decision? They were happy, he was on the phone to Area50, they were happy- and also my chief was happy so basically, forward through the operation.

Decisions are not made by silver commanders alone. Sometimes, tactical advisors are available who can suggest in making decisions as they can provide further information which aids decision making as stated by I4. Similarly, as I2 pointed, there are incidents which involves other agencies or incidents in which information from other agencies is required; in such cases, advice needs to be sought from other agencies.

14: you have your own tactical advisors and you listen to their advice and you listen to the options that they offer you and if you are wise, you have a critical friend, who will say these are the two options; this is the one I fancy, would you agree. And if they say no, and if they make a good agreement, then they can probably change your mind. So, I think one person has to sign off on the decision but I think it will be a foolish one at silver/tactical level to have not thought of all the advice to start with.

12: Very often seeking advice and any information to assemble your own picture as to how things should work, particularly if it is an usual incident particularly if it is a hazardous site, chemical site, things like this; advice from specialists, has to be taken into account before you decide whether it is safe to commit to certain areas or whether certain objectives are achievable.

7.5.1 Issues in Group Decision Making

In the above section it was identified that decisions when made by consulting other commanders or tactical commanders improve. However several factors hinder the

process of consulting others for decision making as will be discussed in the section below.

7.5.1.1 Nature of Decision Made

As indicated by I12 and I7, consulting other people in the decision making process depends on the nature of the decision to be made. If the decision is solely about a particular agency, then information may not be sought for from others.

I12: If it is about patient care, then I would make that decision myself except if safety is concerned in conjunction with police and fire. And if there is a hazard then definitely take advice from the fire so it depends on the incident and sometimes we make decision on our own and say that- convey that to the senior managers and say that we have done this for these reasons but if we need advice because it is not safe or because something happened or because it is unusual and outside our remit then we seek the specialist advice when we feel necessary.

I7: I think it depends on the nature of decisions that needs to be taken. If it is a decision that is not necessarily life threatening, then that would be a strategy to make

7.5.1.2 Availability of Time

It depends on availability of time too. As I18 described, when time is available, suggestion or advice can be taken from others, whereas when time is critical, silver commanders make decision by themselves.

I18: It depends on whether it is time critical as to how much time we have actually got. If I have got time to ask somebody their advice or get a bit of information before I make that decision, I will try and do that. If I haven't got the time to make the decision then I will make it on what information I already have

However as pointed by I2, silver commanders do have some time to analyse the options. This excerpt also shows that although silver commanders have some time before making decisions they generally opt for intuitive type of decision making.

I2: You have got to be conscious of what discretionary time you have got for your decision because not all decisions have got to be made instantly, if they have to be they probably have been already at that level. So by definition at silver level you have got some discretionary time

7.5.1.3 Experience

From the excerpt shown below, it can be suggested that although tactical advisors are available, experienced people do not seek advice from others.

I17: But then again, the more experienced silvers have probably been through the mill a few times and dealt with that sort of incident. For example, that one over the cylinders, I didn't ring the tactical advisor because I had done a few of them in my past so I knew what I needed

to do. I had done the training and done all the other sides of things so I knew what I needed to do and I did it

I7: The chances are you have taken appropriate advice from the people with the knowledge and expertise to arrive on that- that is going to be the best decision.

Thus it can be seen that although silver commanders may benefit from consulting others for decision making due to the fast moving situations, lack of time and experience, they may not seek advice from others and may make decisions on their own.

7.5.1.4 Comfort Zone

Group decision making can also be hindered when silver commanders start acting like bronze commanders. This may be because silver commanders who get promoted from bronze commanders feel comfortable doing the operational level job as indicated by I14, I16 and I6. If a house is on fire, silver commander might be tempted to put the fire off which is an operational level job. However, the duty of silver commander is to keep them away from the operational job and concentrate on the tactical level.

I14: There is a danger that as much as silvers should be quite tactical and there's always a temptation to drop into the operational arena and to start, you know, moving the chess pieces around the board in a way you probably shouldn't

I16: the other silver commanders tend to be very, almost super-bronzes rather than real silvers because, they then seem to set strategy or plan for things. They just respond and deal whereas we are trying to set up you know, here is strategies,

I6: That is the forward control group, often than not, the only one who never turned up or is very very late is the fire silver, who is at scene fighting the fire. And we discussed it and discussed it and discussed it in the emergency planning meetings, multi-agency emergency planning meeting and they assured us that it would not happen again and it happened again and again.

From the discussions above, group decision making during time constrained, uncertain and complex environment is as shown in Figure 7.3 below.

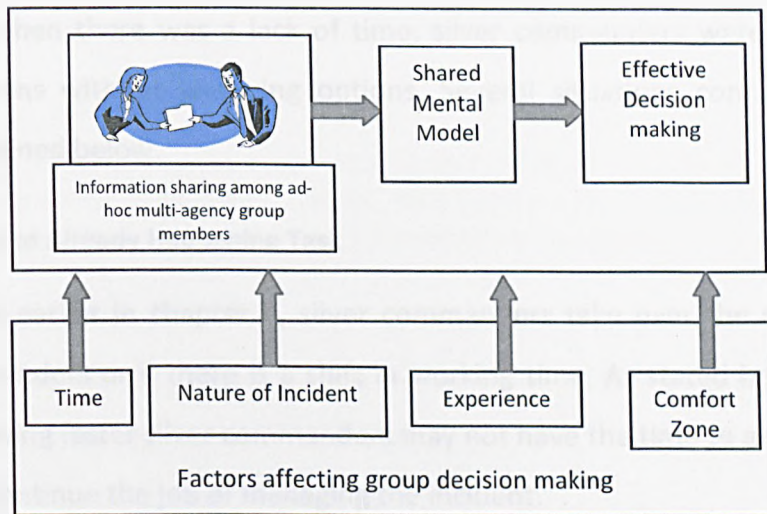


Figure 7.3 Group decision making and factors affecting the process

When silver commanders meet for the silver meeting, they share information and create a shared mental model (or common operating picture). If some decision is to be made, because the commanders will have similar understanding, they may not have conflict. Moreover, by sharing information, commanders are creating a pool of information which also helps in creating the wider picture of the incident. This may result in effective decision making and effective emergency management. However, as shown in the figure, different factors such as time, nature of incident, experience of person and tendency to be in own comfort zone affect information sharing and hence group decision making.

7.6 Issues in Decision Making

It was identified in the above section that different types of decision making are used by the silver commanders. In this section, factors such as time pressure and public expectations that affect the type of decision making will be discussed.

7.6.1 Time

As stated by I7, timely and relevant information is important to ensure informed decisions are made. However, as stated by I8, commanders do not wait for more information if time is not available.

I7: Getting the timely and relevant information and accurate information that will then give you that reliance.

I8: I need some more information and we are not doing anything until we got all the resources there. This is if time is available.

In situations when there was a lack of time, silver commanders were found to be making decisions without analysing options. Several situations contribute to this process as outlined below.

7.6.1.1 Adapt to Already Happening Task

As mentioned earlier in chapter 4, silver commanders take over the role from the bronze commanders or if there is a shift in working time. As stated below, because things are moving faster silver commanders may not have the time to analyse options and need to continue the job of managing the incident.

I13: No, we act first, it will be a calculated but not a delayed response and that response will be adapted as more information comes in, it's a very organic process. The activity particularly with officers that come on at a later stage, the activity has already started you don't, it is very rare to stop everything and then start on with a different course of action. You will turn up and you will adapt the activities to fit your requirements.

I7: In the early stages of the incident before you get all the key players together, it may well be done but the decision is already made by whoever has the primacy without too much consultation. And, certainly, an incident cannot come to a hold.

7.6.1.2 Need to Start

Commanders act first rather than analyse options also because of the possibility of improving the results. In this excerpt it's stated that rather than waiting and analysing options it is better to act first and then improve the situation.

I19: it's easier to get the wheels in motion and cancel it than to wait for sort of 15 minutes until you find out what you have got and then think oh my god we are going to need everybody you know because you have just lost 15 minutes.

7.6.1.3 Easy Thing First

Excerpt from I19 shows that under time pressure, the first decision that silver commanders take is related to public safety.

I19: Sometimes you have to make decisions good or bad, you know, a car is burning, someone has broken their leg, really we shouldn't be dragging them out but if we don't drag them out they are going to die. You know, so they are dragged out, it's like the easy thing- afterwards thinking

7.6.1.4 Reacting to Fast Moving Situation

Another reason delineated here is the lack of time to analyse options in fast moving situations. Because major incidents are fast moving, silver commanders are busy

catching up with what is going around which makes it difficult for them to analyse any options at all.

I14: But broadly speaking, there is a formal QA process for formal intelligence. The problem with fast moving events is sometimes you are reacting to rapidly changing information that doesn't go through that process so you have to make a judgment call.

7.6.1.5 Decisions Made All the Time

I20 illustrated that decisions are made all the time and in vast amounts thus it is not possible to analyse options to make decision.

I20: as I say the floods were slightly different because we had time to plan, time to think, in a big bang situation like the Place5 train crash you make decisions all the time and it is very difficult to one go through the normal rationale of the decision making process and then log your decisions because you are making so many decisions immediately on the hoof.

7.6.1.6 Many Incidents Happening Concurrently

As stated by I16, because there may be various incidents happening concurrently in any major incident, the silver commander may be under pressure and may not have time to think over the options available to him/her, which prompts towards acting and then looking for justification.

I16: Of course this is all happening so fast time because, not only we got the murder investigation, we got her being rapped, we got the guy who was the other man being separated and he didn't know that he is going to be killed- so trying to make decisions about all those sort of things at the same time. So stretched in terms of my thinking, but I said yes GO. You set them off and then you sat and say, I hope that was right- a right decision. And then you have to write what happened and justify why you went through.

Thus it is identified that due to time pressure silver commanders opt for type 1 decision making. However, as stated by I2, silver commanders are under time pressure and unlike bronze commanders they do get some discretionary time which should be utilised to make timely and informed decisions. This excerpt indicates that time pressure may not be a big issue for the silver commanders.

I2: You have got to be conscious of what discretionary time you have got for your decision because not all decisions have got to be made instantly, if they have to be they probably have been already at that level. So by definition at silver level you have got some discretionary time and you have got to be very conscious of what that is

7.6.2 Public Expectation

Silver commanders are supposed to make decisions by analysing options, however due to the public expectation, they need to act fast, due to which there may not be

enough time to analyse options. This can be seen from the excerpts by I8 and I2 below.

I8: but the moral pressure when you are in that situation is that you are quite different because the theory sounds fantastic but you have got pressures from members of the public. If you have got somebody whose family is in that premises, why aren't you doing anything, it's a dilemma for any incident commander whether it is a silver commander, bronze commander or whoever it is.

I2: About building a picture of appropriate allocation of resources, that is the main decision you make in those kinds of situations because the public expectation is that the fire service will help.

7.6.3 Lack of Information

It was identified that silver commanders are provided with very little useful information due to which decisions made at that particular time may not be accurate which might impact the overall management of the major incident.

I10: We had no information about the potential hazards and that the gas which may explode the way that goes because we don't have all the information, as the way the emergency responds. You have to make the decisions and there is an element of risk in responding to any incident as a basis of the more information you have the better you are going to assess that risk but at times you just don't have it.

7.6.4 Information in Bits

As can be seen from Figure 7.4, information is provided to the commanders in bits and pieces due to which it is difficult for the silver commanders to analyse options as in type 2. Thus decision making is limited to type 1 method.

I2: decision is made based on all the little fragments of information that come in from you know what you can see, what you hear over the radio channels, discussions with people who have been at the various sectors and you have the occasional operations meetings to see how well it is going. Knowledge then of the type of structure and type of chemicals and all of this, it comes in lots and lots of little bits and I don't think, and this is where it comes back to the intuitive decision making kind of making situations I don't think there ever comes a point where you have listed all these things and scored them and done it objectively.

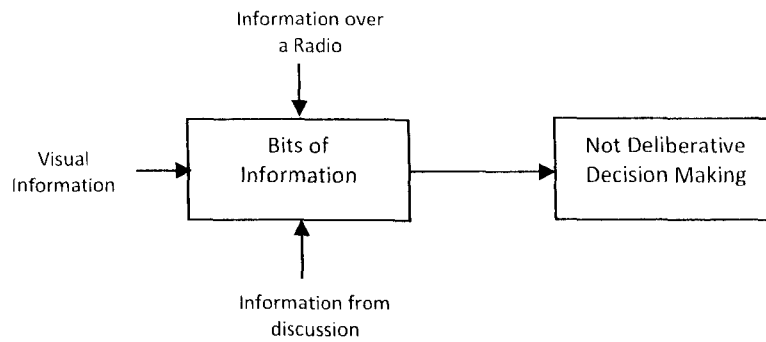


Figure 7.4 Information coming in bits

During time pressure, silver commanders act first and then with the availability of more information they try to adapt and modify their action.

I13: No, we act first, it will be a calculated but not a delayed response and that response will be adapted as more information, it's a very organic process.

I18: I might think afterwards, did I make the right decision? And, if I thought of something later, I would try and see if I could implement what I have made if we can make any changes that in this time, had I forgot something or I did it this way, I'm now thinking about it ten minutes later, it might have been better doing it another way. If I have got chance to still change it I will try and make another decision and alter the course of that decision, but if I can't then that was the decision I made at that point and there is no point in doing anything any different. I have got to move on and say, what is the next decision I have got to make

7.6.5 Change the Course of Decision Made

As stated by I20, because the information comes in bits, silver commanders make decisions with the information available at that time and with more information coming, they change the decisions if applicable. This can be drawn as shown below in Figure 7.5.

I20: you make a decision, you re-evaluate what you are doing and then you change, you know you either accept it and move on or you change that decision and move in a different way. I think all our commanders that would be potential bronze silver or gold commanders would follow that rule

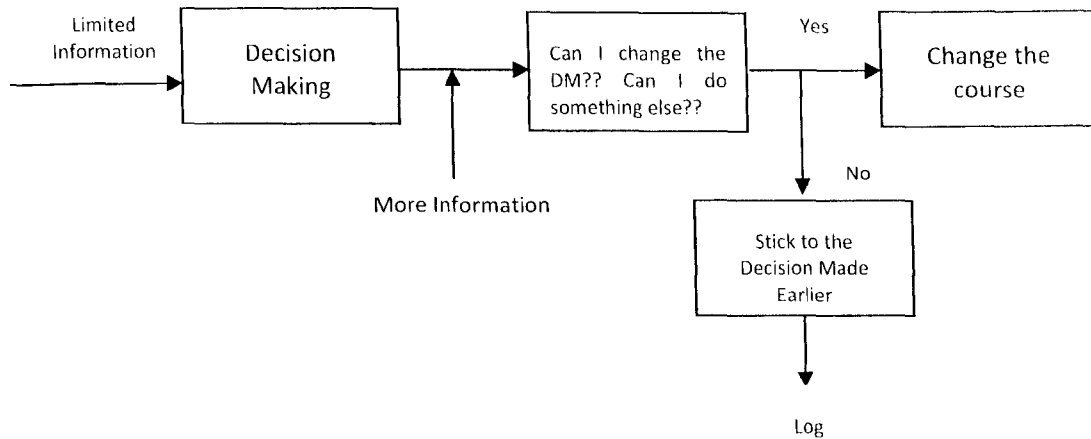


Figure 7.5 Changing the course of action with more information

This suggests there is a lack of information which hinders decision making. Moreover because information comes in bits, it is difficult for the silver commanders to wait for complete information to come, thus decisions are made with incomplete information, leading to type 1 decision making being used.

7.6.6 Norms

In addition to the issues in decision making mentioned above, several other factors affect the decision making process of a silver commander such as cost and politics.

7.6.6.1 Cost is Important

In an observation of the silver commander training for flood scenario, due to the contamination of drinking water by flooded water, public were to be provided with drinking water. The only way identified to deliver drinking water was by helicopter. The RAF²⁴ representative was requested to find out how much money the Helicopter will charge and s/he found that it costs £12,000 per hour. Because of the high cost involved, the silver commanders in the meeting put aside the plan concluding that unless human life is at stake, they may not be hiring a helicopter. This observation raises several important issues concerning costs (and who absorbs them) and the trade-offs between human life and the use of certain resources.

²⁴ RAF: Royal Air Force

With the escalation of the incident, silver commanders may demand more costly resources. The incident stated here shows that if there is not any human life at stake, then organisations will have to bear the expenses.

7.6.6.2 Politics

Similarly, it was also found that though politics should not be involved in the incident management, it has an impact as stated by I2.

I2: You know these happen around the world, these kinds of decisions and different stances are taken..... I think there is a political dimension to it.

This section showed that while cost or politics is not included in the Conflict Management Model, silver commanders' decision making is affected by the cost and politics within the organisations.

7.7 Post Decision Making Information Seeking

From the excerpts below it can be stated that uses of information is not only to make decision but also to justify decisions that are already made. This is especially applicable to the situations where decision making is type 1, as decisions are made on instinct or gut feeling.

I14: You will make an intuitive decision and then in retrospect you will justify that decision ... because I think it's hard to actually show the input and thought process followed by decision. It is easy to make the decision and then show the reasons for it.

I5: If you have got to act quickly then people do take chances.... sure, they will say that they made a dynamic risk assessment. They will say that everything was good and you know that there is an element, it's not lying is it- it is justifying, justifying decisions that have already been made

I2: one of the most critical aspects of your situation awareness is sufficient information to make a valid risk assessment, you know. That's what you are aiming towards because sometimes it is more about reaching a point where the decision you reach is, you have satisfied yourself about what you are already doing rather than making a decision about something new, does that make sense.

I16: The reality is that, you would probably act, take the decision and then report your rationale. But of course you are recording your rationale to fit the choice that you took. You know, that's always the danger that you just making fit. But that decision tends to come from the fact that you got to the point that decision has to be taken and there is no other way of taking information or some of the information that can make it better

From the verbatim quotes above it was found that silver commanders may seek for information after decisions are made. This can be added to Figure 7.2 and can be re-modelled as shown in Figure 7.6.

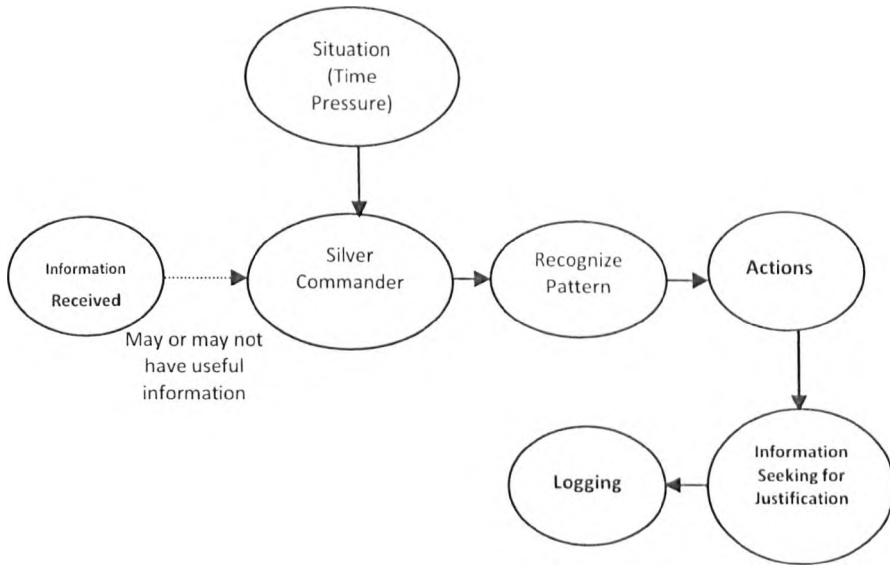


Figure 7.6 Decision making process for silver commanders

Combining Figure 7.5 and Figure 7.6, the model for how information is used by commanders during time constrained, uncertain and complex environment is as shown below in Figure 7.7.

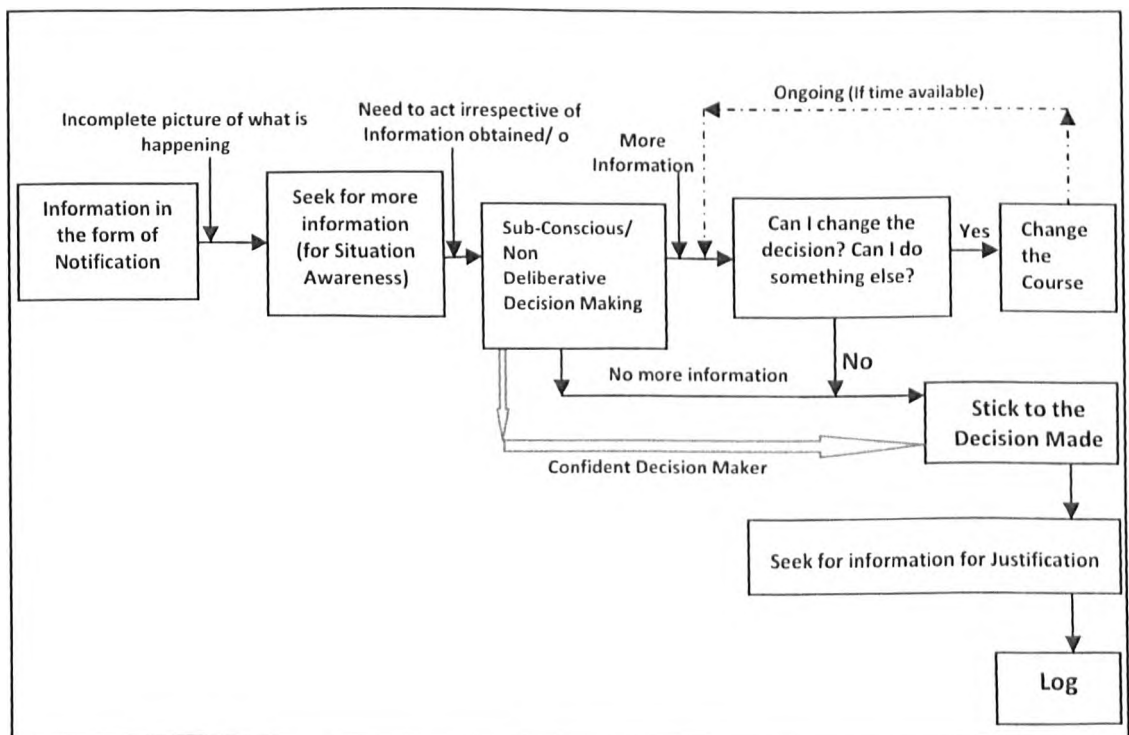


Figure 7.7 General Information use for decision making in time constrained, uncertain and complex environments

This model shows that the notification stage (stated in section 4.3) in which silver commanders are notified of the incident may not create a full picture of what is happening at the incident place. Silver commanders seek for more information to build situation awareness. However, due to public expectations, or the need to act, silver commanders need to choose a decision so that it can be implemented to manage an incident. For expert decision makers, this is a non-deliberative process in which incident may be matched with the mental model already created due to past experience or training. For a more confident decision maker (shaded arrow), this may be the end of the decision making process for that particular instance. However, for an expert but not so confident decision maker, they may change the decision if relevant information is obtained. One thing, however, common in both type (expert and, expert and confident) decision makers is the seeking of information after decisions are made for logging. After managing the incident, silver commanders may have to appear for the de-briefing in which their log books are scrutinised. Thus for the justification purpose information seeking after making decision takes place.

7.8 Conclusion

In this chapter it was identified that silver commanders rely on their own judgment when they are working under time pressure. Even in situations where time is available, as stated by I6, commanders *drill down* and then get to a judgment call. Decision making in most cases is found to be influenced by experience and also other norms for the commanders, such as cost and politics.

In conclusion, the findings in this chapter suggest that information is used by silver commanders to make decisions and may also be used for justifying actions taken. Experience of a silver commander influences all these tasks as it shortens the decision making process. Also, time factor and type of incidents plays an important role in the overall task of a silver commander. If the incident is a major incident and a silver commander is working under time pressure, s/he may have too many concurrent incidents to handle which limits the decision making process and leads to judgment call.

Activity theory is used to provide further insight into the decision making process. Each decision making at the third stage (at incident) was considered as an action (as exemplified in section 4.5). This provided a platform for a micro level of analysis and to achieve a holistic picture of the overall process, which involved not only the commander but also other components which affected the decision-making process.

Chapter 8 Discussion on Information Use for Making Decisions

8.1 Introduction

In this chapter, the second research question: “How is information used for making decisions in time constrained, uncertain and complex environments?” will be further investigated. In addition to the first contribution listed in chapter 6 (section 6.10) on information sharing, based on the findings presented in chapter 7 and literature reviewed in chapter 2, two major findings related to information use for making decisions are now presented:

1. The findings illuminate the ongoing discussion in the extant literature on types of decision making, as stated in section 2.5.2.3. Observers had initially argued that decision-making was either type 1 or type 2 (Stanovich & West, 2000); whereas recent studies have shown that decision making can be made with different combinations of type 1 and type 2 (Allen, 2011; Evans, 2011; Stanovich et al., 2011). Evans (2011) stated that type 2 is followed by type 1; Stanovich et al. (2011) suggested the opposite, whereas Allen (2011) implied that both type 1 and type 2 decision making occur in parallel. This research finding as presented in chapter 7 (see section 7.3.3), suggests that decisions are made using the combination of type 1 and type 2; however, the relationship between type 1 and type 2 may depend on the situation. In time-constrained and complex situations, findings denote that people use type 2 to analyse a few options before using type 1 decision making. Literature in decision making, often tends to favour analytical decision making (Kahneman & Lovallo, 1993) on which decision support systems are designed (French et al., 2007), compared to intuitive decision making as the latter may result in flawed decision making (Finkelstein et al., 2008). However, it was found that in time constrained, uncertain and complex environments, people may not decide deliberately but rather sub-consciously because of information acquired from experience, practice and training. This finding also links to the practitioners’ use of the decision-making model. It was found that although silver commanders are taught or trained for analytical decision making, as suggested by Conflict Management Model (CMM), in practice they may not use CMM but may use their judgment to make decisions. Thus, there is a mismatch between how

commanders are trained and how they work in practice. Subsequently, a model for expert decision makers is proposed in this research. Furthermore, a difference is found in the way experienced people use information to make decisions and the way 'experienced and confident' people use information to make decisions. This finding is largely underexplored in the extant literature.

- II. This research also contributes to the field of information science in terms of information seeking and information use. A modification to Wilson's (1999) problem solving model is proposed to demonstrate how experts solve problems (or make decisions). The contributions are further divided into two sub-sections:
 - a. As in system design for decision-support systems, information practices and information seeking research (Savolainen, 2006) considers decision making to be an analytical activity. However, the present research findings indicate that decision making may not always be analytical because practices in information seeking and use may vary. It was found that if subjects are expert then, in time constrained, uncertain and complex situations, they might not seek information to make decisions. Rather, acquired information (information from practice and experience in the form of mental models) may be used to make decisions. This finding makes it imperative to study the information practices of experts and novice decision makers separately, and is underexplored in information science literature.
 - b. Lastly, drawing upon the previous points, it was found that Wilson's (1999b) problem solving model (section 2.3.2) may not be adequate for expert problem solving for two different reasons. First, Wilson's model does not incorporate acquired information because the problem solver (decision maker) may not consider how to solve a problem. Conversely, because of their expertise, they may act immediately without due consideration. Second, in his model, Wilson illustrated the information seeking process as stopping after the problem is resolved; however, it was reported in this research that when a monitoring process (debriefing) is constituted, post decision making information seeking is conducted. This research supports the emerging dialogue in the information science research where few

researchers have stated the importance of studying decision making in information practice research.

In this chapter, contribution to dual process theory will be explained in section 8.2, followed by a discussion of a model used in practice, and by system designers. In 8.3 contributions to information seeking and information use will be discussed, followed by a conclusion in 8.4.

8.2 Contribution 2: Information Use for Making Decisions

In the decision making literature, often the dichotomy is between type 1 and type 2 decision making (Hammond, 1996; Hodgkinson et al., 2009; Stanovich & West, 2000). Type 1 is defined as intuitive whilst type 2 is considered to be analytic. RPDM which is due to experiential learning, is considered as type 1 or intuitive decision making (Kahneman & Klein, 2009) as it is both faster and intuitive. However, Evans (2008, pp. 267-269) categorised RPDM as type 1 and also as type 2. He stated that during practices, people learn from both human experiences and the integration of rules and conventions, which are often termed as heuristics in the decision making literature. Thus heuristics are 'rule based reasoning, albeit one less effortful' (Evans, 2008, p. 269). However, Kahneman and Klein (2009, p. 519) stated that heuristics 'are less likely to be accurate' and categorised as type 1 decision making. Thus different views exist in the literature regarding type 1 and type 2. Evans (2010, p. 329), in the process of clarifying this confusion, stated that '...intuitive judgment is based on feelings of rightness or confidence and is therefore type 1 and heuristic judgement is based on simple but explicit rules and is therefore type 2'. He also stated that both can be fast and quick processes (Evans, 2011).

Based on the discussion made above and in section 2.5.2.3 and also from the findings in section 7.3.3, it was identified that silver commanders use both types of decision making in time constrained, uncertain and complex environments. The excerpt by 17 in section 7.3.1.2 and also repeated here, illustrates that analysing options takes little time.

I7: ... you come with all these ideas, you refine them and come with 2 out of 5 and – you say that it could be time consuming process, but it's not, that can happen very quickly

This statement by interviewee I7 suggests silver commanders, with regular practice and experience, may have integrated the rules. Although people are often making analytical decisions non-deliberatively, they may be using the heuristics which come with experience, as Evans (2011, p. 89) outlined. He stated that type 2 thinking can also be faster as ‘...with experience people may develop useful heuristics which are quick and simple to process’ (ibid).

The excerpt by I16, presented below, also suggests that even when information is not sufficient to build situation awareness, people can use their experience to fill the gap. An experienced decision maker may often “know” how the incident will transpire, which will subsequently enable them to make swifter decisions.

I16: if you are too experienced, you can try to fill the gaps with I know what is going to happen here- you know in your thinking. This is the way it is going to turn out. And I have spent years in trying to find that myself about, I know how they are going to play it or this is what this is going to do..... I have been here before therefore this is what will happen. I had been through this before- this is easy.

This type of decision making, which emerges through recognition of a pattern, is intuitive and develops due to the regularity of operating in a particular environment (Kahneman & Klein, 2009) and experience. Thompson et al. (2004, p. 70) showed in their research that information seeking is generally associated with inexperienced people rather than experts. This also suggests that expert decision makers may not seek out information as pattern recognition fills the information gaps (Finkelstein et al., 2008). Thus experience is found to be a very useful factor that influences the decision making type.

Although contrasting views are identified in the literature on expert decision making, several researchers (Court, 1997; Rennie & Gibbins, 1993; Ullman, 1992) suggest that experts make better decisions and this is more pronounced in time critical and complex situations (Klein, 1998). This research finding also indicates that people rely on their past experience, and base their present decisions on the knowledge gained from past experience which helps in time constrained, uncertain and complex environments. As was identified in chapter 7, in any emergency environment, where various things happen, often concurrently, decisions need to be changed from time to

time according to the demands of a fast changing situation. Analysing all of the options available is not possible, especially in time-critical scenarios; decision makers may choose a satisficing option rather than an optimal one, but to do so within a limited time frame is difficult for a novice decision maker. Experienced decision makers however may change the course of a decision, depending on the demands of the situation. This may be possible for such decision makers as they use their own experience as a source of information (Choo, 2009, p. 1075) which might help them in deciding their next course of action. Thompson et al. (2004, p. 70) also stated that decision making becomes quicker for experienced people. That said, these decision makers may not use the information in the same way as is implied in the theory that advocates analysing options before coming to a decision. An illustration is provided below for further understanding.

15: I was able to recognise that one of the key processes that would follow would be a casualty bureau... and I quickly recognised that the area I worked was going to be a major ... So I made that executive decision to actually stand back

The above excerpt highlights the decision maker referring to his/her past experiences, which helped him/her to recognise that there may be several other things happening. This prediction or recognition is based upon his/her experience. S/he is able to relate the pattern to something that had happened before which helped him/her to decide on the next course of action. This finding is in line with Richter et al. (2009, p. 538) who stated that when people have sufficient knowledge and experience, they are able to reject false information faster and more effectively.

It was also found that during emergency management, if a silver commander is under time pressure, information seeking is limited. Decisions are made by recognizing a pattern. Richter et al. (2009, p. 539) stated that knowledge (from experience) based validation of information is possible: '...even when the subject is put under load (such as time pressure)'. They also identified that this type of information seeking is fast and efficient. They used the common term '*referential representation*' used in social cognition, which is similar to recognition patterns used in naturalistic decision making (Klein, 1998).

Time is one of the main factors that might affect the decision making process. If time availability is restricted, decision makers may not seek more information and may

make decisions based on their instant understanding of what is happening. Public expectation and concurrent events happening are factors that influence the decision maker in terms of the type of decision making used. As was found in the previous chapter, the public expects decision makers to act fast and to try to solve the immediate problem. To meet this expectation, decision makers need to act quickly, which might not be possible if numerous options are to be analysed.

On top of public expectation, concurrent incidents can also contribute towards the need to act first and think later. In the view of MacGregor (1993, p. 76), time pressure is directly proportional to the number of events. That is, if there are many events happening, then time taken for making decisions also increases. However, MacGregor's research did not directly consider *concurrent* events which might have yielded different findings. In an emergency situation, many incidents can occur concurrently. During such instances, it may be difficult for the decision makers to gauge what is happening and hence they may not be able to assimilate the information needed to make a decision. Thus, if many incidents are happening concurrently, it might result in acting first rather than analysing options. Klein (1998, p. 276) stated that as tasks increase, an individuals' capabilities tend to deteriorate. This supports the view presented in this paragraph on concurrent events, making it difficult for decision makers to decide by analysing options. Similarly, reacting to a fast moving situation is another reason that surfaced in this research which results in decision makers not opting for analytical decision making. Decision makers need some time to use the information being provided by several people to make sense of the situation; however, with fast-moving situations, this may not be possible, which might again lead to acting first. Having said that, the findings also suggest that even when time is available for decision makers to assimilate information and use information to analyse options (by either seeking an optimum or satisficing option), they may not do so if they are experienced, as relying on past experience to make a decision is the simplest way, as I19 stated in section 7.6.1.3. This finding is also supported by Klein (1998, p. 28) who stated that even when decision makers are not under time pressure, they tend not to make decisions by analysing options. Thus it can be stated that experience may impact the way in which decisions are made.

In addition to the experience and time factor issues, the type of decision making may depend on information issues. As stated in section 7.5.1, full information is not easily obtained and commanders may not be able to assess the situation easily due to which they might have to make decisions in the absence of information or with information gaps. To fill these information gaps, they may rely on the mental pattern created by past experience as suggested by Finkelstein et al. (2008, p. 25).

It has been identified in the literature that in the absence of rules, and when the situation is complex, uncertain and time constrained, type 1 decision making is used by expert decision makers (Richter et al., 2009; Thompson et al., 2004). However, due to the criticality of the situation and the public high-risk, analytical decision making is recommended by researchers in emergency management (Crichton & Flin, 2002). Fitzgerald & Galloway (2001, p. 992) supported the view stating that automatic decision making can lead to errors. Bennett (1999) in similar way stated that experience might create obstacles in practice or may lead to acceptance of false information (Richter et al., 2009, p. 554). Interviewee I14, in the excerpt below, suggests that commanders, although they may know all the options, they may feel the need to explore further. This may be because there might be situations where information is available but may not be considered by decision makers, as in this example below where, although the person was deceased; it was not realised as people were not able to explore further options by considering the available information.

I14: You are pretty much aware of your options although I have to say sometimes it is nicer to explore those options a bit further. You know you are aware of the situation..... the guy was actually dead on arrival at the hospital but nobody knew he was dead at the hospital. They had not followed that up. So we had this information out there that was available but wasn't being followed up

However as Finkelstein et al. (2008) stated, even new information may not help decision makers as they decide unconsciously under time pressure. The findings, in a similar way, suggest that though decision makers may have different ways to get information, such as advisors, if they are experienced and familiar with similar situations, they may not seek further information or advice from others as stated by I17 in section 7.3.1.2.

Thus, several views emerged from the findings and literature. There may always be an element of experience and pattern recognition when decisions are to be made by experts in time constrained, uncertain and complex environments. The experience can account for both types (type 1 and type 2) of decision making. Stanovich et al. (2011, p. 107) proposed a tripartite framework in which type 2 is followed by type 1 decision making. However Evans (2011, p. 94) model shows that type 1 is followed by type 2. Findings of this thesis (section 7.3) suggest that a type 2 process is undertaken first, followed by type 1 decision making.

To enable decision makers to make decisions in time constrained and complex environments, several types of decision support systems (DSS) are available (French, 2005), however as Allen (2011, p. 2167) noted, most of these DSS are 'often designed to support' type 2 approach. Furthermore, in practice, as stated in section 2.5.2.4, the CMM model is also based on type 2 decision making. However, in this research, as discussed in section 8.2, the decision making type findings suggest that a combination of type 1 and type 2 decision making is used in practice. This implies an underlying gap between theory and in practice.

The information use model presented in chapter 7 can further be, depending upon the confidence of the silver commander, separated into two simple models as shown below in Figure 8.1 and Figure 8.3. As shown in Figure 8.1, when silver commanders are notified of an incident, they are given basic information such as the nature of the incident, number of casualties and location. With this information, silver commanders decide whether they are going to be based in the headquarters or if they need to go to the incident ground. En-route to the incident place or headquarters, they may get more information or they may not get any information at all. Once they reach the incident place or the headquarters, they communicate with their bronze commanders, other commanders who are already on the scene and their own command and control to develop situation awareness. Irrespective of any additional information they may obtain up to this stage, they need to make decisions in relation to their own command and control, such as coordination, allocating staff to different places and requesting more resources. After these decisions are made, if more information emerges, they can decide if they should change the course of the decision or not. If

they can change the decision course, they will do so; if not, then they will stick to the decisions already made. Furthermore, because logging is an important part of emergency management which is reviewed during debriefing, silver commanders need to log down the reasons for making particular decisions.

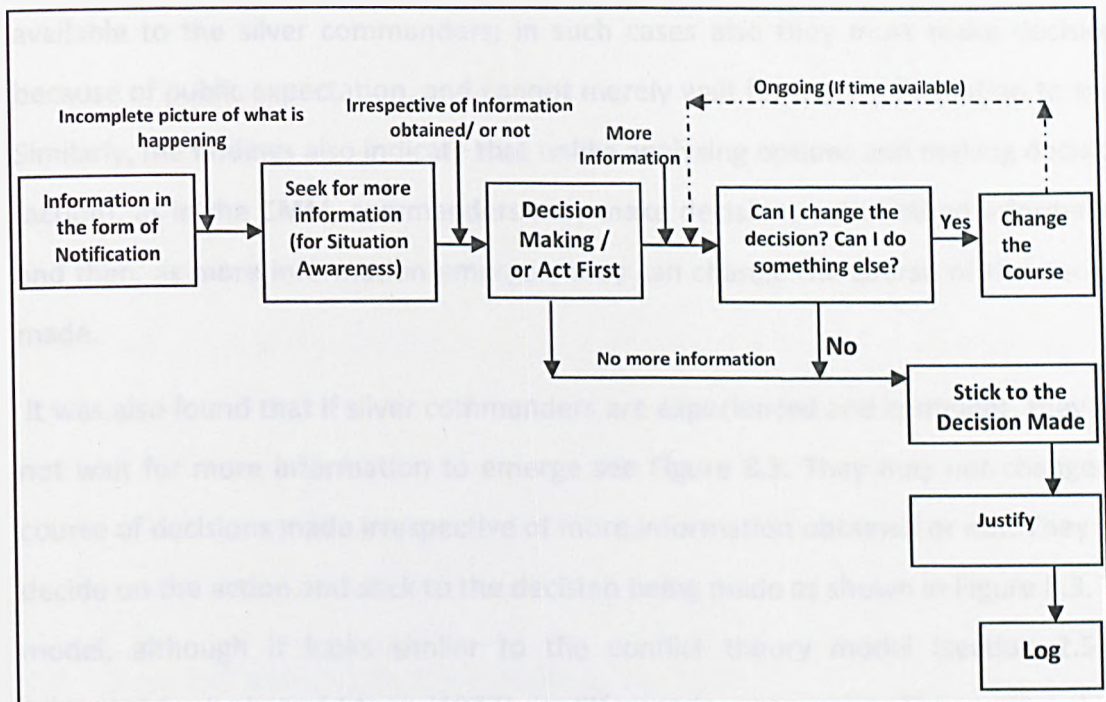


Figure 8.1 Information use for decision making in time constraint, uncertain and complex environments

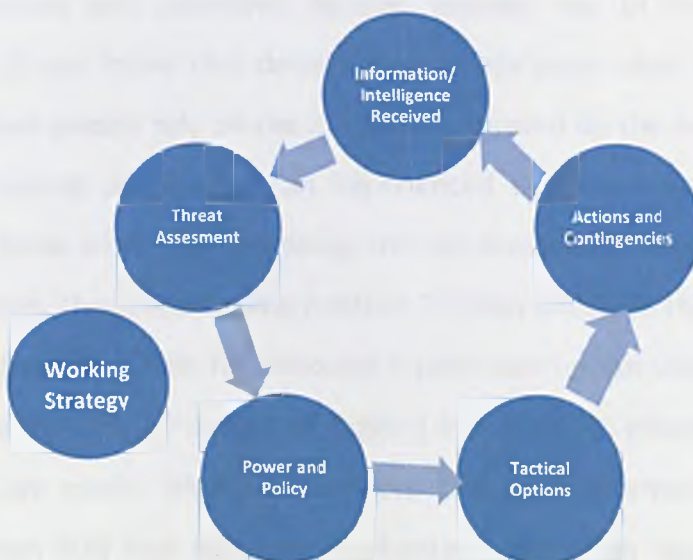


Figure 8.2. The conflict management model

The decision making model in Figure 8.1, when compared with the CMM model, Figure 8.2, used in the emergency services, it can be seen that the decision making process is not simple and continuous. Silver commanders, upon receiving information, undertake threat assessment (situation awareness and dynamic risk assessment). However, there may be situations where further information/intelligence is not made available to the silver commanders; in such cases also they must make decisions, because of public expectation, and cannot merely wait for more information to arise. Similarly, the findings also indicate that unlike analysing options and making decisions (action), as in the CMM, commanders may make decisions with limited information, and then, as more information emerges, they can change the course of the decision made.

It was also found that if silver commanders are experienced and confident, they may not wait for more information to emerge see Figure 8.3. They may not change the course of decisions made irrespective of more information obtained or not. They may decide on the action and stick to the decision being made as shown in Figure 8.3. This model, although it looks similar to the conflict theory model (section 2.5.3.1) proposed by Janis and Mann (1977), is different in many ways. The conflict theory model does not incorporate situations where no additional information is available. Also, acquired information from experience and practice is not included, which evidently plays a significant role in decision making. However, in this proposed model of experienced and confident decision makers' use of information for making decisions, it was found that decisions are made even when full information is not available and people rely on mental models formed on the basis of experience. The decision making process, for an experienced decision maker, is quicker as they generally know what they are doing and can anticipate things that will happen as a consequence. This thesis finding (section 7.7) also indicated that although options are available and the reason for choosing a particular option should be recorded in the log, in the majority of situations, logging is a post-hoc process which is done after decisions are made. Silver commanders may seek information after decisions are made, which they then record in log books as it is often used during the debriefing process, this will be further discussed in section 8.3.

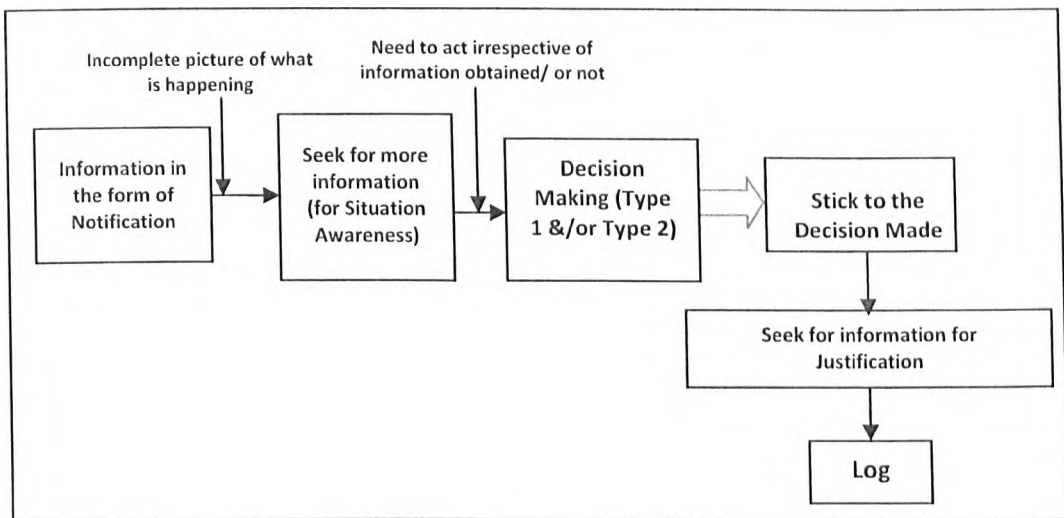


Figure 8.3. Experienced and confident decision makers' use of information

At present, most of the decision support systems are built on the analytical decision making model (French et al., 2007). However, the research findings and literature (Evans, 2008; Evans, 2011) indicates that integration of type 1 and type 2 is necessary. The next step in decision making research may be to design support systems that can accommodate both types of decision making.

8.3 Contribution 3: Expert Problem Solving Model

In the information science literature, information seeking is often identified to be analytical and conscious (Allen, 2011, p. 2165) in which once user (subject) identifies the need of information, they start searching for information and select information based on relevance (Savolainen, 2006). However, in this research, as can be seen from the discussions made in section 8.2 and 8.3, it was found that during time constrained, uncertain and complex situations, while making decisions, expert decision makers may not seek for information and may rely on their experience and mental models. It was also found (as shown in Figure 8.3) that for expert and confident decision makers, the decision making process is often quicker in which case s/he may barely search for any information to solve problems. This finding is in contrast with the problem solving model proposed by Wilson (1999b).

8.3.1 Experts Information Seeking

In his problem solving model (section 2.3.2) with four different stages, Wilson stated that with each passing stage, 'the individual moves from uncertainty to increasing certainty' (p.841). Although the first and the second stage of the problem solving model may be seen in expert problem solving (such as Silver commanders), findings suggest that in the third stage of *problem resolution*, experts may not consider how to find the answer to a problem but would act immediately. The problem is often resolved sub-consciously without the experts (silver commander) being aware of this. Shanteau (1992, p. 256) stated that experts build a mnemonic in their mind. Thus experience acts as a source of information due to which expert decision makers (problem solver) may not feel a need to seek for information.

Furthermore, Wilson's proposal that with each stage uncertainty is resolved may not always happen as suggested by I16.

I16: So stretched in terms of my thinking, but I said yes GO. You set them off and then you sat and say, I hope that was right- a right decision. And then you have to write what happened and justify why you went through

In this statement, I16 made a decision to ask his/her commanders to go and raid the hotel rooms which is a decision made (and falls under *solution statement* of Wilson's problem solving model), however, as s/he further added- "...I hope that was right- a right decision". This shows that even though a decision (*solution*) was made, the commander was still uncertain, so uncertainty had not been fully resolved. In such scenarios, Wilson (1999b, p. 841) added, '...if uncertainty fails to be resolved at any one stage, it may result in a feedback loop'. However, Silver commanders need to work under time pressure; in such scenarios, there might not be enough time for considering the implications of the feedback loop and trying to resolve the same problem again.

8.3.2 Post Decision Making Information Seeking

It was found in this research that if justification is required after the task is concluded, silver commanders generally seek out information after making their decision.

I5: If you have got to act quickly then people do take chances.... sure, they will say that they made a dynamic risk assessment. They will say that everything was good and you know that

there is an element, it's not lying is it- it is justifying, justifying decisions that have already been made.

I14: absolutely yes, you will make an intuitive decision and then in retrospect you will justify that decision and funny enough I think the decision logs encourage that

This form of information seeking after information use (decision making) has not been explored in depth within information behaviour/practice research. In Wilson's (1999) model, it is evident that with the solution statement, the information seeking process stops. However, in this research, the findings indicate that even after the problem is resolved, information seeking takes place when justification needs to be provided. Thus, to accommodate information seeking after the problem is solved (decision made), Wilson's (1999b) model as stated in can be extended as shown in Figure 8.4.

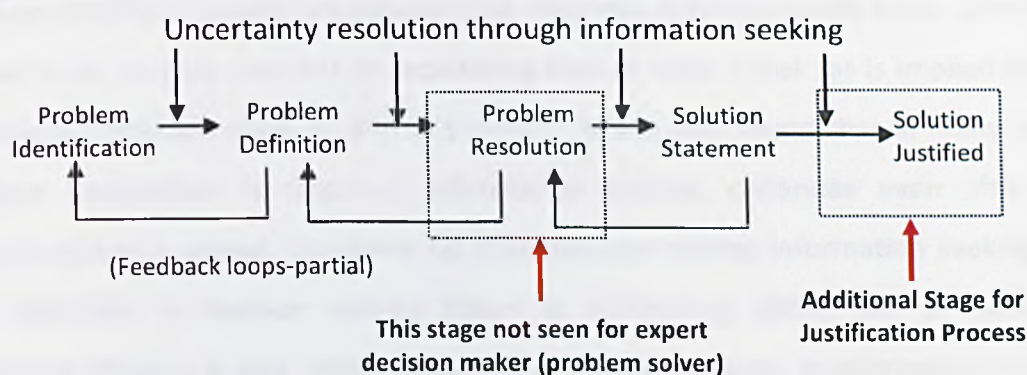


Figure 8.4 Expert problem solving model: an extension to Wilson's (1999a) model

8.4 Conclusion

From the discussion above, it can be concluded that the combination of type 1 and type 2 decision making may be used in an emergency situation with a time constrained, uncertain and complex environment. Silver commanders are not encouraged to use type 1 decision making, as the literature indicates that it may result in error prone decisions (Fitzgerald & Galloway, 2001, p. 992). However, findings suggest that if a silver commander is experienced and confident, then it is easy for him/her to recognise a pattern, seek information quickly and thus manage an incident promptly. This finding is similar to Klein's (1998) findings where he identified that fire fighters make their decision based on RPDM. This research is however different than Klein's (1998) research. First, fire fighters in Klein's study were people with an operational role, whereas in this research, the subjects are silver

commanders whose role is tactical in nature. Second the research context also differs. Subjects in this research are not only from the fire services but from multiple agencies involved in emergency services, such as police forces and ambulance services, which thus demands additional work such as coordination and cooperation. The findings also suggest that although silver commanders may have some discretionary time available, they are inclined towards the combination of type 1 and type 2 decision making, which as Evans (2008) stated, is quicker and comes from regular practice and integration of rules.

Similarly, this research proposes a problem solving model for experts in time constrained, uncertain and complex environments. It was found that experts (in this case silver commanders) may not go through each of the four stages proposed by Wilson (1999b). If people are experienced, they may sub-consciously know what they have to do, so they may not be wondering how to solve a task (as is implied by the problem resolution stage in Wilson's model). It was also found that in many cases, where justification is required, information seeking continues even after the task/problem is solved. Literature on post decision making information seeking can be identified in decision making (Shani & Zeelenberg, 2007) and in marketing research (Perkins & Rao, 1990); however, it is underexplored in information science research.

Within decision making, this research also provides an insight into post decision making information seeking from an interpretive viewpoint in a naturalistic setting compared to much research in this area which is often restricted to non-real time situations of laboratory experiments (Lundberg & Nagle, 2002; Shani & Zeelenberg, 2007).

Lastly, MacFarlane (2010) highlighted the gap in the emergency literature regarding 'how leaders are informed and how [do] they act in making decisions'. This research has shed some light on this issue. A model for how information is used by silver commanders during management of major incidents is proposed, linking information behaviour research to decision making research.

Chapter 9 Conclusions and Implications

9.1 Introduction

A review of the literature shows that only a limited amount of research has been done in the context of time constrained, uncertain and complex environments. Allen (2011, p. 2168) for example, highlighted that information practices research has not focused much on this topic. The research reported in this thesis investigates information use within such an environment.

In this chapter, the relevant research gap from chapter 2 will be restated in section 9.2 followed by the implications of this research for theory (section 9.3) and practice (section 9.4). Limitations of this research are then stated in section 9.5 followed by suggestions for future research (section 9.6) and concluding remarks in section 9.7.

9.2 The Research Gap: At a Glance

A few studies have advocated that context can be studied by using a multifaceted approach (Fidel et al., 2004; Fisher et al., 2004). However, it was identified that the multifaceted approach is not used extensively to understand information practices, thus signifying a possible need for research on this aspect.

Where models have been developed (cf. Chatman, 1992; Pettigrew, 1999), they have been developed to understand the specific context of everyday life information seeking rather than work based practice. This limits the utility of these models. Moreover, information behaviour research has mostly focused on static environments using subjects such as academics and students.

Similarly, an underlying research gap was identified in information use. Wilson (1997, p. 552) in reviewing the information behaviour literature, stated that not much has been done in information use as opposed to information need and seeking. Recently, some studies (Bruce & Hughes, 2010; Choo, 2009; Kari, 2010) have addressed information use in information science. However, the context they addressed can be argued to be lacking the complexity and uncertainty or time constraints that characterise emergency response. Choo's (2009) research on information use in early warning systems is closer to the research context of the current research. However, it

can be argued that this is not as time constrained as response to a major incident as in Choo's warning systems examines future events.

In the extant literature, information sharing is considered a separate topic to information use, information seeking or information need. However, in this research a holistic view as proposed by Hughes (2006) is taken due to which information sharing is considered within information use. Moreover, information sharing is an underexplored area of research (Wilson, 2010) which has not been investigated in depth in the information practices research.

Similarly, decision making as a form of information use is not explored in depth in information science research with a few exceptions (Allen, 2011; Berryman, 2008). It was identified that there are two different schools of thought regarding the mode of decision making, intuitive and analytic. Although, this research does not address directly the cognitive process involved in decision making (which has been done for example by Klein (1998) for the RPDM model, as described in section 2.5.2.2), an attempt has been made to analyse the type of decision making adopted by experts.

This research aimed to fill some of these gaps. The main implications of this research for theory and for practice are as outlined in the next section.

9.3 Implication for Theory

From the research findings and the discussion in chapters 6 and 8, the main contributions to the theory are as stated in section 6.10, section 8.2 and section 8.3. These contributions are summarised in the following sections.

9.3.1 Contribution 1: The POSSTT Model for Information Sharing

In information practice research, as Wilson (2010) recently stated, information sharing is an under researched area. In the work setting, especially for time constrained and complex and uncertain tasks, information sharing study is limited, with the exception of Sonnenwald and her colleagues (Sonnenwald, 2006; Sonnenwald & Pierce, 2000; Sonnenwald et al., 2008). Against this backdrop, the present research (see chapter 6) proposes the POSSTT model which not only investigates the information sharing issues in time constrained, complex and

uncertain environments, but also incorporates different contextual dimensions. Thus, this research contributes in two different aspects to the state-of-art:

- use of a multifaceted approach to understand the context and underlying issues within information practices
- addressing information sharing for ad-hoc multi-agency teams

9.3.2 Contribution 2: Information Use for Making Decisions

The information science literature implicitly assumes decision making to be rational (Allen, 2011; Berryman, 2008). Several studies have identified that people “satisfice” while seeking information (Agosto, 2002; Zach, 2005), which again is part of a deliberative and conscious process and hence falls under type 2 decision making.

A few studies, however, are emerging in the information science literature which contradicts this assumption of decision making as a rational process. For example, Zach (2005, p. 32) identified that during non-routine situations, art administrators ‘rely heavily on direct personal experience to fill their information-seeking needs’ which is an intuitive process. Similarly, Allen (2011) identified that the decision making for police officers who work in a time constrained, complex and uncertain environment is a dual process where both type 1 and type 2 decision making is done in parallel. The current research findings (section 7.3.3 and 8.2) reinforces Allen’s (2011) conclusion. The findings in this thesis suggest that decision makers make decisions based on the mental model created due to their constant practice and experience using both type 1 and type 2 decision making, however not deliberatively. This finding, however, contradicts the existing models which are used for decision support systems. It also contradicts the conflict management model which practitioners are encouraged to use. A model for how information is used by experts is proposed in Figure 7.7 (chapter 7). This model when compared with a similar model from Zach (2005, p. 31), shows that Zach’s model suggests decision making to be intuitive. However, as Evans (2011), Stanovich et al. (2011) and Allen (2011) recently argued and as has been found in this research, the decision making process is a combination of type 1 and type 2. The need to further categorise the information use model in Figure 7.7 is realised to be necessary because of the difference in the use of

information for making decisions. This is further illustrated in section 8.3 (see Figure 8.1 and Figure 8.3).

9.3.3 Contribution 3: Expert Problem Solving Model

One theoretical implication is also highlighted regarding the problem solving model proposed by Wilson (1999). It was identified (section 7.3) that because people may not seek for information to find the solution to the problem, the third component of Wilson's model, *problem resolution*, may not be seen in problem solving by experts. Thus a modification is required to the problem solving model for experts. Moreover, the findings (section 7.7 and section 8.3.2) suggest that if a justification process exists in any work place setting, then people may seek information even after the problem is solved. Thus a need to modify the problem solving model (see Figure 8.4) is realised also in terms of information seeking.

Several studies in the decision making or marketing research literature identified this need for information seeking after decision making and it has been named as 'post decision making information seeking' (Huber & Seiser, 2001; Jonas et al., 2008; Shani & Zeelenberg, 2007). In information science research, Choo (2008) stated that decision makers may choose a "justificationist" approach. Similarly, Ellis et al. (2002) stated that retrospective information search may take place. However, this concept of "post decision making information seeking" although an important phenomenon of information practices, is not further explored.

These contributions when integrated together can have an overall impact of having an effective emergency management as stated in the next section.

9.3.4 Integrated framework for effective emergency management

One particular issue highlighted in the research about group decision-making concerns the inability of the decision support-system to enhance informed decision-making (McNamara, Dennis, & Carte, 2008). McNamara et al. also implied that information must be integrated into an individual's decision framework (ibid. p.22), thus indicating that for any decision support-system, an individuals' decision-making must also be addressed. Based on the findings discussed in sections 9.3.1 - 9.3.3, an integrated model for effective emergency management is illustrated in

Figure 9.1.

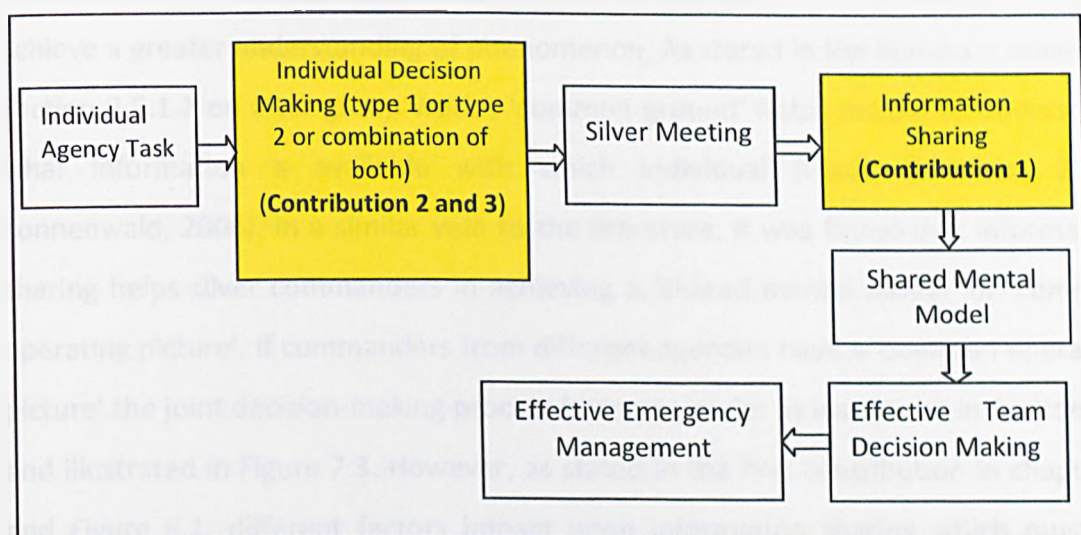


Figure 9.1 Integrated Framework for Effective Emergency Management

Upon arrival at the incident place, as identified in section 4.5, silver commanders must command, control and coordinate own agency's task.

One significant task at this stage entails the decision-making process. One must:

- decide whether or not to occupy the silver commander role (section 4.5.5)
- be offensive or defensive (section 4.5.6)
- to analyse different options (section 4.5.7)

During this phase, the findings stated in Section 7.6 and illustrated in Figure 7.7, highlight the way information is used to make decisions. It was found that decision-makers may not use information in a similar manner to what is predicted in literature and theory. There is a clear need to revisit the decision-making process for individual decision-makers for which training, plans and policies should be addressed (as explained in section 9.4). If the information needs of individual decision makers are catered for, it will enable them to make effective decisions in time -constrained, uncertain and complex environments; thus making individual decision-making more effective.

After managing their own agency's task, silver commanders must hold a silver meeting within which they decide about joint tasks. They must also discuss and decide how best to achieve the common aims and objectives outlined by the gold

commander. This demands the need to share information among the silver commanders of different agencies. Information sharing also helps commanders to achieve a greater understanding of phenomenon. As stated in the literature review in Section 2.5.1.2 on inter group work , 'common ground' helps people to understand what information is available with which individual (Olson & Olson, 2000; Sonnenwald, 2006). In a similar vein to the literature, it was found that information sharing helps silver commanders in achieving a 'shared mental model' or 'common operating picture'. If commanders from different agencies have a 'common operating picture' the joint decision-making process becomes easier as was found in Section 7.5 and illustrated in Figure 7.3. However, as stated in the first contribution in chapter 6 and Figure 6.1, different factors impact upon information sharing which must be addressed to ensure that silver commanders from multi-agency networks have a shared mental model. The phenomena of information sharing in turn enables effective decision-making which results in less conflicting working environments among multi-agency teams. This leads to effective emergency management. Thus the findings of this research can have a high impact towards saving human life and property.

9.4 Implication for Policy and Practice

In this thesis, findings throughout, in chapter 4, 5, 6, 7 and 8, indicate that rules and regulations, training and technology are important issues affecting information sharing and decision making in time constrained, complex and uncertain environments. These factors will be revisited in this section and discussed in terms of their implications for practice.

9.4.1 Rules and Regulations

Rules and regulations play a major role in encouraging decision makers towards a certain type of decision making. Because emergency situations, such as major incidents, are dynamic in nature, rules are typically flexible. This flexibility in turn was found to incline decision makers towards type 1 decision making. This finding is supported by Stanovich & West (1997) who stated that if there is flexibility in decision making, people perform cognitively. Choo (2009, p. 1075) in a similar way, stated that

‘when rules are unavailable, people look for patterns [] derived from past experience’. This might be seen as suggesting that rules should be made for any and all types of incident. It was also found that silver commanders are mostly asked to justify their actions during the debrief process. If satisfactory justification is provided during the debrief process, then the way in which silver commanders performed their task is not questioned. Choo (1998, p. 200) further advocated the importance of rules in the organisation for decision makers. He stated that due to the limitations of human information processing capacity, during uncertain and time critical situations, rules (and routines) are established which can provide a rule of thumb for decision makers. However, Crichton et al. (2005, p. 163), citing Skriver & Flin, argued that with an increase in rules, difficulty in making decisions increases. To this, Constant et al. (1994, p. 401) added, it is not practical for the organisations to ‘supervise and sanction the rules and norms rather employees must internalise them as attitude’. Thus it is imperative for the policy makers to ensure that the members of each agency internalise the plans and policies. Frequent training and exercising together may aid in internalising the organisational rules.

At present, there is a conflict between the rules available and the practice that is followed by silver commanders. Rules for tactical commanders are based on type 2 decision making whereby commanders are supposed to analyse all the available options and then choose the optimum option. However, in practice, due to several underlying reasons stated in chapter 8 such as time pressure, public expectations, and information coming in bits, silver commanders use a combination of type 1 and type 2 decision making, albeit not deliberative. Thus there is a need to revisit policies to minimise the difference between theory and practice.

Physical distances between silver commanders also depend on the rules and regulations. It was found that there is no mandatory rule which specifies the location of the silver commander. Distance between silver commanders is found to affect information sharing as stated in section 5.3.4.8.

It was found in section 6.5 that difference in terminologies and language used can also affect information sharing. Thus a guideline should be in place which will facilitate the use of similar terminologies and languages. It was also found that the

way information is distributed/available to each agency affects information sharing. In some incidents, the police for example, might have more information than other agencies; thus, they may not share it with others. This creates conflict among ad-hoc multi-agency team members. As Stasser and Titus (1987) suggested, information pooling may help overcome this issue.

9.4.2 Training

In this research, it was found that tactical commanders, although they are trained to opt for type 2 decision making, follow both type 1 and type 2 decision making. However, the process is not deliberative. A mismatch is thus found in the way silver commander's work in practice and the way they are trained. Because silver commanders mostly rely on their past experience, one suggestion by Rennie & Gibbins (1993, p. 46) is to include a wide range of topics in training such that mental models can be formed in different areas which can aid commanders. Kahneman & Frederick (2002, p. 50) showed a similar concern, stating that intuitive answers are not always available. However, it can be argued that if training is provided in different scenarios as Rennie & Gibbins (1993, p. 46) stated, intuitive answers may be made available (Klein, 1997a). Thus training is another important component which needs to be revisited.

Another recommendation to improve decision making by minimizing flawed decision making is to provide feedback (Bramble, 2009). After each incident, commanders should be given feedback on what they have done. They should also be encouraged to reflect on their own actions which can then be compared with the feedback provided to them. This experiential learning helps decision makers prevent themselves from making flawed decisions. A positive response to incident management should be promoted so that it will be easier for commanders to use their experience in the future.

The literature has stated the importance of trust in a team for information sharing and seeking. The importance of trust and inter personal relationship is even higher in a multi-agency ad-hoc team. Ad-hoc teams do not meet frequently on an everyday basis unlike stable teams within an organisation. Thus special attention needs to be given to frequent training and interaction among multi-agency commanders. Doney

et al. (1998) highlighted the importance of organisational factors such as culture and social norms in developing trust which is necessary for the voluntarily giving of information. In a diverse workforce, culture needs to be studied to develop trust. Thus a focus should be given to the culture of different organisations. It is also necessary for the members of the ad-hoc multi-agency teams to know the culture of the other organisations involved. This objective can be met if frequent interaction is provided. For frequent interaction, training and exercise should be done in a multi-agency environment.

9.4.3 Technology

Familiar technology aids information sharing (section 6.8); therefore, when tools are developed, it may be necessary to use familiar types of technology that commanders use in everyday life. Also after the technology is brought into an agency, the users need to get used to the technology. For this training needs to be conducted regularly in which technologies are used more frequently.

At present, emergency services are using technologies as per their demand and need. Due to this reason, different counties have different technologies which may not be compatible with each other. Thus, when the commanders come together to manage a major incident, incompatibility of technology makes information sharing difficult. Thus it is necessary that technologies are interoperable among all the agencies involved in a major incident. Recently, emergency services in the UK rolled out Airwave radio (Wallace et al., 2010) to overcome the issue of interoperability and to ensure better information sharing among members of multi-agency teams which can be considered as a good initiative.

It was identified in this research that responders prefer face-to-face communication/information sharing. One of the reasons for commanders not being co-located is because they prefer to be located at places where the resources for information are readily available. For silver commanders from ambulance and fire services, this is possible near the scene. For police forces, resources are mostly available at the headquarters. To ensure that silver commanders are co-located, it is imperative for the policy makers to make the resources, for different agencies, available at the same place. During an observation, it was found that to mitigate

these differences, different counties are coming up with the concept of “silver city”. This is a concept where the vehicles of the police, ambulance and fire services can be put together so that they can have face-to-face interaction (see picture in Appendix 3). However, it was also found that co-location may not always be possible in situations where the disaster is big or too complicated for the commanders to come together. In such situations, either liaison officers are in place to communicate between silver commanders adding an extra line in the communication or technology is used for sharing information. It is thus imperative for the technology developers to design technologies that can provide the sense of place within the space.

In this section, different social factors that are intertwined with technological issues have been highlighted and recommendations provided to mitigate the conflict that may arise when different types of technologies are in use.

9.5 Limitations

Although an effort has been made to make this research perfect, it is impossible to achieve such a target. Some limitations of this research are as outlined:

- 20 interviews and nearly six full days’ observation of training and exercises were carried for this research. This limits from making claims as the sample size may not represent satisfactory groups.
- Data collection involved semi-structured interviews and observation of training and exercises. Real time observation would have yielded better results but due to the lack of access to such real time incidents, the analysis may be limited.
- Although the research was conducted with an effort to exclude bias, the findings and their meaning are the researcher’s interpretation which may need validation from further research.
- Though an effort has been made to include many important but less frequently referred nodes in analysis, as can be seen in chapter 4, 5 and 7 (Figure 4.2, Figure 5.1 and Figure 7.1), it was not possible to include all those less frequently cited concepts in the discussion.

9.6 Further Research

- Type 1 and type 2 decision making are found to be used by silver commanders. As suggested by Evans (2007), it would be worthwhile to investigate the relationship between these types.
- In this research information use by experienced and confident decision makers is studied. However, the findings also suggest that if decision makers are “over-confident” or if they start assuming and expecting from others, then informed decisions may not be made. This should be investigated further.
- The trend to involve local authority, representatives from utility companies and humanitarian aid agencies is increasing in managing an incident. Though in observations many agencies were involved, interviews were conducted only with silver commanders from the blue light services. It will be worthwhile to expand this research also involving other agencies.
- Also, this research was conducted in the UK; the similar context in other countries can be researched to compare the outcome.
- The POSSTT model proposed in this research needs further verification for robustness. The model should also be verified in other settings. Moreover, instead of information sharing, other information practices such as information seeking, or information needs may be investigated using the POSSTT model as a framework.

9.7 Concluding Remarks

In this research, the first research question was to investigate the issues impacting information sharing among ad-hoc multi-agency teams such as in the emergency services. Various components are found to affect information sharing which was categorised into six dimensions providing a holistic view of the information practices taken into consideration.

The second research question was to investigate how information is used for making decisions in time constrained, uncertain and complex environments. It was found that information can be used for building situation awareness. Once people are aware of the situation, information can be used to trigger and recognise the pattern from the

mental models. Decisions are mostly found to be made from the acquired information which can be a combination of type 1 and type 2 decision making. This finding contrasts with several theoretical foundations on which support systems are developed.

In section 1.2.4 it was seen that in decision making research, literature highlighted the importance of type 2 decision making. Similarly in information science research, as Savolainen (2006) and Zach (2005) stated, analytical (rational) decision making is dominant. However, as indicated by several researchers such as Allen (2011) or Zach (2005) or Klein (1998), in critical situations people may make decisions non-deliberatively. In this research too as stated in section 7.3, it was found that decisions are made either intuitively or analytical, albeit, non-deliberatively. This contradicts with the conflict management model (see section 2.5.2.4) on which training in emergency services is designed (see section 9.4.2). Thus, the findings provide a new dimension to the training platform. Training should be designed to accommodate and encourage silver commanders to integrate plans and policies as Constant et al. (1994) proposed. Furthermore, because in the time constrained, uncertain and complex environments, deliberative analytical process is difficult to achieve (Choo, 2009), decision support systems should be designed to accommodate the decision process used in practice and should not just be based on the theoretical models. Moreover for information sharing, which is an essential criterion in multi-agency working environment, technologies should be such designed that each service can interact easily with the other agency. Language, terminologies, interoperability should be focused too. These changes in turn, may result in managing a major incident in a more effective way.

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Appendices

Appendix 1: Request for Data Collection

I am Jyoti Mishra, a 2nd year PhD student studying in the Business School at the University of Leeds. I am researching Information Management and Decision Making in Emergency Management.

My research focuses on finding the current practice in terms of information that is being used by the silver (tactical) level commanders of emergency services (Police Forces, Fire & Rescue Services and Ambulance Service). Within Emergency Management, I am interested in the initial response to a major incident and in understanding how the information is processed and decisions are made from the moment a silver commander is notified of the incident. Furthermore, I am looking at the ways in which silver commanders communicate and share information with each other across multiple agencies. From this research I am trying to find out the issues related to information which might help practitioners in achieving more effective coordination across agencies, for example, what is the format of information that silver commanders really need and at what point in time; how can the accuracy of information be understood and improved?

This is a qualitative research in which data collection will be done through expert interviews with practitioners and also by observing exercises or drills. I am planning to do a focus group interview too if I can get a chance to put together silver commanders from all three blue light services at same place. Interviews are focused at practitioners who were incident commanders of multi-agency. These interviews will last for 60 to 90 minutes and will involve storytelling of major incident handled in the past.

All data collected will be treated with complete confidentiality. The University of Leeds, code of practice on data protection will be followed²⁵. Anonymity of stakeholders is assured.

Contact Email ID: bnjlm@leeds.ac.uk

²⁵ <http://campus.leeds.ac.uk/dpa/code.htm>

Appendix 2: Interview Questions

Organisation:

Name:

Job Title:

Work role:

Years of Service:

Gender: M/F

Date of interview:

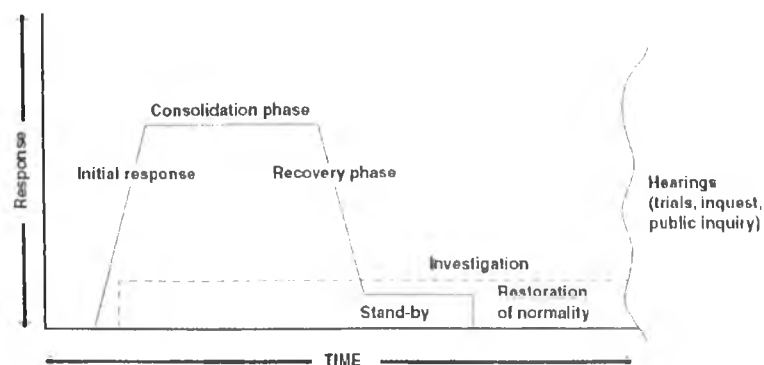
Time of interview:

Time finished:

General Aim:

This interview question is a part of the data collection for my PhD research titled “multi-agency coordination in emergency management: Making Sense, Information Practices and Decision Making”. I am looking at the current information practices followed by silver commanders of multi-agency, during a critical incident. My focus is on the action followed by commanders for processing information to make decision. The University of Leeds, code of practice on data protection²⁶, will be followed. Anonymity of data and confidentiality is assured.

I am looking at the response phase of the emergency cycle. Within the response phase, my interest is in the initial response which includes activities from the moment a silver commander (Category 1 responders as stated in Civil Contingencies Act, 2004) gets a call of an incident to the effective management of resources when the situation escalates.



Stages of the response against time (LESLP, 2007:8)

²⁶ <http://campus.leeds.ac.uk/dpa/code.htm>

* With your permission, I would like to voice record the session to ensure accurate capture of your responses. I'd like to assure you that all your responses will be made anonymous and a transcript of the interview will be made available to you on request.

2.1 First version of designed interviewed questions

To understand issues of lack of information and the process followed:

1. Could you please illustrate what happened in the incident that you managed recently? OR Could you please illustrate the process that you followed in a major incident that you can recall vividly?

Helping Questions:

2. How were you informed about the incident?
3. What did you do in terms of incident management?
4. What information were you provided with?
5. Was the information enough for you to proceed?
 - a. NO: Where did you look for more information?
 - b. YES: what did you do with the information obtained? OR What immediate action you followed with available information?
6. Were you provided with further information while you were on the way to the incident place?
 - a. If YES, what information were you provided?

To find out about the extracted cues and plausibility rather than accuracy:

7. Was the information sufficient for you to act promptly when you reached the incident place?
 - a. If No: How did you deal with incomplete information?
8. Did you look at the environment around you (incident spot) to collect information (scanning)?
 - a. YES, why? (Example: immediate risk, clues for decision making).
 - b. Did you get any clues from looking at the environment which helped you in making decision easier?
9. How did you ensure the quality (accuracy) of information? (Quality of information can be accuracy, timeliness, format, completeness, relevance. Out of these, accuracy, relevance, format and completeness are of interest).

10. How did you interpret the meaning of information that you obtained from the environment?

Information sharing /to find if Sensemaking is done/ and if it is useful (know about the information flow through observation):

11. How did you obtain other information? Did you call command and control? Did you seek for information from silver commanders of other agencies too?
12. How often did you talk with silver commanders across multi-agency?
13. What was the reason for group talks (What event made you talk with other silver commanders)?
14. Was the group talking useful?

To find about Tools:

15. What devices/means did you use to gather information? (**Show prompt cards of the type of tools used viz. radio, GIS, map, face-to-face, personal communication**)
16. Which tool is difficult to use and why?

To find out the norms:

17. How do you communicate with silver commanders (incident commanders) of other agencies?
18. In terms of information use, seeking and sharing, what is the rule or policy that you need to follow?
19. Can you recall of the situation in which you or other incident commanders made effective decision by deviating from the rules?

To find out which model is used:

20. Was there any occasion where there was a change in the plan?
21. What made you change the plan?
22. Under time pressure, do you generally tend to make decision by yourself or you seek for suggestion from other incident commanders too? Why?
23. Did you come across situation where there was a contradiction in the role of silver commanders across agencies?

Further questions after the storytelling:

24. In your opinion, does the interaction across TALK GROUP (of incident commanders) helps in effective team coordination? How? Could you please illustrate?
25. What information in your view might (or will) help you to create a wider picture of what is happening? (This question is to support that SM helps in creating wider picture.)
26. In your view, does technology help in creating wider picture? (For example, it is said in practitioners report that GI systems are built to provide wider picture, does it really help?). If yes, in what way?
27. Did you come across situation when there was a misunderstanding about the role among the silver commanders? What happened?
28. Can you think of any action performed by silver commanders of other agency (in terms of information sharing, seeking, use) that you think needs to be encouraged?
 - a. Actions that needs to be avoided?

2.2 Final version of interview questions**To understand issues of lack of information and the process followed:**

1. Could you please illustrate what happened in the incident that you managed recently? OR Could you please illustrate the process that you followed in a major incident that you can recall vividly?

Helping Questions:

2. How were you informed about the incident?
3. What did you do in terms of incident management?
4. What information were you provided with?
5. Was the information enough for you to proceed?
 - a. NO: Where did you look for more information?
 - b. YES: what did you do with the information obtained? OR What immediate action you followed with available information?

6. Were you provided with further information while you were on the way to the incident place?
 - a. If YES, what information were you provided?

To find out about the extracted cues and plausibility rather than accuracy:

7. Was the information sufficient for you to act promptly when you reached the incident place?
 - a. If No: How did you deal with incomplete information?
8. Did you look at the environment around you (incident spot) to collect information (scanning)?
 - a. YES, why? (Example: immediate risk, clues for decision making).
 - b. Did you get any clues from looking at the environment? Did it help you in decision making?
9. How did you ensure the quality (accuracy) of information? (Quality of information can be accuracy, timeliness, format, completeness, relevance. Out of these, accuracy, relevance, format and completeness are of interest)
 - a. How do you process incomplete information? OR If the information is incomplete, how do you carry on the decision making process?
10. How did you interpret the meaning of information that you obtained from the environment?

Information sharing /to find if Sense-making is done/ and if it is useful (know about the information flow through observation):

11. How did you obtain other information? Did you call command and control? Did you seek for information from silver commanders of other agencies too?
12. How often did you talk with silver commanders across multi-agency?
13. What was the reason for group talks (What event made you talk with other silver commanders)?
14. Was the group talking useful?
15. How do you communicate with silver commanders (incident commanders) of other agencies?

To find about Tools:

16. Which technology did you use to gather information? (**Show prompt cards of the type of tools used viz. radio, GIS, map, face-to-face, personal communication**)
17. Which tool is difficult to use and why?

To find out the norms:

18. In terms of information use, seeking and sharing, what is the rule or policy that you need to follow?
19. Can you recall any situation in which you or other incident commanders made effective decision by not complying with the guidance (deviating from the rules)?
20. Do any norms exist in the practice? If yes, what kinds of norms are there?
OR What unspoken rule exists in practice?
21. Police Silver away from scene but Ambulance and FRS silver on or near incident spot, so how do you manage the communication for silver meetings?

To find out which model is used:

22. Was there any occasion where there was an inconsistency (or contradiction) in the role of silver commanders across the agencies?
23. Under time pressure, do you generally tend to make decision by yourself or you seek for suggestion from other incident commanders too? Why?

Further questions after the storytelling:

24. Under time pressure, do you generally act first and then think for justification or you analyze options and then reach to a conclusion?
25. What information in your view might (or will) help you to create a wider picture of what is happening? (This question is to support that SM helps in creating wider picture.)
26. In your view, does technology help in creating wider picture? (For example, it is said in practitioners report that GI systems are built to provide wider picture, does it really help?). If yes, in what way?

27. Can you think of any action performed by silver commanders of other agency (in terms of information sharing, seeking, use) that you think needs to be encouraged?
 - a. Actions that needs to be avoided?
28. What in your opinion will encourage multi-agency coordinators to interact?
29. All three agencies of the blue light service have different objectives but common aim of managing an incident and saving lives, how do you tackle with this situation of different objectives?
30. What makes better incident commander?

Appendix 3: Silver City

As illustrated by the practitioners, silver city is the concept put forward to encourage silver commanders from police forces, fire and rescue services and ambulance service to be co-located so that face-to-face interaction is possible.

Vehicle of each agency has essential communication devices and other technologies to access information. Commanders from each agency are co-located in the space (in the middle).



Concept of Silver City