Information Sharing in Major Events

By

Guadalupe Hernandez-Escobedo

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Intellectual Property and Publication Statements

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

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Everything that is written is my own: errors and omissions.

Our tools make us who we are
Bonnie A. Nardi

Abstract

This thesis argues that information sharing is crucial for creating and maintaining shared situational awareness in the context of routine operation and incident management at major events. Information sharing and situational awareness are needed for controlling and coordinating individuals from the police, fire, rescue, voluntary groups, organisers and the public, who were typically linked together in this naturalistic context. The research thus focuses on investigating how information sharing influences situational awareness, what motivates information sharing and what tools are used to mediate and control information sharing. Activity theory is utilised as a conceptual framework and as an analytical tool to portray the motivated activity of information sharing. This activity is directed at creating and maintaining shared situational awareness. Recognising this multi-voiced context, the research was founded upon a qualitative and interpretive paradigm. Review of organisational documentation, observation of current practices and interviews were employed to collect information for concerts and baseball matches in Mexico. Data collected were transcribed verbatim and an open, axial and selective coding approach was used to analyse the data. Themes and activity elements were recognised and utilised to uncover links in the light of contextual features to make sense of relationships between them. From those relationships, surface credibility and normative altruism as motivations and situational awareness as an abstract tool are proposed as contributions to knowledge. In addition, the Situational Awareness Modes in Incident Management (SAMIM) model is proposed to frame and exhibit the necessity for individuals to be aware of diverse situations in context. Moreover, the findings have practical implications concerning the development of adequate protocols for managing incidents; improvement of abstract and material tools; and training to tune the coordination and control of individuals serving as incident responders, including the public. This can be done through practice exercises in routine operation and simulated incident management at major events.

Table of Contents

List of Tables

List of Figures

CHAPTER 1
INTRODUCTION

This thesis focuses on information sharing in the context of routine operation and incident management at major events. The study considers incidents, both routine and contingent involving individuals serving as incident responders coming together from diverse organisations. Here, incident management is particularly considered as taking place in a time constrained, uncertain and complex environment. The thesis begins with recognising information sharing as a nested element of information behaviour. It also discusses the motivations and challenges identified in the literature for exploring information sharing in different contexts. Furthermore, it investigates issues surrounding information sharing in order to create and maintain situational awareness. Similarly, it examines explicit and implied tools employed to facilitate information sharing. Consequently, diverse gaps in knowledge were discovered and filled. In this respect, this thesis offers a contribution to the development of theory on information sharing behaviour within the context described, using Mexico as case study.

This chapter presents a brief review of the current literature on information sharing, tools, situational awareness and collaborative information behaviour to outline a background for the research. It then describes the research problem. This is followed by sections presenting the theoretical implications and significance of this study within the literature and the subject domain. The major findings are also described. The chapter closes with a description of the major terms and definitions and an outline of the thesis structure.

1.1 Background

The major incidents are remembered because the damage experienced by individuals which resulted in casualties, destruction of infrastructure, economic losses and interruption of normal life (Alexander, 2002; Altay and

Green III, 2006; Dantas and Seville, 2006; Muhren et al., 2008; Paton et al., 1998; Rozakis, 2007). Their causes can be either natural - severe weather, flooding, landslides, earthquakes, epidemics and heatwaves -, or man-made - air, rail, waterways and road accidents- ; escape of dangerous chemicals; explosions; radiation incidents; terrorist acts; crowd related incidents; oil pollution; and fire and building collapses. So, the Association of Chief Police Officers (2009) defined a major incident as:

> "any emergency that requires the implementation of special arrangements by one or more of the emergency services, the NHS or the local authority for: a) the initial treatment, rescue and transport of a large number of casualties; b) the involvement either directly or indirectly of large numbers of people; c) the handling of a larger of enquiries likely to be generated both from the public and the news media, usually to the police; d) the need for the large scale combined resources of two or more of the emergency services; e) the mobilisation and organisation of the emergency services and supporting organisations, e.g. local authority, to cater for the threat of death, serious injury or homelessness to a large number of people" (p.13).

Research in this area has primarily been focused in the management of major incidents with a large amount of damage caused, but others, as exceptions of minor magnitude, have been subject to investigation such as the King's Cross Station fire (Rozakis, 2007). Results uncovered that "uncertainty" and "complexity" were two attributes requiring a great of deal of attention (Benini, 1997; Shone and Parry, 2004). These were also characterised by being highly time dependent (under considerable time pressure), uncertain (unreliable, ambiguous, or conflicting information) and dynamic environments (on-going and ever-changing) (Benini, 1997).

Other types of incidents occurred at major events. Major events are defined as public or social occasions that take place with the purpose of entertaining a group of people who have leisure objectives within a venue (Bowdin et al*,* 2006; Shone and Parry, 2004; Soanes and Hawker, 2006). The Lubumbashi in Congo and Accra in Ghana incidents are examples in which casualties and destruction of infrastructure resulted (Contrast, 2009). Major incidents in major events can exhibit the same complications of other incidents (Rozakis, 2007). An example was the Hillsborough incident. This happened in 1989 during a football match interrupting the routine operation

(Rozakis, 2007), which was considered as an unusual situation in which diverse emergency services such as the fire services, the ambulance services and the Police came together to manage it. Nonetheless, additional challenges emerged when these services were brought together into a unified effort (Jackson, 2006). The challenges were further increased when volunteers and the public were involved (Rozakis, 2007).

A consequence of these challenges was the lack of communication (called information sharing or information sharing behaviour in this thesis) between the emergency services and the volunteers and the public (called individuals interchangeable in this thesis) involved. This lack consequently increased the number of casualties (Rozakis, 2007) and was attributed to two factors: one was the type of behaviour required for sharing information in incident management. This factor was observed when the formal responders (emergency services) ignored recommendations from the informal responders (the volunteers and the public converted) (Rozakis, 2007). The formal responders also ignored information provided by other formal responders. The second one was the kind of information required by the services to respond properly, that was perceived in the information provided by the informal responders. That information included the risk and hazard awareness from the incident but was disregarded (Rozakis, 2007). Consequently, individuals failed in creating and maintaining a clear understanding of what happened, what was happening and what would happen (situational awareness) demanded for making informed decisions.

To deal with the challenges and both factors, information management was a crucial element (McEntire, 2002; Paton and Flin, 1999; Paton et al., 1998; Jackson, 2006; Paton and Jackson, 2002). Specifically, uncertainty and complexity are minimised with the appropriate information management (McEntire, 2002; Paton and Flin, 1999; Paton et al., 1998). In this line, researchers and practitioners in the discipline of event management proposed diverse tasks of information management at major events (Bowdin et al., 2006; Spengler et al., 2006; HSE, 2005). Some of them were converted in legal requirements to assure their implementation (Regester, 2008). In addition, they proposed protocols of reaction, norms on division of labour and the use of technological tools to support the information flow.

Most of these tasks were encouraged to facilitate it for creating and maintaining the situational awareness demanded over time (Bowdin et al., 2006). Similarly, technology was aligned to assist collaboration (Raths, 2008) facilitating to the individuals stay at the centre of the communication.

Going further, some researchers also argued that it is important to consider the visualisation of the future states of incidents, the collaboration between individuals and the use of technology. The visualisation of future states is referred to the tasks used to understand situations (Regester and Larkin, 2002) by creating situational awareness as a part of their information behaviour. Furthermore, this is related to information sharing concerned to information needs in static contexts (Case, 2006; Sonnenwald and Pierce, 2000; Wilson, 1981). However, recent research is concentrated in dynamic contexts as the incident management and command and control in the military in which collaborative information behaviour is included (Chen et al, 2008; Sonnenwald, 2006). That switch is based on the variety of approaches visualising that behaviour from cognitive and social approaches (Pettigrew et al., 2001). Savolainen (2007) argued that the cognitive approach served to support the information behaviour and the social constructionist approach, the information practice, considered synonyms in the current literature. Although, Savolainen (2007) suggested taking only one approach, researchers found advantageous by using both approaches at the same time. They argued that both overlap when they investigate (Widen-Wulff and Davenport, 2007) because this overlap add significance to this research.

The collaboration between individuals is seen as the sharing of information for creating situational awareness during the major events (Bowdin et al., 2006; Pidgeon and O'Leary, 2000; Smallman and Weir, 1999; Watt, 2003). For instance, information sharing is relevant in collaborative work with dynamic characteristics such as healthcare teams and information seeking in command and control (Reddy and Jansen, 2008; Sonnenwald, 2006; Sonnenwald and Pierce, 2000). Specifically, this forms the basis of that work because "when information is not effectively shared, collaborative works fails" (Sonnenwald, 2006, p.1) and is a desirable behaviour and asset to obtain collaboration (Li et al., 2007; Muhren et al., 2008). This also brings benefits in terms of organisational efficiency, innovation, flexibility and

learning and comprehension of their objectives (Chen et al., 2008; Fan et al., 2005). However, there is a lack of communication (or information sharing) as a critical issue (Chen et al., 2007; Cho and Salmon, 2007; Jackson, 1998; Rozakis, 2007). That is, communication is a challenging task as “the giving, receiving or exchanging so that the material is clearly understood by everyone concerned” (Watt, 2003, p.105). This is exhibited when “getting the right information to only the right people, at the right place and the right time” (Legrand, 2008, p.5). In this sense, the House of Representatives Committee on Government Reform (2006) argued that information sharing is the backbone to successful incident management. This entails the process of exchanging information to have common understandings of the situations (Spengler et al., 2006). From these reasons, individuals should be disposed to share information, serving as information providers from the incidents (Muhren et al., 2008). However, their motivations were uncovered as one cause of that lack. To counteract it, the adequate motivations should be encouraged (Morgan et al., 2002; Loewenstein, 2009; Jackson, 2006). For this reason, the discovery of the motivations add significance to this research in this context considering the causes of that lack.

The use of technology is concerned to the alignment of the information and communication technologies (ICTs) and language to the work practices. This is because it should improve the communication amongst the individuals involved in the routine operations and incident management (Bowdin et al., 2006; Mutch, 2008; Parkhouse, 2001; Spengler et al., 2006). Specifically, language has been as a technological tool which needs to be understood by individuals (Paton and Jackson, 2002) and its terminology should have common understandings (situational awareness) for making informed decisions in environments where lack of information is a frequent challenge (Chen et al., 2007). This might help on taking appropriated responsibility in incident management. Moreover, this understanding may show the complexity of the incident and at the same time, a favourable angle to react to the situations (Helbing et al., 2006).

Furthermore, the ICTs facilitate information sharing between individuals. For example, responders usually utilise radios (a communication technology) with designated frequencies, but they should have attributes as

interoperability. Interoperability is defined as the ability to interchange information and to use the exchanged information in situations (IEEE, 1990; Chen et al., 2008; Gottschalk, 2008; Weihua and Shixian, 2005). For instance, Usuda (2008) argued that information should have specifications in consistent formats to help on swapping information between ICT's. Here, language aids with that swapping. However, Härtwig and Böhm (2006) argued that interoperability is a process of information sharing between individuals, inside or through organisations, which is named cooperative information management. This process is not related to novel technology, but it is a consequence of "the clear identification of working roles, tasks and structures to be used to achieve effective and efficient organization" (Watt, 2003, p.104). Furthermore, this is centred in users performing their tasks and their informational abstractions accord to the level of required detail of uses (Gottschalk, 2008; Härtwig and Böhm, 2006). So, this research might help on discovering the significance of the technology and their attributes for sharing information to create and maintain situational understanding.

To sum up, the relevance of the visualisation of future states of incidents, the collaboration between individuals and the use of technology are consequently considered to take into account in the routine operation at those major events as the 2012 Olympic Games. For example, its organisers expected to sell 7.7 million of tickets during 16 days of the competition. There were around 10,700 world-class athletes who competed in 26 sports and the venues had capacity from 3,000 to 90,000 people (Authority, 2007, p.13). These numbers served to anticipate uncertainty and complexity as attributes in this event. Complexity is referred to the number of organisers involved to attend their demand and uncertainty is considered as "initial doubt about such issues as the cost, the time schedule and the technical requirements" (Shone and Parry, 2004, p.5). In addition, its nature suggests the requirement for a huge quantity of resources which "include the involvement, either directly or indirectly, of a large number of people" (LESLP, 2007, p.7). Those individuals were responsible for carrying out the routine operations and emergency services.

For these reasons, the 2012 Olympic Games in the United Kingdom as case study was the initial target for investigating information sharing, but the

access was refused. So, Mexico as case study was chosen as second option. Its rationale is based on the following reasons. First, the access to the football and baseball matches was chosen for recognising its experience on them. There, the access to the football matches was discarded, but for general security reasons. At that time, most of the cities in which the football matches took place were considered insecure, so the researcher changed the events. Consequently, the access was granted by a local government and by the professional baseball league in the northwest of Mexico organising concerts and baseball matches respectively, see section 3.5.

Second, the majority of the research in major events and incident management has been done in countries classified as developed economies. This opens a gap to study information sharing in a country classified as a developing economy. So, it was assumed that one difference between those economies is the use of technologies in the routine operation. For instance, recent research in incident management exhibits that responders use ICTs to improve information sharing (Chen et al*.,* 2007; Cho and Salmon, 2007; Jackson, 1998). Consequently, it was expected that in Mexico there were limitations so that individuals or responders used only basic ICTs for supporting their activities, using radio, for example, without interoperable attributes. This means that this research can aid in discovering other technologies employed in the routine operation in major events.

Third, according to the Authority (2007), representing a developed economy (United Kingdom), it is suggested that organisers of events should form organisations with linear or military characteristics. Here, authority and responsibility are at the top and down respectively. Furthermore, a command and control area is formed with the leaders of the diverse organisations that converge. In the same line, In Mexico there is the General Law of the Civil Protection (Estados-Unidos-Mexicanos, 2012) that states the same characteristics of the mentioned area. The objective is to manage effectively the routine operation and incident management at major events so that this policy offered similar conditions to those in developed economies.

Fourth, Rozakis (2007) pointed out that during incident management in the Hillsborough incident, individuals from diverse organisations and the

public converge organisations creating emergent organisations, which once the incidents were managed, those organisations disappeared. Thus, these exhibited characteristics of those organisations denominated “knots”. The knots are included in the concept of “knotworking” in which the authority is diluted between individuals (Engeström, 2008). These were the types of organisation formed in incident management at major events in Mexico. This research uncovered that diverse emergent organisations were formed during incident management. In other words, this suggests that “knotworking” is a common work practice in different contexts which includes the incident management at major events in developed and developing economies.

Lastly, the Authority (2007) suggested that each event involves complexity and uncertainty throughout its duration. In order to control them, individuals should create continuously situational awareness that is similarly shared using diverse technologies. This means that responders should use information to control each state of the major events. Thus, it should be common that individuals create diverse situational awareness from situations so that these are related to the type of technology employed, the type of organisations formed in incident management and the motivations for sharing information. However, a critical variable in the mentioned attributes is the public. For this reason, it was assumed that there is a difference between the public in developed economies and the public of developing economies. Consequently, this variable was only considered within the information sharing process for creating situational awareness.

1.2 Research Problem

There is significant evidence to suggest that poor information sharing is still a problem between individuals, leading to a lack of situational awareness in the context of routine operation and the management of routine and contingent incidents at major events (Boyle, 2007). This is generally observed when individuals converged from diverse agencies and organisations (the police, firemen, ambulances), including volunteers and the public (Rozakis, 2007; MacPherson, 1996). In particular, when those

individuals are tied in, but once the incident is managed, the organisation formed is untied (Mishra et al., 2011b), this is because incident management is characterised by tying and untying individuals from those agencies and organisations over time. That lack of information sharing leads to an absence of knowing “what is going on around you” (situational awareness) (Millward, 2008, p.4). Specifically, this is for creating and maintaining situational awareness in context. “Getting the right information to only the right people, at the right place and the right time” (Legrand, 2008, p.5) summarises the existence or absence of information sharing between individuals, the creation and maintenance of situational awareness and the relationship between them. This was uncovered in research from the Hillsborough football crowd disaster (MacPherson, 1996; Rozakis, 2007). So the key research question in this thesis that addresses this relationship is: how does information sharing influence situational awareness?

Moreover, this question leads to two other queries. One is related to the motivations for information sharing and the other refers to the tools employed in information sharing. These are: what motivates information sharing? and what tools mediate and control information sharing?

1.3 Theoretical Implications

This study focuses specifically on gaps discovered in four areas of knowledge which led to the research questions mentioned previously. The areas are the context of routine operation and incident management at major events; information sharing; tools utilised to mediate and control information sharing, and situational awareness. In relation to the context, most research has focused on the outcomes of incidents (Rozakis, 2007; Contrast, 2012; Cooper, 2012; Sedgwick, 2010; Alexander, 2002; Altay and Green III, 2006; Dantas and Seville, 2006; Muhren et al., 2008; Paton et al., 1998) and the challenges within incident management (Bowdin et al., 2006; Boyle, 2007; HSE, 2005; Spengler et al., 2006); although little research has been concentrated on the routine operation and incident management at major events. This is a limitation that this thesis addresses.

In relation to the information sharing area, it is a relatively unexplored part of information behaviour (Wilson, 2010). Wilson (2010) argued that despite information sharing has received attention from some researchers, there is gap in employment of information sharing to improve information practices in context. That is the case of the context treated in this thesis. Furthermore, most of the current research focusing on motivations for information sharing is approached from cognitive perspectives (Bao and Bouthillier, 2007; Constant et al., 1994; Jappelli and Pagano, 2000) or social perspectives (Chen and Huang, 2007; Richardson and Asthana, 2005; Richardson and Asthana, 2006; Kimble and Bourdon, 2008; Talja, 2002). Nonetheless, based on past research (Hassan Ibrahim and Allen, 2012; Marcella and Baxter, 2006; Mishra et al., 2011b; Sonnenwald, 2006; Sonnenwald and Pierce, 2000; Söderholm et al., 2008; Sonnenwald et al., 2008), this thesis argues that motivations for sharing information can emerge from cognitive and social perspectives. In other words, both sources of motivation are not mutually exclusive in this context. Lastly, there is little attention on outcomes of information sharing, specifically on creating and maintaining situational awareness in collaborative environments (Paul et al., 2008a; Sonnenwald, 2006; Sonnenwald and Pierce, 2000; Sonnenwald et al., 2008; Sonnenwald et al., 2004; Paul et al., 2008b). However, past research was focused on different contexts in developed economies, rather than in developing economies, therefore this thesis fills a gap in this area.

Related to the tools employed to mediate and control information sharing, little research exists in the information behavior and cognitive engineering (concerned to situational awareness) fields. In the cognitive engineering field, it is assumed that if individuals have the right collaborative tools (ICTs) at the right time, they could be more likely to create and maintain situational awareness in collaborative tasks via communication (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005). In the information behaviour area, some researchers found that information technologies foster information sharing to create situational awareness (Sonnenwald et al., 2008; Sonnenwald et al., 2004; Sonnenwald, 2006). However, abstract tools such as language, skills or memory were undervalued in both fields. In this line, Allen et al. (2011) pointed out that information practices are mediated

and controlled by abstract and material tools which boost the achievement of objectives. This is the case of information sharing, which is mainly mediated and controlled by ITCs. Thus, this gap in the knowledge is filled here through a focus on the use of the abstract and material tools in information sharing for creating and maintaining situational awareness demanded in the context of routine operation and incident management at major events.

Regarding situational awareness, it has been studied in several domains such as management of complex systems, scientific collaboration, virtual teams and command and control areas, among other contexts (Endsley, 1994b; Kaber and Endsley, 1998; Fan et al., 2005; Harrald and Jefferson, 2007; Adams et al., 1995; Cuevas and Bolstad, 2010; Desourdis and Contestabile, 2011; Sonnenwald et al., 2004; Sonnenwald and Pierce, 2000). Some of them were focused on measuring situational awareness in controlled environments within communication perspectives (Tenney and Pew, 2006; Endsley, 1994b; Endsley and Jones, 2001; Endsley, 2001; Betts et al., 2005). There are other examples where situational awareness was analysed from information behaviour and communication perspectives within controlled contexts (Millward, 2008; Söderholm et al., 2008; Sonnenwald et al., 2004; Sonnenwald et al., 2008). Nevertheless, situational awareness is still under-explored in the information behaviour field (Talja and Hansen, 2006; Widen and Hansen, 2012), particularly in the naturalistic context studied here. Hence, this research fills a gap in the literature concerning to the analysis of situational awareness in the routine operation and incident management at major events within the information behaviour field.

1.4 Significance of the Research

Major events are not exempt from threats and hazards that can lead to incidents during the routine operation (Bowdin et al., 2006; Parkhouse, 2001; Spengler et al., 2006; Watt, 2003). Although diverse tasks are carried out to deal with those threats and hazards, the tasks assumed that if individuals involved are aware of what has happened and what is happening, they could be capable of being aware of what could happen in the near future (Endsley, 1995). This lays the foundation for improving the situational awareness

demanded by individuals. Here, information sharing is the key element for creating and maintaining situational awareness at collaborative levels (Reddy et al., 2008). Being in the middle of the information flow, individuals could be able to handle the information provided (UKSport, 2005; Watt, 2003) and this consequently serves to effectively manage potential or contingent incidents. So, it is presumed that the discovery of motivations for information sharing could lead to the detection of the impact of the norms, policies and division of labour on individuals. Moreover, the discovery of the abstract and material tools used by individuals could lead to discover their impact on mediating and controlling the information sharing. This is because adequate tools to be employed in the process are still missing.

1.5 Main Contributions

This thesis offers a set of theoretical contributions based upon four main findings related to information sharing and situational awareness as follows:

1. Surface credibility as a motivation for information sharing. This is associated with trust between individuals wearing uniforms, but not at the individual level. They are connected to the roles of individuals and their organisations. So, responders trust on others “based on the simple inspection” (Tseng and Fogg, 1999, p.42) of uniforms in face-to-face interactions motivating information sharing between them.
2. Normative altruism as a motivation for information sharing. This is linked with the counteracting actions of information sharing required to control and coordinate the altruistic organisations deployed in context. Leaders from organisations in charge of the operation at major events stated that altruistic individuals managing incidents should share information because “sharing at least some information is obligatory to become part of the community” (Parrish, 2010, p.189).
3. Situational awareness as an abstract tool. This is employed to mediate and control information sharing for creating and maintaining shared situational awareness demanded in context over time. This is because individuals understood the meaning of environmental

elements (Gibson, 1983; Gibson, 1986; Flach, 1995) employing the four - stage process of situational awareness - (Endsley, 1995) to subsequently mediate shared situational awareness amongst other responders (Endsley and Jones, 2001; Millward, 2008) using abstract and material tools in the information sharing process. This serves to balance individual and organisational responsibilities and authority.

4. The Situational Awareness Modes in Incident Management (SAMIM) Model. This model is proposed to point out the necessity of individuals being aware of diverse situations (Endsley, 1994b), being engaged in sharing information for creating and maintaining shared situational awareness for other individuals (Millward, 2008) and using abstract and material tools in the information sharing process in context over time. To do so, individuals exhibit their roles (Sonnenwald and Pierce, 2000) balancing individual and organisational responsibilities and authority.

1.6 Basic Definitions

This section presents a brief description of the principal terms utilised:

- Incident: defined as any unusual situation that could lead to the loss or disruption of routine operation.

- Incident management: represents the set of tasks that are performed before, during, and after the routine or contingent incidents with the goal of preventing casualties, reducing their impact on infrastructure and returning to a state of normalcy as routine operation.

- Information behaviour: defined as "'the study of how people need, seek, give and use information in different contexts, including the workplace and everyday living" (Pettigrew, Fidel and Bruce, 2001; p.44).

- Information practice: defined as the act of seeking, sharing and using information to perform tasks in the routine operation.

- Information sharing or information sharing behaviour: “The goal of sharing information is to provide information to others, either proactively or upon request, so that the information has an impact on another person's (or persons') image of the world, i.e., it changes the person's image of the world, and creates a shared, or mutually compatible working, understanding of the world” (Berger and Luckman, 1967, cited in Sonnenwald, 2006, p.1).
- Information use: “Information use behaviour consists of the physical and mental acts involved in incorporating the information found into the person's existing knowledge base” (Wilson, 2000; p.50).
- Knots: “refers to rapidly pulsating, distributed, and partially improvised orchestration of collaborative performance between otherwise loosely connected actors and activity systems” (Engeström, 2008, p.194).
- Knotworking: “is characterised by a movement of tying, untying, and retying together seemingly separate threads of activity” (Engeström, 2008, p.184).
- Motivation: It is defined as “the energisation and direction of behaviour” (Elliot and Covington, 2001, p.73) for sharing information.
- Routine operation: It is the set of tasks that are performed before, during, and after the normal operation with the goal of preventing incidents or managing potential or active incidents.
- Situational awareness (SA): “the perception of elements in the environment within a volume of time and space, the comprehension of their meaning in terms of task goals, and the projection of their status in the near future” (Endsley, 1995, p.36). In the current literature the terms situational awareness or situation awareness are used interchangeably; but, in this thesis the term situational awareness is preferred to point out the necessity of individuals to be aware of diverse situations in incident management at major events.
- Shared Situational Awareness (Shared SA): “a process of knowing what is going around oneself and others with whom one interacts” (Millward, 2008, p.13).

- Valences of motivation: refers to expected outcomes of motivation. Those motivations are focused to obtain positive/desirable (approach) or negative/undesirable (avoidance) outcomes" (Elliot and Covington, 2001, p.73-74). In this research, both valences are considered.
- Uncertainty: "initial doubt about such issues as the cost, the time schedule and the technical requirements" (Shone and Parry, 2004, p.5).

1.7 Thesis Structure

The remainder of the thesis is structured as follows: Chapter 2 reviews and discusses the current literature on topics related to information sharing, tools, situational awareness and collaborative information behaviour. Chapter 3 presents the methodological approach followed, which adopts activity theory as a conceptual framework and as an analytical tool. In addition, there are set out the research methods employed for gathering, analysing and interpreting data. Chapter 4 presents a description of major events and analyses relevant activities within the study context. Chapter 5 presents the discussion of the findings related to motivations for information sharing. Chapter 6 depicts and reviews tools utilised to mediate and control information sharing that were categorised as "abstract tools" and "material tools". Chapter 7 presents and examines three types of situational awareness modes. They provided foundations to propose a model that is based on the necessity of individuals to be aware of diverse situations, the engagement in information sharing for creating and maintaining shared situational awareness and using abstract and material tools in information sharing. The last chapter reviews the main findings presented as contributions and practical implications of this study. Strengths and limitations of it and the directions for future research are also provided.

CHAPTER 2
LITERATURE REVIEW

This chapter presents a review of the literature reflecting crucial features in four areas pertinent to this study, shaped by the research questions stated in section 1.2. The first area is information sharing. This is principally studied from cognitive and social perspectives to comprehend its motivations. The second area is related to the tools that are implicitly or explicitly employed as mediators in information sharing. For instance, the ICTs and specialised language are in close relation with the context of study. The next area is situational awareness studied from the information processing and ecological approaches. This is considered as a process and product and is investigated in different levels of collaboration by creating individual and shared situational awareness. The last area is collaborative information behaviour. This area is presented and reviewed as a complementary natural organisational process in collaborative work environments where information sharing is included and technology plays an important role.

The chapter begins by presenting an overview of information sharing research, its conceptualisation, motivations, outcomes and implications for this research. This is followed by an overview of the tools employed to mediate and control information sharing incorporating abstract and material tools and their implications for this investigation. Thereafter an overview of situational awareness is presented including its conceptualisation, types and implications for this study. An overview of collaborative information behaviour is then given that includes its dimensions, social practices and implications for this investigation. The chapter finishes with a summary.

2.1 Information Sharing

Although research on information sharing behaviour is not new, it has gained popularity after the attack on New York in 2001 (Reform, 2006). Emergent

investigation on this issue is taken under both information behaviour (Wilson, 2010; Allen, 2011; Hassan Ibrahim and Allen, 2012; Sonnenwald, 2006; Sonnenwald and Pierce, 2000; Sonnenwald et al., 2004) and communication approaches (Dunn et al., 2002; Stasser et al., 2000; Wittenbaum et al., 2004; Yang and Maxwell, 2011; Constant et al., 1994). So, this research followed the information behaviour approach as noted in sections 1.3, 2.1.1, 3.1 and 3.2.4. The first section concerns the conceptualisation of information sharing as a nested element of information behaviour. The second section presents motivations for sharing information and the approaches which served to inform it. The third section reports its outcomes. The subsequent sections depict its classifications and its implications in the research.

2.1.1 Conceptualising Information Sharing

The origins of information behaviour are located in Library Science and the field of readership. Studies on uses of libraries and how scholars used information relative to their work emerged 90 years ago (Wilson, 2010). The research in these fields included the switch from system-centred to user-centred (Wilson, 2000a; Rioux, 2004; Case, 2006). In addition, this served to evaluate technological tools and relations with users. Moreover, this extended the studies to information sources that are in physical or electronic form in libraries or places where users were immersed. This also considered the individuals as sources of information (Wilson, 1981). Similarly, this recognised the importance of contexts such as everyday life and incident management. For instance, Talja and Hansen (2006) stressed that information behaviour can change the course of the relationships between individuals and their information sources. This is because information behaviour offered a concise relationship with contextual and situational variables, resources and rules to seek and use information (Wilson, 1981).

A consequence of that relation is that information behaviour is considered as an umbrella term. This is seen when the terms information behaviour and information practice are used interchangeably (Savolainen, 2007). However, Savolainen (2007) argues that despite both terms are used in the same form, there is a difference in relation to the approach in which

they are conceived. He pointed out that information behaviour is conceived in the cognitive approach and the information practice, in the social constructionist approach. That is, information behaviour is considered as a product of the mind and information practice, a product of the social interactions between individuals. Therefore, it is important to consider that information behaviour and information practice are mutually related, so both the cognitive and the social perspectives are considered in this research. This is because the cognitive approach can help to understand the behaviour and the social constructionist approach, the collaborative nature of incident management using information sharing as the principal means.

In this study, the term information behaviour is employed in line with Wilson (2009). He pointed out that the human acts have both cognitive and social dimensions. For this reason, Wilson (2000a) outlines: “Information behaviour is the totality of human behaviour in relation to sources and channels of information, including active and passive information seeking, and information use” (p.29). Although there is not a universally accepted definition of it, the above definition is used in this thesis and information sharing behaviour is seen as an extension. In other words, information sharing is seen as a nested component of information behaviour.

Alternatively, in the current literature three theories of information sharing were found. Stasser and Titus (1985), Constant et al. (1994) and Marcella and Baxter (2006) proposed these theories. Each theory is restricted to its context, perspective on study, outcomes and proposed approaches for carrying out future research. For example, in terms of contact and interaction to transfer information, Stasser and Titus (1985) presented an approach in which behaviour is mediated by information technologies reducing the decision alternatives in conflict between individuals. Here, they shared information to achieve a consensus in the decision making process. This study was done in an academic environment with its variables controlled. Following the line of controlled environments, the work of Constant et al. (1994) measured the attitudes for sharing information including the technical work and expertise of individual. Interestingly in the study, researchers used mediators of behaviour to compare that information and knowledge in terms of information. This theory

only represented attitudes for sharing information within organisations, but it was not mentioned how knowledge was reduced in information. In this line, line, Wilson (2010) argued that information and knowledge are different and knowledge has to take the form of information to be shared. Conversely, Marcella and Baxter (2006) put the basis of their theory in the relationships between governmental agencies and their users mediated by information systems. They found some issues that subsequently were incorporated in those systems facilitating those relationships. So, this theory was focused on the ways to improve the technological mediators of information sharing.

To sum up, these theories understood the basis of information sharing. Researchers moved from quantitative to qualitative methods to understand it. Research provided its deep understanding, but similarly, provided the background to comprehend that it varied in relation to the context. Specifically, it works in relation to the context and is affected by mediators. So, methods to study information sharing, motivations for sharing information and tools used in information sharing process are presented and discussed in chapters 4, 5 and 6 respectively.

2.1.1.1 Theoretical Perspectives

Current research has treated information sharing as a component of the communication approach (Dunn et al., 2002; Stasser et al., 2000; Wittenbaum et al., 2004; Yang and Maxwell, 2011; Constant et al., 1994), or as a component of the information behaviour approach (Wilson, 2010; Allen, 2011; Hassan Ibrahim and Allen, 2012; Sonnenwald, 2006; Sonnenwald and Pierce, 2000; Sonnenwald et al., 2004). Both approaches are identified individual and contextual rules for sharing information. Nonetheless, their differences are the paradigms, the assumptions and the methods of how information sharing is investigated. For example, the communication perspective is primarily built upon by quantitative strategies; on the other hand, the information behaviour perspective, by interpretive strategies. Consequently, their findings partially diverged in relation with the context.

In this respect, information sharing as a nested element of information behaviour is principally studied in interpretive strategies. Here, information

sharing considered the interactions between individuals seeking or using information. In this line, Sonnenwald (2006) stated that information sharing research is centred on types and motivations, technological and individual mediators and challenges for sharing information. In fact, challenges dealt with barriers of information sharing and expected results from it. Wilson (2010) has analysed and stated some dimensions in terms of personal and organisational relationships, context and rules for sharing information. In addition, he revised and examined its triggers. This resulted in a lucid set of propositions based on the associations of trust, risk/reward and proximity as motivations for sharing information. Outcomes and types of information sharing are presented in sections 2.1.3 and 2.1.4 respectively.

2.1.1.2 Theoretical Considerations

Even though both information behaviour and information practice approaches are relevant to study information sharing, a notable separation is denoted in the current literature. Within the information behaviour approach, information sharing is seen from an individual perspective. Here, the individual is investigated in connection with the use technological tools, the state of responsibilities and roles of individuals and the consideration of contextual situations (Sonnenwald and Pierce, 2000). In contrast, information practice is connected with the interactions between individuals who collaborated in information seeking and use (Folb et al., 2010). Nevertheless and in spite of this, to understand information sharing in depth, certain researchers used both approaches without distinction (Sonnenwald, 2006; Savolainen, 2009; Savolainen, 2011; Talja and Hansen, 2006).

Moreover, individuals are situated in relation to their context. For instance, Wilson (1997) noted that individuals should be situated in context to understand their barriers in the information practices that are related to personal, social and environmental aspects. Similarly, Allen (1996) stated that individual barriers are related to contextual variables. Furthermore, he found that individuals' decisions about being engaged in information sharing are affected by the type of information requested (Constant et al., 1994; DiGangi and Wasko, 2008; Jarvenpaa and Staples, 2001).

Consequently, three questions arose in relation to the context being studied: what are the relevant reasons to consider information sharing important in incident management?; why information sharing is significant in working practices?, and how information sharing is affected by the type of information requested? Here, the first question is related to the importance of incident management; the second one, the significance of working practices; and finally, to the type of information requested. To answer the last question, it is required to consider the social constructionist perspective. This is because it suggests that information sharing is affected by social interactions in context. The answer to the second question refers to the cognitive perspective where the information needs is emphasised. In addition, information sharing is affected by the individual's barriers. These are stressed by and within the social relations and the environment where individuals are immersed. The reply to the first question concerns a situation where both the cognitive and social constructionist perspectives are stressed. Firstly, incident management is characterised for being a collaborative task (i.e. social interaction between individuals involved) (Hassan Ibrahim and Allen, 2012; Mishra et al., 2011b). Secondly, to manage the incidents, individuals should need to understand the situations and to subsequently respond to them. The response can be individual or collective (i.e. cognitive or social constructionist approaches) and in relation with the incident (Hassan Ibrahim and Allen, 2012; Mishra et al., 2011b). Therefore, this suggests that information sharing should consider both cognitive and social constructionist perspectives for a full understanding.

2.1.1.3 Defining Information Sharing

Within the current literature both the cognitive and social constructionist approaches are considered so multiple definitions of information sharing are found. Here, two are used to narrow the definition utilised in this thesis. The first one is provided by Choo et al. (2008) who defined information sharing as "the willingness to provide others with information in an appropriate and collaborative fashion" (p.974). The second definition is supplied by Bao and Bouthillier (2007), who stated that information sharing is the "type of activity in which the information provider and information seeker work together to

achieve the transfer of a certain type of information from the former to the latter" (p.2). Both definitions confirmed that information sharing is considered as a collaborative activity. Nevertheless, in the former definition, cognitive aspects are emphasised when the word willingness is mentioned. This indicates a human cognitive state to share and its final status is collaboration. In other words, this suggests an individual status at the start and a collective status at the end. This also expressed an interiorised a mental state for sharing information being part of the organisational culture. On the other hand, the latter expressed a collaborative status. Both individuals worked together to satisfy their information needs. Collaboration for gathering information is also implied in which is clearly understood what kind of information is necessary to satisfy their information needs. A social interaction between individuals is suggested and encouraged. Taking this into account, information sharing could be considered as an umbrella concept in which both information behaviour and practice approaches may converge. However, neither definition states implicitly or explicitly what information needs should be satisfied. For these reasons, information sharing in this thesis is defined as

> "the goal of sharing information is to provide information to others, either proactively or upon request, so that the information has an impact on another person's (or persons') image of the world, i.e., it changes the person's image of the world, and creates a shared, or mutually compatible working, understanding of the world" (Berger and Luckman, 1967, cited in Sonnenwald, 2006, p.1).

Information sharing could have an impact in the creation of shared understandings between at least two individuals, who take place in determined moments of time and space reflecting accurately the reality of a given situation within their working world. So, this understanding suggests the creation of the situational awareness demanded at individual and collective levels in context.

2.1.1.4 Context and Situation

Continuing this discussion, "context" and "situation" are clarified. In the current literature, there are diverse definitions that are primarily fitted to each

investigation so that both terms are also considered umbrella terms. For instance, context is a broad concept defined as part of the routine tasks of individuals and part of diverse organisations or specialised work situations (Widén-Wulff and Davenport, 2005). In this line, Savolainen (2006) argued that context could be pronounced in terms of place, time, goals, tasks, systems, situations, processes, organisations, and type of participants. In between and going so far, Savolainen (2009) compared context within the construction of a small world and information grounds elaborated in terms of spatial and social factors in everyday information seeking and sharing. So, context implied certain limitations of this research and scrutiny of information sharing and is defined as "the quintessence of a set (or group) of past, present and future situations" (Sonnenwald, 1999, p.178). For this reason, routine operation and incident management at major events assumed the role of context in this study in which situations are included.

Situation is another term in which a universal definition is not completely accepted. Sonnenwald (1999) explained the relationship between context and situation. The latter is subject to the former so that situation is outlined as "a set of related activities, or a set of related stories that occur over time" (Sonnenwald, 1999, p.180). In this study, both refer to the tasks or activities, actions and operations required in routine operation and incident management at a particular time and place at the major events. Similarly, another relevant term which needs to be defined in this thesis is major events. This is broadly defined using the background of the definitions of Bowdin et al. (2006), Shone and Parry (2004) and Soanes and Hawker (2006). Thus, major events are public or social gatherings that take place with the purpose of entertaining a group of people who have leisure objectives within a place or venue.

2.1.2 Motivations for Sharing Information

Two approaches are used to study the motivations for information sharing in which the cognitive approach is presented under the information behaviour perspective and the social constructionist approach, under the information practice perspective. Within this thesis, motivation is defined as the "energisation and direction of behaviour" (Elliot and Covington, 2001, p.73)

for sharing information. Elliot and Covington (2001) suggest that motivations are sourced from the positive or negative valences or directions. In other words, the motivations are focused to obtain positive/desirable (approach) or negative/undesirable (avoidance) outcomes, respectively. Although they are sourced from cognitive perspectives, suggested in section 2.1.1, they are in relation to information needs and uses. They are also basic to the definition of information sharing presented in the section 2.1.1.3, when an individual shares information proactively or upon request. Overall this suggests that individuals exhibiting information problems may expose positive or/and negative valences of motivations in context.

2.1.2.1 Cognitive Approaches

This part presents five motivations in relation to the cognitive approach. In the first instance, Constant et al. (1994) proposed the theory of information sharing in order to understand the attitudes of people towards sharing information. This theory is built on social exchange theory and researchers assumed that attitudes are influenced by those coming from personal issues and those coming from context. So, this behaviour is predicted on the basis of a rational self-interest in sharing information and in expecting reciprocity once information is shared. However, Constant et al. (1994) argued that their study has only a simple survey which served to measure pro-social attitudes and this limits the comprehension of their motivations. Notwithstanding, this provided advances in the understanding it. For instance, the consideration of the context and how it influences information sharing were uncovered as relevant elements. The study also addressed the organisational culture and policies and individual factors. Similarly, diverse influencers such as information systems, organisational mandates and financial incentives were stressed as relevant for motivating information sharing.

Moreover, Sharkie (2005) argued that trust is one key element that influences information sharing. He assumed that trust is developed on a daily basis within social and continuous interactions between individuals. In other words, trust takes time to develop it and it can be seen at individual and organisational levels. At organisational level, in how organisations treat their personnel, keep their promises and meet their obligations to individuals

in both the present and the future. At a personal level, this can be seen in how people converse during work practices. Thereby, conversation between individuals is seen as a medium by which formal and informal information is shared within informal networks in organisations. The informal networks are seen as an advantage or disadvantage depending upon the context. For example, it can be as an advantage in incident management, because it can help to re-install trust between individuals that have initially lost trust between them (Sonnenwald, 2006). However, individuals may have no time to develop it when they converge from multiple organisations. For this reason, Sharkie (2005) argued in “environments with high levels of trust between individuals and their organisations, individuals may be predisposed to share information” (p.40).

In addition, Härtwig and Böhm (2006) argued that individuals having similar positions and responsibilities are disposed to share information with individuals from other organisations but at the same organisational levels. The organisational roles of those information sharers (i.e. those individuals who are disposed to share) are influenced by other individuals at the same organisational level. As the motivations are in individual origin, these are exhibited in consideration of contextual factors. Nonetheless, technology can help to bring together people located in diverse places and enhance information sharing between individuals at different levels (Härtwig and Böhm, 2006). They pointed out that the organisational boundaries were left outside and information richness arose within the information sharing activities, specifically when time pressure began. However, those meetings or encounters in incident management should be mediated by other technologies, supporting the tasks of incident management (Ward, 1995). In other words, technologies might support negotiations and feedback processes in real time to improve the individual performance. Here, the motivations for sharing information should be situated in internal sources but considering contextual factors such as the mediation of technology that can help on respecting or crossing organisational boundaries.

Furthermore, ethical issues influence information sharing. Lin (2007b) argued that in routine working conditions, it is expected that individuals should be predisposed to share information influenced by moral standards.

According to Lin (2007b), information sharing should be positioned as an ethical issue that individuals should consider. The moral standards of them should be apparent in their behaviour in the routine work and information sharing can exhibit those standards. However, Lin (2007b) suggested that information may be difficult to share in work environments when the individuals converge from diverse backgrounds. Unfortunately, this is the case in incident management in which the individuals managing it are characterised by having different backgrounds. This environment is regularly oriented to achieve organisational goals, but may provide diverse moral standards in reference to information sharing activities. For this, Lin (2007b) proposed that ethical issues should be included in the social norms of social interaction but not such as a mandatory rule, as found on this research.

Lastly, Constant et al. (1994) found that attitudes for sharing information serve as mediators of positive self-identity and self-expression of individuals in relation to other individuals. These attitudes are also seen as mediators for the individual reinforcement and the strength of social relationships, specifically between those individuals “who need them, who will hear them, who will respect them, and who may even thank them” (Constant et al., 1994 p.419). In the same line, Marouf (2007) suggested that closeness of relationships between individuals and frequency of those social interactions may serve to the strengthen social relationships. He also pointed out that additional organisational elements can play important roles. These elements can be under organisational structures including uncertainty. This is seen in the organisational flexibility which incorporates situations with high levels of uncertainty; here, the attitudes for sharing information can be exhibited in the social interactions between the individuals involved. This also reinforces their presence by creating a shared image of the world, being the case of incident management in which diverse organisations converged adding flexibility to the organisation generated.

From the foregoing discussion, it is important to remark that these motivations for sharing information are uncovered within research that has predicted this behaviour. Motivations were also uncovered in conditioned contexts where information sharing is influenced by contextual aspects. Nonetheless, their values were recognised because they provided insights of

it. Similarly, research provides a basis to deeply understand some of the motivations in other contexts of study, such as incident management at major events. For instance, most of these motivations are found on social norms within time constrained, uncertain and complex contexts. Moreover, the consideration of information sharing as a two-way process (Talja, 2002) is related to social interaction between individuals.

Other motivations are detected in the leadership foundations (Talja, 2002; Cooper et al., 2007; Waugh and Streib, 2006); the increase of information richness (Daft and Lengel, 1983); the decrease of spatial proximity between actors (Knoben and Oerlemans, 2006); the employment of patrols to decrease spatial proximity (Zerubavel, 1976); the consideration of swift trust (Meyerson et al., 1996; Robert et al., 2009; Hassan Ibrahim and Allen, 2012); the surface credibility (Tseng and Fogg, 1999); the reconsideration of ethical issues (Richardson and Asthana, 2005), and the reconsideration of attitudes for sharing minimal information (Parrish, 2010). Consequently, those and other motivations can be considered in the context treated here.

2.1.2.2 Social Approaches

This part presents four motivations in relation to social approaches. The first one is professional culture. This is considered one of the principal barriers that stop individuals being engaged in information sharing. Richardson and Asthana (2005, 2006) pointed out that organisations where there are individuals with diverse backgrounds and expertise bring additional challenges for sharing information. This can be observed in the specialised language used by them and it is located as an important factor (Sonnenwald, 2006). Moreover, Richardson and Asthana (2005, 2006) argued that those individuals can form internal groups which can not show interest for sharing information with other groups. They assumed that others are not interested in information sharing thus gaps in information are created. Nonetheless, they recognised that information sharing is an important asset in daily working practices helping on solving routine problems. Hence, this lack of information sharing is present, but at the same time, individuals showed a

positive view of information sharing. In other words, there is a positive attitude for sharing information, but individuals with diverse background and expertise using specialised languages inhibit information sharing.

Another social motivation is organisational climate. Chen and Huang (2007) argued that it is a relevant element in information sharing because this is present in the common working practices, the shared beliefs and the usual value systems that organisations follow. This is also a set of factors that influence individual behaviours, specifically the social interaction between the authority and operational personnel (Ivancevich et al., 2007). That is the roles and levels in the organisational structure can affect information sharing. Although centralised and integrated structures offered benefits to the organisations, a centralised structure in which authority is situated in higher levels can inhibit information sharing between and with individuals in higher and lower levels. Contrarily, an integrated structure may encourage information sharing (Wilson, 1997).

The next social motivations are sociability and solidarity. Kimble and Bourdon (2008) argued that social relations should be based on them. According to Kimble and Bourdon (2008), these elements of the organisational culture can affect the cognitive states exposed in the social interactions that motivate information sharing. It is common that individuals share information with individuals who have showed reciprocal relationships between them (i.e. sociability) and a strong relation between individuals and the organisations (i.e. solidarity) (Kimble and Bourdon, 2008, p.462). However, these motivations cannot be found in fragmented organisational cultures. This culture is characterised by low sociability and low solidarity not encouraging information sharing. Here, if individuals or groups exhibited it, other individuals may exclude them so this can be seen in this study.

To sum up, the cultural diversity in context may not encourage information sharing (Kimble and Bourdon 2008). Other social motivations included in organisational cultures are security, employability and rewards (Sharkie, 2005). However, these may not be relevant in the context in study because they are considered sensitive issues.

2.1.3 Outcomes of Information Sharing

Diverse outcomes of information sharing were found on the current literature. These were based on the collaborative tasks employing information sharing on them. The main results are described below.

2.1.3.1 Sense-making

Sense-making is a procedure for comprehending the unknown, unstructured and information-rich situations (Paul et al., 2008b) and is studied in individual and organisational contexts (Dervin, 1996; Weick, 1995). At the individual level, it helps to bridge the cognitive gap that exists in new situations in the context (Dervin, 1996), and to link the initial states of situation awareness (Paul et al., 2008b), exhibited in section 2.1.3.4. At organisational level in which collaborative tasks are common, sense-making at individual level offer foundations for creating collaborative sense making (Paul et al., 2008b). Similarly, it supports the origin of shared initial states of situational awareness and gives opportunity to know individual perspectives and interests (Weick, 1995). Moreover, it is utilised to understand unpredicted and unfamiliar situations and to confirm well-known situations. However, it does not have the capability to project future states of the situations (final state of situational awareness). For this reason, it can be considered as a static comprehension of situations, but this is relevant as the initial situational understanding demanded in the context treated here.

2.1.3.2 Social Meaning

Social meaning is passing additional emerged understandings from shared human experiences and understandings (Miranda and Saunders, 2003). Here, the members of groups have equal access to the human experiences and understandings and to those emerged social understandings via information sharing. This social meaning is derived from an iterative process of interpretations shared by diverse individuals but not cognitions by single individuals. Individuals can achieve a general meaning of things when their interpretations are discussed with other members of their groups (Maines, 2000). In this case, ICTs can aid with those discussions and interpretations

until a meaning is achieved. Meaning is a social construction that helps on the “objective nature as facts in the social world” (Miranda and Saunders, 2003, p.88). Nevertheless, this is considered as a static outcome related to the second stage of situational awareness denominated comprehension of the elements in the situations. This creates shared comprehension of the elements in those situations, but additional changes in their states are not considered. Thus, this provides incomplete situational awareness.

2.1.3.3 Common Ground

Common ground is associated with information, beliefs and knowledge that a group have in common and their collective shared awareness of them (Sonnenwald, 2006). This is estimated in terms of creation of common meanings within groups and evidenced by contextual confirmations and common situational testimonies. Going further, Hertzum (2008) presented a model that emphasises it such as collaborative grounding. He argued that this grounding is the result of vivid interactions between individuals to construct general understandings assimilating and exposing existing information from the context. This is also associated with passing from individual to group groundings and its construction results from information sharing between the members of those groups. Common ground is investigated in the military (Sonnenwald, 2006) and hospital contexts (Reddy et al., 2008), contexts considered dynamical, time constrained and uncertain as the treated here. However, their results (Hertzum, 2008; Reddy et al., 2008; Sonnenwald, 2006) suggest that when individuals have common groundings, collaborative behaviour stops and individual behaviours reappear. For this reason and not diminishing its value, common ground is a good tool to gather shared groundings and to aid with the study of the interactions between individuals and their groups.

2.1.3.4 Situational Awareness

Situational awareness is related to the continuous extraction of environmental information in order to predict future states of situations (Endsley, 1995; Endsley, 1995b; Endsley et al., 2003; Sonnenwald and

Pierce, 2000; Sonnenwald et al., 2004; Betts et al., 2005). This concept establishes individual states of knowledge and capacity to mix extracted information with individual knowledge so that individuals may be able to foresee future situations (Endsley, 1994b). That also implies uses of mental models within the information processing process (Endsley, 1995). Situational awareness is used in the military (Sonnenwald and Pierce, 2000), emergency response (Betts et al., 2005) and scientific collaboration (Sonnenwald et al., 2004) as a result of information sharing. However, discovering its stages at an individual and collaborative level is a challenging task (Endsley and Robertson, 2000). For example, situational awareness is considered as a dynamic task involving extra efforts to elucidate those states (French et al., 2007) at individual and collective levels for creating and maintaining shared situational awareness, discussed in sections 2.3.

To sum up, outcomes of information sharing established a dynamical and collaborative process that included the stages of individual and collective situational awareness, noted in section 2.3.3. For instance, the understanding of unexpected situations bridges the gaps of knowledge on creating meaning. Then, a common opinion is developed with the shaped meaning. Next, situations are projected with the common view in which, finally, self-reinforcement and strength of social relationships are exposed. These stages are found separately in the current literature but they are related to the mentioned states of situational awareness.

2.1.4 Types of Information Sharing Behaviours

Five typologies were discovered in the current literature. One classification stated that information providers served as information intermediaries themselves within the context of libraries and their users of written information (O'Day and Jeffries, 1993). Those individuals served as intermediaries between information users and the library clients and at the same time, they served as information providers. So this classification includes four categories to point out that information providers offered updates to other team members, consultations, broadcasts and put information in a shared archive. This archive was used in present or future

consultations by the information users of other organisations. Nevertheless, the categorisation lacks the details of the information sharing used for creating and maintaining shared understandings of that information and how the information was prepared to facilitate its use. Moreover, this classification was uncovered in a context considered static with different characteristics to those included in the context treated here.

The following typology puts this basis in the experiences of people on encountering information in tasks of information seeking at individual and/or collective levels (Erdelez, 1997). As a result, four categories were proposed in relation to what extent people have experienced encountering information in the information seeking process: super-encounters, encounters, occasional-encounters, non-encounters from the perspective of the information receivers (Erdelez, 1997); or super-sharers, sharers, occasional sharers, or no sharers from the perspective of the information provider (Talja, 2002). Both perspectives are related to each other. The first perspective is concerned to the degree on encountering information and the second perspective, to the degree for sharing information and both are nested elements of the information behaviour. Nonetheless, the classification suggests a one-way process depending on whether the information receiver or provider is studied. It is assumed that in the context of study both perspectives (receivers and providers) should be considered to provide additional insights for sharing information in context.

The next typology is founded on the roles of individuals in the academic context. Talja (2002) argued that in current research there is a lack of consideration of information behaviour in collective and collaborative contexts. For this reason, it is necessary to consider information seeking as a two-way process in which its goals, purposes and tasks are included in the information sharing. So, she reported four types of information sharing: strategic sharing, paradigmatic sharing, directive sharing and social sharing. The strategic sharing is focused on maximising efficiency in a group; the paradigmatic sharing opens new areas or considers new research approaches; the directive sharing is employed by teachers for sharing information with students, and the social sharing grows social relationships. However, this classification was developed in a static environment where

clear boundaries of their roles were stated. Similarly, it did not exhibit to what extent the individuals played their roles and how the individual attitudes and information seeking styles motivated information sharing, suggesting that this should be included in this study.

The subsequent typology was proposed on the basis of patterns of information sharing in the context of health and social services (Richardson and Asthana 2005, 2006). Two elements were considered in it: the motivation for information sharing and the assurance of the complete comprehension of the information received. The results were four logical possibilities which were ideal, over-open, over-cautious and chaotic. The ideal implies passing sensitive information to correct receivers and the chaotic implies passing non-sensitive information to improper receivers. On the other hand, the over-open implies passing sensitive information to improper receivers and the over-cautious implies passing non-sensitive information to proper receivers. The types also implied ethical and legal issues considering the challenges in this process. Nonetheless, the classification suggests the inclusion of governmental rules imposed in the information management between the health and social services. This was because the personal information is a complex asset in those services. For this reason, the motivations, the assurance of the complete reception of information and the ethical and legal issues should be included in the information sharing process in this study.

The last category resulted from the operationalisation of diverse factors that influence information sharing in the routine operation of supply chains in small and medium companies. These factors were included in the content (types of information shared and level of detail), spatial (distance of seekers or providers and their involvement in this behaviour) and time (frequency and timeliness) dimensions (Bao and Bouthillier, 2007). Each dimension and their categories were measured to gain insights on those influencers of information sharing and at the same time, the levels of engagement in context. The result was an index that exhibits the propensity for sharing information in context. For this reason, the consideration of the dimensions and categories for sharing information should be considered in this study.

Overall, classifications cannot be applied directly to information sharing this study, but it is possible to understand the principal characteristics that were utilised by these authors in developing them. These characteristics are levels of the engagement for sharing information; the roles of individuals in organisations and the exploration of the potential relationships with/between members of other organisations.

2.1.5 Implications for the Research

An implication is to answer the research question related to *what motivates information sharing?* In this line and in strong relation with the review of the current literature, the motivations should be informed by cognitive and social perspectives. In addition, these should be taking into account the relationships between actors converging from the same or different organisations. Moreover, the motivations should reflect the diverse situations in which the individuals are immersed in context.

Similarly, information sharing or exchanging (Wilson 1981, 2010) should be defined considering the tasks of information seeking and information use, stated in sections 1.6 and 2.1.1.3. The model proposed by Wilson (1981) is used to capture the essence of both activities considering information sharing as information seeking from the diverse sources in context or/and information use in the creation and maintenance of images of the surrounding world of the individuals in context. Consequently, the model presented in figure 2-1 is utilised to situate and understand information sharing or exchanging in the information behaviour research.

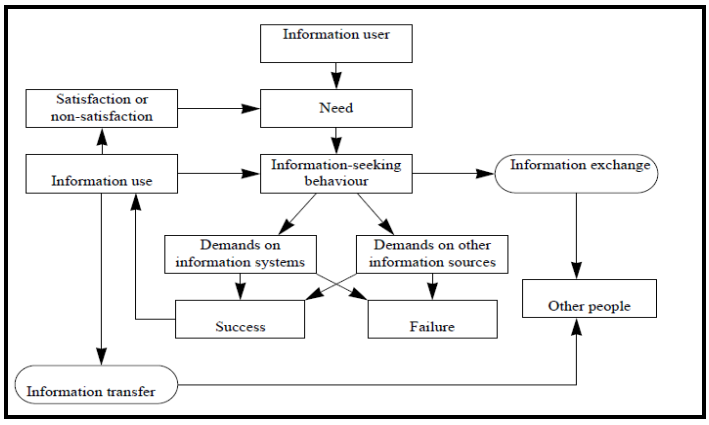

Figure 2-1 A model of information behaviour (Wilson,1981)

2.2 Tools

This section presents the abstract and material tools used implicitly and explicitly in the current research in information sharing under the information behaviour or practice area. The tools facilitated and mediated the information sharing between information providers and information users. In addition, these tools served to understand the information sharing in context (Pilerot and Limberg, 2011). That is, abstract and material tools included cultural elements that may be seen in how the tools were utilised in achieving the object-oriented activity and how the tools mediated that activity in the study (Allen et al., 2011; Kutti, 1996). For instance, the tools exhibited meaning that shaped the activities of individuals and activities and similarly the use of the tools in those activities (Allen et al., 2011; Kaptelinin and Nardi, 2006). Moreover, the use of tools “impose rules and constraints, as well as affordances” (Pilerot and Limberg, 2010, p.330) on mediating and controlling the activity being studied (Allen et al., 2011). Indeed, two types of tools are considered: the abstract (signs or mental) and material (physical) tools (Engeström, 1987). Material or physical tools “are material and mediate object-oriented activity, whereas signs are abstract and manifest in the form of language and mediate social intercourse” (Allen et al., 2011, p.783). However, researchers have primarily focused on material tools (ICTs). Consequently, this leaves a gap in knowledge in respect of the abstract tools in mediating and controlling information sharing for creating and maintaining a shared image of the surrounding world of individuals in the context studied.

2.2.1 Abstract Tools

As was pointed out by Engeström (1987), language is the principal abstract tool utilised to mediate and control human activity. This is principally used during social interactions between individuals that underpin face-to-face interactions (Wilson, 1997; Daft and Lengel, 1983). This is consequently the predominant form of mediating information sharing, but in past research, it is as a control variable. In those studies, the language is contextualised as the language of sport (Poizat et al., 2009); emergency management (Mishra et al., 2011a; Mishra et al., 2011b); marketing professionals (Tina Du et al.,

2012); programmers (Poltrock et al., 2003); everyday issues (Savolainen, 2009; Savolainen, 2011); multidisciplinary research (Reijonen and Talja, 2006); the military (Sonnenwald and Pierce, 2000; Sonnenwald, 2006); the police (Allen, 2011); scientific collaboration (Sonnenwald et al., 2004); hospitals (Wittenbaum et al., 2004); collaborative design (Belkadi et al., 2013; Belkadi et al., 2005), insurance organisation (Widén-Wulff and Davenport, 2005) among others. Nonetheless, in other research, the language is signalled as a dependent variable including it as a variable in study. In this line, Richardson and Asthana (2005, 2006) argued that professional language is an important element that can be considered in information sharing between individuals converging from diverse organisations. For example, it can help on clarifying the relationships between members of diverse services (Richardson and Asthana 2005, 2006). This also serves to put foundations by considering the use of professional language in information sharing for creating and maintaining a shared image of the world, since the context in study is characterised by converging diverse organisations utilising different professional languages.

Another abstract tool is expertise which facilitates information sharing between individuals in incident management (Schraagen et al., 2010) or controls information sharing between individuals converging from diverse groups (Sonnenwald, 1995). Constant et al. (1994) argued that expertise is an element of behaviour that facilitated and regulated information sharing. Nevertheless, it is strongly linked to attitudes for sharing information. That is individuals with expertise are likely to exhibit positive attitudes for sharing information in their routine work (Constant et al., 1994; Hara and Kling, 2002). Therefore, it is considered in this study and the relationship with attitudes for sharing information.

Other abstract tools considered are training (Hara and Kling, 2002); interdependence between individuals and their cohesion (Hunter and Pierce, 2010); incentives and culture (Muller et al., 2005); information culture (Jarvenpaa and Staples, 2000; Jarvenpaa and Staples, 2001; Meyer, 2009); exchange ideology orientation (Lin, 2007b; Lin, 2007a); connections at individual level (Shin et al., 2007; Li et al., 2007); body language and socio

emotional information (Sonnenwald et al., 2004); shared meanings of symbols and implications of information (Sonnenwald, 2006); among others.

In short, abstract tools can be employed for mediating and controlling information sharing. However, their efficacy and/or efficiency have not been commented on in terms of facilitating or regulating information sharing towards creating and maintaining shared situation awareness. For example, this is seen when Shattuck and Woods (2000) pointed out the necessity to deal with ambiguity of language in dynamic and complex environments. This is because it can lead to misunderstandings in creating usable images of the world. Moreover, language can be seen as a complementary technological tool. This can be seen in adopting a common terminology facilitating the comprehension of incidents (Paton and Jackson, 2002), specifically the challenging incidents (Chen and Huang, 2007). In addition, terminology can facilitate the interaction between individuals and/between agencies or organisations (Muhren et al., 2008) and give favourable understandings of the unpredictable situations (Helbing et al., 2006).

2.2.2 Material Tools

Most researchers considered information and communication technologies (ICTs) as the principal tools employed for mediating and controlling information sharing. This is because they improve it in incident management (Bowdin et al., 2006; Mutch, 2008; Parkhouse, 2001; Spengler et al., 2006; Jackson, 2006; Loewenstein, 2009). Technology is defined as “those tools, devices and knowledge that mediate between inputs and outputs (process technology) and/or that create new products or services (product technology)” (Rosenberg, 1972, cited in Tushman and Anderson, 1986, p.440). At this point, agencies developed technologies to support information requirements of incident responders to ensure that no re-occurrence of errors is possible and to reduce the effects where damage was caused (Perry, 2003; Perry and Lindell, 2003; BMIIB, 2007; Davis, 2005; Edmond, 2009). These technologies are also prepared to manage the information emerging from diverse sources, considering that “information is often limited both in terms of quantity and quality” (Cosgrave, 1996, p.1). In addition,

these technologies are equipped to manage the complexity of tasks in managing information (Clifton and Sutcliffe, 1994; Kendall, 1989).

For instance, information technologies are regularly the tools employed in mediating and controlling information sharing in the information behaviour area. Research was found in contexts such as the military (Sonnenwald, 2006; Sonnenwald and Pierce, 2000); scientific collaboration (Sonnenwald et al., 2004); routine organisational work (Constant et al., 1994; Jarvenpaa and Staples, 2000; Jarvenpaa and Staples, 2001; Razavi and Iverson, 2006; Lin, 2007b; Lin, 2007a; Widén-Wulff and Davenport, 2005; Lamont, 2011); everyday issues and blogging (Savolainen, 2009; Savolainen, 2011); introducing these tools in development contexts (Meyer, 2009); introducing new protocols (Bajaj and Ram, 2003); marketing sector (Tina Du et al., 2012; Du, 2012); security coalitions (Phillips Jr et al., 2002); design teams (Poltrock et al., 2003); multi-agency working (Peel and Rowley, 2010); among other contexts. Nevertheless, efficacy and efficiency in mediating and controlling information sharing is not clearly stated specifically in the context of study. Efficacy is the ability to produce a desired or intended result (Oxford 2014) and efficiency is the state or quality of being efficient (Oxford 2014).

Other material tools are the command and control areas (C2's). These areas are principally composed by ICTs. The areas serve to facilitate and regulate information sharing between located and distributed individuals in context. In this line, Sonnenwald (2006) and Sonnenwald and Pierce (2000) pointed out the necessity of efficacy and efficiency in the information sharing and the technology used in that process. However, the same researchers argued that lack of similar technology between individuals and their organisations may generate contested collaboration, inhibiting information sharing. This means that if individuals and organisations do not have similar technologies (C2's), information sharing can be obstructed due to technical constraints. A consequence can be seen in information sharing and its relationships for creating and preserving usable images of the world in context. For this, the consideration of C2's is important in the context in study.

Another material tool is radio. This tool is considered as an element of command areas (Sonnenwald, 2006; Sonnenwald and Pierce, 2000) or as a complementary tool in the emergency management context (Mishra et al., 2011a; Mishra et al., 2011b). In both cases, radio is considered as a preponderant tool for facilitating and regulating information sharing primarily between and with individuals distributed in other areas of the context. However, according to Mishra et al. (2011b), radio should be reliable and interoperable to comprehend their efficacy and efficiency in context considering that individuals and their organisations converge using diverse technological tools. Hence, reliability is defined as "a network's ability to perform a designated set of functions under certain conditions for specified operational times" (Snow, Varshney and Malloy, 2000, p.49). Althought, there are diverse definitions of interoperability, this is defined as the technological capacity to swap between frequency spectrums (Miller et al., 2005; Timmons, 2007). This is the ability of the technological tools to interchange information and to use this information where it is required (IEEE, 1990; Chen et al., 2008a; Gottschalk, 2008; Weihua and Shixian, 2005). Loewenstein (2009) and Usuda (2008) argued that all information exchanged should have the same specification in order to be consistent in facilitating the swapping between information and communication technologies. Consequently, in current research there is a lack of consideration of efficacy and efficiency of radio in mediating and controlling information sharing for creating and maintaining situational awareness.

A further tool is video that is considered as another relevant technology in emergency care (Sonnenwald et al., 2008) and emergency response (Bergstrand and Landgren, 2009). Video is mixed with other technologies to facilitate information sharing between individuals located in diverse areas. For instance, Sonnenwald et al. (2008) pointed out that video can be a relevant tool in terms of efficacy and efficiency, but some issues should be investigated to understand how this technology can facilitate and control information sharing, specifically between those individuals situated in specialised areas and those located remotely. Moreover, Bergstrand and Landgren (2009) argued that video can enhance information sharing between those individuals situated in the emergency areas and those

located in C2's. Nonetheless, some technical aspects such as video quality and coverage are still needed to effectively and efficiently use this technology for creating and maintaining shared situational awareness.

There are other types of material tools mentioned in the current literature. These are documents, pieces of paper, maps and tables (Sonnenwald, 2006; Sonnenwald and Pierce, 2000); blogs on the internet (Savolainen, 2009; Savolainen, 2011); visual cues, log book, internet (Mishra et al., 2011a). Kendall (1989) argued that technological tools should be adaptive and user friendly and should be able to facilitate information sharing (Drapeau, 2009). Nonetheless, their efficacy and efficiency are not clearly stated by mediating and controlling information sharing specifically for creating and maintaining shared situational awareness.

To sum up, abstract and material tools mediate and control information sharing in context in which individuals can be included and/or excluded in this process. In addition, the phenomenon of contested collaboration (Sonnenwald, 1995) is considered as a way to uncover what tools are utilised in information sharing. For this reason, the taxonomy developed by Bolstad and Endsley (2005, 2003) can aid in uncovering useful criteria to evaluate the efficacy and efficiency of tools in context such as reliability and interoperability. This taxonomy includes the types of collaboration supported by technology, the technological characteristics that affect collaboration, the effectiveness of tools in supporting transmission of different types of information, and those tools suiting different types of collaborative processes such as shared situational awareness. It also includes the extent of supporting the synchronous information sharing in unscheduled and unpredictable collaboration between collocated and distributed individuals permitting high degrees of interaction in back-and-forth interactivity (Bolstad and Endsley 2005, 2003). Endsley and Jones (2001) pointed out that "with good communications and supporting technologies, cases in which different pictures exist of the same situation will be revealed so that the team can take steps to gather information or work to resolve differences" (p.48). This means that information sharing should be supported by effective and efficient ICTs for creating and maintaining shared situational awareness in context.

2.2.3 Implications for the Research

The first implication is to answer the research question *what tools mediate and control information sharing?* It is expected to find abstract and material tools which are implicitly and/or explicitly used in context. The phenomenon of contested collaboration (Sonnenwald, 1995) can also help on uncovering the technological constraints in the research to encapsulate both types of tools, specifically, those tools employed to create and maintain shared situational awareness. This is because this phenomenon is concerned with the use of specialised abstract and material tools that contribute in the behaviour of individuals (Sonnenwald and Pierce 2000).

Additionally, once the abstract and material tools are discovered in context, each tool is discussed in terms of efficacy and/or efficiency in the information sharing process. For example, this is achieved by knowing what tools should permit the inclusion of new channels or organisations for sharing information and the use of diverse languages. Moreover, what tools can increase the number of means for sharing information facilitating it (Constant et al., 1994; DiGangi and Wasko, 2008; Morgan et al., 2002; Vanderford et al., 2007). One example is the radio that can integrate multiple channels facilitating information sharing between/with collocated individuals from the same and/or other organisations.

2.3 Situational Awareness

This section presents a review of the current literature on situational awareness. In the current literature the terms situation awareness or situational awareness are used interchangeably, but in this thesis, it is preferable to use the term situational awareness to point out that situational awareness is analysed and not measured (Endsley, 1994a). In other words, researchers commonly use the term situation awareness to measure the understanding of controlled situations and situational awareness to analyse the understanding of naturalistic situations. This section comprises the conceptualisation of situational awareness, individual situational awareness, collective situational awareness and implications for this study.

2.3.1 Conceptualising Situational Awareness

This concept comes from aeronautics and its value is critical to control complex and dynamic environments (Sonnenwald and Pierce, 2000). Its value can be seen by understanding those environments so that individuals can control and manage them. This is the case of the context treated here, the context of routine operation and incident management at major events. Svenson et al. (2007) argue that situational awareness is also an important element in decision making because it helps to project future states of environments or contexts. Specifically, with a clear picture of the incident, individuals can comprehend what kinds of emergency services, personnel and resources should be required to manage the incidents.

However, it was found that researchers used interchangeably the terms situation awareness and situational awareness which are semantically similar. Nonetheless, it is important to note the difference between them. Situation awareness is related to the “awareness of the situation” (Endsley, 1994a, p.315) and situational awareness is associated with “type of awareness relating to situations” (Endsley, 1994a, p.315). In other words, situation awareness is appropriate to emphasise the awareness of the situations created with the goal to measure that awareness and situational awareness is appropriate to point out the awareness relating to those situations with unique characteristics and attributes of time constrained, uncertain and complexity within naturalistic contexts. Only this awareness is analysed in this thesis.

2.3.1.1 Definitions of Situational Awareness

Multiple definitions of situational awareness were found. This denotes the enormous importance of the topic and those challenges implied in forming mental models that represent accurately situations in a determined time and space in context (Breton and Rousseau, 2003; Vidulich et al., 1994; Millward, 2008). Breton and Rousseau (2003) indicated that there are some definitions which are related to the views of the situations, individuals and context of use. The House of Representatives Committee of Government Reform (2006) defined situational awareness as “a common perception and

understanding of the operational environment and its implications" (p.37). Another definition was given by Vidulich et al. (1994), who defined situational awareness as "continuous extraction of environmental information, integration of this information with previous knowledge to form a coherent mental picture in directing further perception and anticipating future events" (p.11). Additionally, Endsley (1995) defined situational awareness "as the perception of elements in the environment within a volume of time and space, the comprehension of their meaning in terms of task goals, and the projection of their status in the near future" (p.36). An extended revision of other definitions of situational awareness was provided by Vidulich et al. (1994) and Society (2008). This clarifies that situational awareness is associated with the understanding of situations to make informed decisions.

However, the first definition mentioned before shows the lack of consideration of future states of the environments within that understanding. For instance, this provides a static understanding of the environments and shows a clear cognitive behaviour when perception is stated. Referring to the second and third definitions, both share the same meanings and include future states of environments within the understanding. Conversely, the second one does not specify reasons why situational awareness is required. Nevertheless, the third definition considers and includes those reasons which are to control the situations. In addition, the definition suggests a state of situational knowledge that may be stipulated in terms of that state. Situational knowledge is transformed in a mental model that describes accurately a situation in a given time and space. For instance, This is seen in the form of how individuals prepare and use the abstract and material tools in incident management. For these reasons, the definition of Endsley (1995) is used in this research. It "leads to decision making, which turn motivates actions to improve the situation" (Billings 1994, p.322).

2.3.1.2 Situational Awareness as Product or Process

Situational awareness is considered both as a process and as a product (Endsley et al., 2003; Adams et al., 1995; Stanton et al., 2001). The researchers considering situational awareness as a product, argued that this

is the outcome of the complete understanding of specific situations (Breton and Rousseau, 2003). The information gathered from situations is judged by individuals involved in those situations in order to understand them. A mental model or picture resulted from those understandings. For instance, the value of those understandings is displayed in operational environments such as automation or design (Adams et al., 1995; Durso and Sethumadhavan, 2008; Endsley et al., 2003). However, the majority of this research is done in static environments in which time is not considered. Similarly, situational awareness is generally measured in terms of the relevant variables to the tasks in study and ignores contextual variables related to the situations.

Investigators considering situational awareness as a process argue that it should involve specific stages to achieve a complete situational understanding. In other words, the creation of the conscious situational awareness requires certain stages to achieve it. The scientific appreciation of this process is called by some researchers (Breton and Rousseau, 2003), “situation assessment” or recently “sense-making”. Similarly, this process uses a variety of techniques to allow workers to understand those situations (Adams et al., 1995; Durso and Sethumadhavan, 2008; Leonard et al., 2004; Manternach and Broadstock, 2006). However, the understanding of this process in naturalistic contexts is a challenge. For instance, the comprehension of current terminology used to create situational awareness and the comprehension of levels or elements of situational awareness are challenging tasks. Nonetheless, in this research both types of situational awareness are considered, as stated in sections 2.3.2 and 2.3.3.

2.1.1.3 Theoretical Approaches

Situational awareness is informed from diverse theoretical approaches which are principally utilised to assess it. The key approaches are the information processing perspective and the ecological (Stanton et al., 2001; Tenney and Pew, 2006). The information processing approach is mainly represented by the theory developed and proposed by Endsley (1995). This theory is a continuation of the theory proposed by Neisser (1976) and has dominated the current literature for almost 25 years. It involves four stages that can be

summarised as perception of environmental elements, comprehension of those elements in relation to the context, projection of the states of those elements in relation to the context and the prediction of what external variables may affect the projection of the states of the prior stage. The first stage includes (a) perceiving the status of the context, (b) its attributes and (c) dynamics of relevant elements from the environment. The second stage is an understanding of the significance of those elements perceived from the environment. This is based upon a synthesis of those elements for creating a holistic picture of the environment in relation to the context. Here the meanings of the objects and events within the context are created. The third stage is related to the ability of individuals to project on the near future the states of the relevant elements within the context. This understanding gives the opportunity to decide a favourable course of actions (Endsley, 1995). The last stage refers to the discovery and consideration of those external variables that may act upon those projections in the previous stage. For instance, these variables are in strong relation with the context in study. However, the discovery of each stage in naturalistic environments is a challenge and time demanding. Moreover, this approach is not considered performance in its accounts (Tenney and Pew, 2006), separating situational awareness and performance. Therefore, researchers using this approach assumed that individuals perform effectively without having high levels of situational awareness.

The ecological approach can be summarised in the dynamic interaction between individuals and the environment. This interaction defines situational awareness of the context (Smith and Hanckock, 1995; Adams et al., 1995; Flach, 1995; Gibson, 1983; Gibson, 1986). Flach (1995) argued that situational awareness is the creation of “meaning with respect to both the objective tasks constraints (i.e. the situation) and the mental interpretation (i.e. awareness)” (p.151) at individual level. In addition, he pointed out that “meaning can be used to refer to both the interpretation of a message and the actual significance of a message” (p.151) at a collective level or when situational awareness is shared forming shared situational awareness (presented in section 2.3.3). This suggests that two things should be considered: “who understand via awareness (the cognitive agent) and the

implications of the situation (objective reality)" (Flach, 1995, p.151). Additionally, this approach includes the theory of affordances (Gibson, 1983; Gibson, 1986). Affordance is an attribute of objects or elements of the environment that allow individuals to perform actions (Gibson, 1983; Gibson, 1986). In other words, this is concerned with obtaining meaning from objects and/or elements of the environment that lead performance of individuals. However, researchers employing this approach "are less enamored [*i.e. engaged*] of the idea that situational awareness and performance can be out of synch" (Tenney and Pew, 2006, p. 4). That is, situational awareness is created in close relation with the situation and the surrounding context served to shape the tasks performed, but this relationship is not clearly defined (Tenney and Pew, 2006) as the information processing approach.

In sum, situational awareness is studied as process and product, informed mostly by the information processing and the ecological approaches. This is also associated with leading to the informed decision making process and performance, but this relationship is not clearly stated. Moreover, it was found that both approaches are used in controlled environments to principally measure situational awareness. Furthermore, it was found that situational awareness as a situational understanding that implied individual creations but, in certain situations, implied collective creations. In these cases, researchers named those collective situational awareness as team, distributed and shared situational awareness (Nofi, 2000) and interwoven situational awareness (Sonnenwald and Pierce, 2000). This refers to situational awareness between individuals from the same or diverse organisations, between individuals collocated and distributed, and between individuals using technology for mediating their interactions for creating collective situational awareness, presented and discussed in sections 2.3.2 and 2.3.3.

2.3.2 Individual Situational Awareness

Situational awareness implies the discovery of information in context to create and maintain awareness of what is going on around individuals (Millward, 2008). Individuals should internalise it as a part of their working

practices and this internalisation is through the representation of a mental model of the current state of their context, specifically in a determined area (Endsley et al., 2003). Furthermore, it can also lead to information sharing (Solomon, 2002), if individuals create meanings of the environmental elements (Flach, 1995) in which other individuals formed part of their situational awareness. This is because differences in the mental model can lead to information sharing and can be observed in the diverse relationships emerged between individuals during the routine work (Endsley et al., 2003).

Additionally, recent research uncovered that individuals developed adaptive consciousness to unexpected and complex situations. This adaptation allows individuals to generate appropriate behaviour to react to those dynamic situations (Gorman et al., 2005; Smith and Hanckock, 1995; Wong and Blandford, 2001), increasing the challenges for analysing and evaluating situational awareness (Miller and Shattuck, 2004). The response can be seen in how individuals manage the information obtained and how information is shared. For this reason, the relationships between those individuals is used to discover who shares information with whom (Huvila, 2008) for creating and maintain situational awareness at individual and collective levels considering if individuals are from same or other organisations. It also considers the organisational culture, language, values and/or patterns of work because it can affect that process. Similarly, other challenges can arise such as the difficulties in information management, including what information should be transferred (French et al., 2009).

Another relevant aspect is the time required to create and maintain individual situational awareness in collaborative environments. Here, individuals have a limited amount of time to form a working picture. This starts with the stages of situational awareness at individual levels considering other individuals in context. Kaber and Endsley (1998) indicated that in routine work it is normal that systems are based at individual level, but at the same time, they included other individuals forming collective environments in which each individual adds separately their piece of context so that a whole picture is formed. Consequently, information sharing is one way to form that picture. At this point, time puts pressure on individuals to obtain information that should be subsequently shared with/between other

individuals from the same organisation (Widén-Wulff and Davenport, 2005) or other organisations, if individuals recognise the wisdom (Savolainen, 2006), experience and personal abilities (Gu et al., 2003; Gu and Mendoca, 2004) of other individuals in context. However, certain individuals are not prepared to add their pieces of situational information in time constrained environments (Kaber and Endsley, 1998). Therefore, it is important to recognise that each individual should have particular goals to accomplish, plays a specific role, or performs a certain function in interacting with elements in the task environment by creating and maintaining the individual and/or collective situational awareness. Thus, individual situational awareness plays an important role in generating and preserving collective situational awareness (Millward, 2008), specifically in contexts where diverse individuals with different goals converge.

2.3.3 Collective Situational Awareness

Diverse types of collective situational awareness were found in the current literature. According to Nofi (2000), there is a notable confusion in concern with research in the area of situational awareness at collective levels and a fact to prove it is the multiplication of terminology to name shared understandings. For instance, Nofi (2000) reduced these types to only one, the shared situational awareness. He proposed two types of situational awareness in order to facilitate its measurement and analysis: individual and shared. Hence, it is important to comment that, individual situational awareness (as presented and discussed in section 2.3.2) is related to the mental model demanded by individuals to achieve their roles in context. For this, throughout this thesis the term shared situational awareness is preferred to point out the collective situational awareness between at least two individuals in context; but both collective situational awareness or shared situational awareness are used interchangeably. So the next sections present and discuss four types of shared or collective situational awareness.

2.3.3.1 Team Situational Awareness

Team situational awareness is treated as an element required by diverse members of teams to achieve their roles. That is, members of the teams require situational awareness helping with the understanding of what is happening in situations in context, and how this understanding aids with their responsibilities. This suggests that teams are formed by individuals from the same organisations accomplishing shared goals. For instance, the definition of team situational awareness provided by Endsley (1995) stated this relationship as “the degree to which every team member possess the situational awareness required for his or her responsibilities” (Endsley, 1995, p. 39). Moreover, Salas (2005) defined teams “as consisting of two or more people, dealing with multiple information sources, who work to accomplish a shared goal” (cited in Salmon et al., 2008, p.308).

However, Salmon et al. (2008) pointed out that team situational awareness is multi-dimensional because it comprises individual situational awareness and shared situational awareness with members of the team and other members of the entire organisation. This means that team situational awareness can be achieved with members of the team and with members of the organisation located and distributed in context. This serves to obtain a common picture of what is happening to accomplish diverse organisational processes such as communication, coordination, collaboration and performance. In addition, this type of situational awareness includes tensions between the members of teams who are at the same hierarchical levels in those organisations (Artman, 1999). This is because the roles and hierarchical levels of the members of the organisations were clearly stated (Salas et al., 1992; Riley et al., 2006) affecting their performance due to the crossing of those roles. For instance, information sharing as process is utilised to back up the coordination and collaboration processes. In this line, Sonnenwald (2006) reinforces that “when information is not effectively shared, collaborative group fails” (p.1). Thus, information sharing is seen as a process that has a clear impact on understandings in other individuals so that individual situational awareness is consequently modified (Salas et al., 1995). This new situational awareness provokes changes in perception of the situations that leads individuals for sharing information again to reinforce

situational awareness so that team situational awareness is modified again. This suggests that team situational awareness has a cyclical nature in organisations (Salas et al., 1995).

This cyclical nature suggests that in certain situations, members of teams and organisations are not able to form a shared understanding of the situations (Endsley et al., 2003) and this can be solved by using technology. According to Golightly et al. (2010), the use of ICTs and the consideration of location of individuals can give advantages in creating and maintaining team situational awareness. This requires exclusive abilities and knowledge of situations and performance of other members of teams (Endsley, 1993; Golightly et al., 2010; Kaber and Endsley, 1998); the ICTs that facilitate the process (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005), and the location of members (Golightly et al., 2010). Overall, team situational awareness is related with the individual situational awareness that is passed to other individuals from the same organisations (Endsley and Robertson, 2000) forming and maintaining shared situational awareness. There, the individuals can be located or distributed in context and information sharing is usually present in face-to-face interactions and/or mediated by ICTs.

2.3.3.2 Distributed Situational Awareness

Distributed situational awareness is related to the description of “the notion of systems comprising the people in the system and the artefacts that they use” (Salmon et al., 2008, p.312). That is, it is “system-oriented, rather than individual-oriented” (Stanton et al., 2006, p.1289)” and “this permits to develop measures which serve to predict performance and to inform interpretations of those observations made in context” (Stanton et al., 2006, p.1289). However, this type of situational awareness is not related to shared situational awareness, “but rather as an entity that is separate from team members and is in fact a characteristic of the system itself” (Artman and Garbs, 1998, cited in Salmon et al., 2008, p.312)”. In other words, it is assumed that “collaborative systems possess cognitive properties (such as situational awareness) that are not part of individual cognition” (Salmon et al., 2008, p.312) and is available to be consulted by the individuals .

In other words, this type of situational awareness is more related to the interaction between individuals with devices which provide knowledge and information to understand situations in context. It considers situational awareness and other cognitive practices as evolving assets of the combined systems (Salmon et al., 2007). According to Stanton et al. (2006), “a situation requires the use of appropriate knowledge (held by individuals and captured by devices, etc.) that relates to the state of the environment and those changes as the situation develops” (cited in Salmon et al., 2007, p.414). Nevertheless, this awareness suggests the use of sophisticated devices that should be prepared to provide and share information with those individuals having and carrying those devices. This can be a great limitation in the context treated in this study for being located in a developing country. In addition, this awareness is more system owned than individual owned until individuals used the system to gather data (Salmon et al., 2007). To sum up, distributed situational awareness is concerned with the use of technology to provide information for creating and maintaining a cognitive state of the system, excluding individuals who do not use that technology.

2.3.3.3 Shared Situational Awareness

Shared situational awareness is seen as the overlaps between individuals in context (Endsley and Jones, 2001; Endsley and Jones, 1997; Nofi, 2000) and in consideration of shared requirements (Endsley and Jones, 2001; Endsley and Jones, 1997). These requirements include the elements of the environment including other individuals, the comprehension of goals and actions of those individuals and the projection of the effects of those actions in relation with that environment. In particular, these requirements are connected with the existence of individuals for creating and maintaining shared situational awareness with them (Jones et al., 2011). This is suggested in its definition as “a process of knowing what is going around oneself and others with whom one interacts” (Millward 2008, p.13). Going further, Millward (2008) argued that there are two types of shared situational awareness. The first type is concerned with that shared situational awareness created and maintained by individuals immersed in the same context without using information sharing (called type I). The second type is

concerned with the employment of information sharing for creating and maintaining shared situational awareness in context (called type II). In other words, the type I does not demand information sharing, but the type II demands information sharing.

Moreover, shared situational awareness is specifically considered an asset in collaborative environments as incident management. In this line, Gorman et al. (2005) indicate that this awareness is an important element of mutual interest amongst incident services for coordinating the incident activities. However, if multiple types of situational information is shared and received by individuals for being informed what is going on (Höglund et al., 2010), this can lead to information problems such as misinformation and information overload (Kaber and Endsley, 1998) not achieving that shared understanding. In addition, using diverse sources of information can generate tensions with/between individuals and their organisations because that information is based on responsibilities and authority of individuals performing their roles (Endsley and Jones, 2001). However, these have not been recognised in dynamic environments (Salas et al., 1995) as elements for creating and maintaining shared situational awareness, thus this provides a gap in the current knowledge.

Furthermore, shared situational awareness is considered a product of individuals collocated and distributed in context using technology to mediate information sharing between them (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005). This technology enables actors to act in coordinated fashion to achieve organisational goals (Endsley and Jones, 2001). Patrick and Morgan (2010) pointed out that organisational goals serve to decompose that shared situational awareness between/with people and to include the tools which made possible that situational awareness. There, the use of technology enables shared situational awareness demanded by collocated and distributed individuals. Finally, how shared situational awareness is created and maintained, who participates in this awareness, what motivates those individuals and what tools are used are some questions that arose but are not contested in the current literature, providing gaps of knowledge, specifically in the context treated in this study.

2.3.3.4 Interwoven Situational Awareness

This type of situational awareness stressed the necessity of diverse types of situational awareness to "facilitate task completion" (Sonnenwald and Pierce, 2000, p.471). This is defined as the "interwoven patterns of individual, intra-group and intergroup situational awareness" (Sonnenwald and Pierce, 2000, p.476) and includes three types of situational awareness required by individuals in context: individual situational awareness; shared situational awareness between individuals from the same group or team, and shared situational awareness between individuals from diverse groups and teams collocated and distributed in other areas outside of context but in close relation with them. That is, individuals in close relation with the context and performing their roles can require being in contact with other members of groups and teams for creating and maintaining that shared situational awareness. Their creation and maintenance are facilitated by recognising the roles of other individuals, distinguishing their physical position and using tools for facilitating the interaction between them. Nonetheless, the uses of technological tools were not considered and the relationships between individuals and those tools used were not explored. Consequently, this provides a gap in the knowledge as commented on in the last section. This is concerned to what tools are used in shared situational awareness.

2.3.4 Implications for the Research

An implication for this research is to answer the research question *how information sharing influences situational awareness?* Therefore, the answer should consider the individual situational awareness and the shared situational awareness created and maintained by individuals and their organisations in context. That is, individual situational awareness should serve as basis for creating and maintaining that shared situational awareness demanded in context. Consequently, situational awareness can be connected with the individual interpretations of the situations implying also diverse shared situational understandings for achieving a holistic understanding of the problematic situations. Moreover, these types of shared situational awareness can be in relation to the role of individuals;

relationships with/between members of same and other organisations; physical position of those individuals, and uses of tools.

However, it is clear that the discovery of the elements of shared situational awareness can be a challenge. This is because it involves perception of environmental elements, comprehension of meanings, the projection of states of those elements and prediction of affecting variables to those states. It also implicates to consider the cognitive agent (who understands) and the objectivity of the situation. Another challenge is to know the diverse interpretations stated by responders involved. Additionally, it is to know the form or forms on how shared situational awareness is obtained and maintained, and how information sharing influences that shared situational awareness in the context treated.

2.4 Collaborative Information Behaviour

Information behaviour is considered an umbrella concept (Savolainen, 2007), in which information sharing - as one of its elements - is related to collaborative behaviours (Widen and Hansen, 2012; Talja and Hansen, 2006). These behaviours involve the sharing of information accidentally encountered to goal oriented tasks of information seeking and sharing information proactively and upon request between individuals (Sonnenwald, 2006). For this, collaborative information behaviour is considered a common and natural behaviour present in daily activities and in every day, academic and other environments (Talja, 2002).

Similarly, this behaviour is present in collocated and distributed work environments such as the military (Sonnenwald and Pierce, 2000), rail road operations (Roth et al., 2006), emergency management (Mishra et al., 2011b; Mishra et al., 2011a), scientific areas (Sonnenwald et al., 2004) and response coordination (Treurniet et al., 2012). In these cases the collaboration is judged as planned in collective and collaborative tasks involving several individuals. In other contexts, it emerges as an unplanned event because collaboration is a common and natural information practice in context (Talja and Hansen, 2006). Both types of collaboration are usually

mediated by ICTs (Kanfer et al., 2000). Consequently, this collaborative information behaviour is an emergent area of research of information behaviour. Here, information sharing is seen as an element of this behaviour which, similarly, is relatively understudied (Widen and Hansen, 2012). In the following sections, its conceptualisation, a model to frame it, its dimensions and its social practice are presented and discussed.

2.4.1 Conceptualising Collaborative Information Behaviour

In the current literature diverse definitions were found to present clear frames of research. For example, Reddy and Jansen (2008) defined collaborative information behaviour is defined “as the totality of how people work together to identify a common information need, gather and share information with each other, and then utilize the found information” (Jansen, 2008, cited in Spence, 2008, p.6). This definition captures important concepts such as collaboration, information needs, information share and information use, that are relevant to this research, specifically information sharing in collaborative contexts.

In addition, this behaviour is also considered as an umbrella concept because it ranges from sharing information which was found accidentally through to collaborative query. Besides, it involves collaborative information seeking and retrieval to solve specific tasks. Similarly, information sharing is about information acquired by active, explicit, less goal oriented or implicit information exchanges. However, information sharing represent a challenge for understanding dimensions of collaborative tasks in context, specifically in the treated here. Moreover, this understanding can show dimensions in which there are overlaps in the motivations for sharing information from different perspectives (Talja and Hansen, 2006).

2.4.2 A Model of Collaborative Information Behaviour

Sonnenwald and Pierce (2000) argued that research in information behaviour, the majority of theoretical models are focused on individual information behaviour. Moreover, these were based on individualistic

information needs including the interaction between users and technology. In addition, the emphasis of them is in individualistic work practices and not collaborative (Reddy and Jansen, 2008; Sonnenwald and Pierce, 2000; Talja and Hansen, 2006). Thus, it is important to recognise a set of foundations to understanding the collaborative information behaviour in context.

In addition, these models denoted particular limitations when they are applied to real life situations, specifically in dynamic and complex contexts within collaborative environments. Hence, Talja and Hansen (2006), Reddy and Jansen (2008) and Karunakaran et al. (2010) presented their models integrating past and current findings of research in this area. Specifically, the model of Reddy and Jansen (2008), shown in figure 2-2, encloses two relevant elements to this research. One is the change from individual to collaborative behaviour. The other is the interaction between individuals and/with systems or technological tools. This model also includes some environmental elements that affect this behaviour, incorporating other individuals and the problems or unusual situations in context.

Notwithstanding, the interesting element in that model is the change from individual to collaborative behaviour when triggers occur. This means that transformation is through the action of triggers defined as “an external event within the environment that initiates collaborative information behaviour amongst a formal or informal group of people” (Reddy and Spence, 2008, p.249), specifically by passing from individual tasks to collaborative tasks. Reddy and Spence (2008) showed four types of triggers: complexity of information need, fragmented information resources, lack of domain expertise, and lack of immediately accessible information. Nevertheless, the model was developed in medical contexts and is focused on environments where there are ICTs supporting work practices. This shows that can be modified on other contexts in which there is a lack of those technologies, being the case of this context in a developing economy. Moreover, the mentioned triggers can be still valid in this study, but other triggers could be added in order to fit information needs and uses in context.

To put it briefly, the model is a good theoretical start for understanding information sharing in collaborative environments as the

context treated here. Making clear the interactions between individuals and technology and how social interactions between collocated and distributed individuals are two points for uncovering the insights of information sharing. In addition, the model can serve to analyse the collected data to subsequently formulate some propositions which describe the gained insights of the phenomenon in collaborative environments.

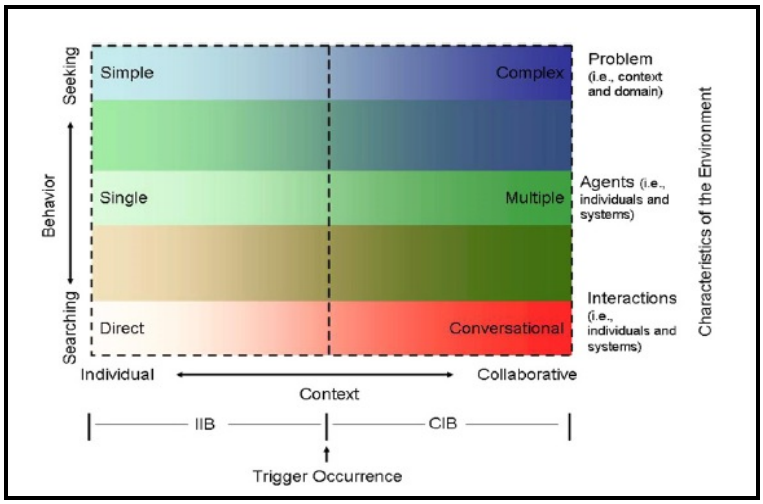

Figure 2-2 Model of collaborative information behaviour (Reddy and Jansen, 2008)

2.4.3 Dimensions of Collaborative Information Behaviour

Collaborative information behaviour is considered, analysed and classified in principally three dimensions. The first dimension is the communication or information sharing as a two-way process (Talja, 2002) considering the time (synchronous or asynchronous – in real time -), space (collocated and remote or distributed) and tools mediating this process. For instance, information sharing between remote and collocated individuals is principally mediated by computers and video conferencing in real time (synchronous). Contrarily, email or searching in the internet is considered as asynchronous time (Ehrlich and Cash, 1994). However, in dynamic collaborative environments, synchronous technologies is more valuable than asynchronous (Golovchinsky et al., 2009). Similarly, interoperability is stressed as another valuable technological ability of tools that can facilitate information sharing (Loewenstein, 2009) in collaborative environments in real time. Otherwise, lack of it ability may affect the behaviours.

Another dimension is the planned or unplanned collaboration supported by technology. This is concerned with the employment of technology supporting collaborative behaviours on planned and/or unplanned collaborative tasks. For instance, unplanned collaborative tasks are found when individuals assist suddenly other individuals in information seeking tasks and in attention to solicited support from one to another (Hansen and Järvelin, 2005). For this reason, certain researchers argued that the lack of technology led to unplanned collaboration (Twidale et al., 1997; Twidale and Nichols, 1998a; Twidale and Nichols, 1998b). Thus, this opens the opportunity to develop technology that may support this unplanned collaboration. Contrarily, other researchers argued that technology should be aligned to support planned collaboration. For example, Sonnenwald et al. (2004) proposed a form of planned collaboration in the context of scientific collaboration, specifically to support the creation and maintenance of situational awareness between collocated and remote individuals. They used a virtual reality system with this objective. Nevertheless, this type of collaboration was done in artificial environments where contextual variables are controlled and novel technology.

The last dimension is related to the organisational role of individuals in collaborative tasks. This serves to show that individuals come with diverse goals in mind representing their organisations, which are categorised in the same or different groups or teams of similar or diverse organisations performing varied collaborative tasks. Nonetheless, the majority of research is focused in collaborative tasks in same or different groups or teams within one organisation (Hansen and Järvelin, 2005; Hansen and Järvelin, 2004; Reddy and Spence, 2008; Reddy and Jansen, 2008; Sonnenwald and Pierce, 2000). Work practices in command and control in the military is an example of collaborative work where members share the same organisational goals (Sonnenwald and Pierce, 2000). Other examples are the work practices in hospitals (Reddy and Spence, 2008; Reddy and Jansen, 2008) and in patent office's (Hansen and Järvelin, 2004; Hansen and Järvelin, 2005) in which members share partially organisational goals. This is also discovered in those contexts in which individuals are located in the same areas or buildings. To sum up, this dimension examines the

locations and the relationships between individuals from the same or other organisations in context in which technology is employed to mediate those collaborative tasks (Talja and Hansen, 2006; Golovchinsky et al., 2009; Shah and González-Ibáñez, 2012). This consideration helps on answering the research questions presented in section 1.2.

2.4.4 Social Practice in Collaborative Information Behaviour

The social practice approach studies collaborative information behaviour considering that collaboration emerges during current work practices and these are a consequence of how people naturally act and interact in gathering and using information (Talja and Hansen, 2006). Moreover, this approach considers that collaboration is related to the participation of individuals performing their roles within their organisations, organisations that promote communities of information sharing. This means that individuals performing their roles are immersed in information sharing practices because they found benefits in being submerged into these collaborative environments. Furthermore, the approach tries to capture the relationships between the information, the collaboration practices and the use of tools developed to support that collaboration and communication (Talja and Hansen, 2006). However, Talja and Hansen (2006) argued that the relationships are not understood by not taking into account their advantages in the work practice. This is seen when technology satisfies other needs but does not support the work practices. For this reason, Ingwersen and Järvelin (2005) suggest that technology should consider human needs to facilitate those relationships, adapting technology to the human needs (Blake and Pratt, 2002).

Furthermore, collaborative information behaviour is a human practice that consequently is social (Talja and Hansen, 2006). The information practices are mostly organised to encourage interactions between individuals. An example is seen in information seeking such as part of the work practice. If two or more individuals seek information and it is interpreted by them, this is considered a collaborative work practice (Talja and Hansen, 2006). Nonetheless, Reddy et al. (2001) argued that information seeking

does not tell the whole complete picture, information use can complete the history. The integration of pieces of information into a whole picture can give the complete history and tasks required to create this picture. It also includes information seeking and information use as information practice at a collaborative level in context.

In addition, collaborative information practices imply cultural knowledge. This knowledge is observed in the information practices of individuals and the procedures historically developed (Davenport, 2002; Eckert and McConnell-Ginet, 2006; Hara and Schwen, 2006; Hara and Kling, 2002), named “communities of practice”. That is, individuals learn the work practices in a natural way from the organisational culture and in continuous development over time. In addition, these communities include individuals with the same goals in mind; common work practices; using the same information objects, tools and technology, and using the same terminology in communication (Hara and Kling, 2002; Hara and Schwen, 2006; Østerlund and Carlile, 2005). In other words, communities of practice as collaborative information behaviour can be found in organisations with similar work conditions, flexible organisational structures and clear organisational collaborative cultures.

2.5 Summary of Literature Review

This summary presents the literature gaps discovered, a methodological consideration and the key points in the areas reviewed.

2.5.1 Literature Gaps

Literature gaps were discovered within four areas. The first area involves the context. Past research provides an opening to answer the research questions postulated in section 1.2. This is because most research is focused on the results of incidents (Rozakis, 2007; Contrast, 2012; Cooper, 2012; Sedgwick, 2010; Alexander, 2002; Altay and Green III, 2006; Dantas and Seville, 2006; Muhren et al., 2008; Paton et al., 1998) and the threats in incident management (Bowdin et al., 2006; Boyle, 2007; HSE, 2005;

Spengler et al., 2006). However, little research has been concentrated in the context of routine operation and incident management at major events, as indicated in section 1.1.

The second area is information sharing. It was found that information sharing is a relatively un-investigated part of information behaviour (Wilson, 2010) and, although, it would help in improving the information practices in context (Wilson, 2010), it has received relatively little attention from researchers. Research in the context treated here is an example of this premise. Besides, the majority of past research in the motivations for sharing information is found within cognitive (Bao and Bouthillier, 2007; Constant et al., 1994; Jappelli and Pagano, 2000) or social viewpoints (Chen and Huang, 2007; Richardson and Asthana, 2005; Richardson and Asthana, 2006; Kimble and Bourdon, 2008; Talja, 2002). Nonetheless, recent research (Hassan Ibrahim and Allen, 2012; Marcella and Baxter, 2006; Mishra et al., 2011b; Sonnenwald, 2006; Sonnenwald and Pierce, 2000; Söderholm et al., 2008; Sonnenwald et al., 2008) demonstrates that motivations can arise from cognitive and social sources at the same time providing the option to find both sources in this context. Furthermore, one of the outcomes of information sharing is the creation and maintenance of situational awareness in collaborative contexts (Paul et al., 2008a; Sonnenwald, 2006; Sonnenwald and Pierce, 2000; Sonnenwald et al., 2008; Sonnenwald et al., 2004; Paul et al., 2008b). Nevertheless, these investigations were primarily concentrated in hospitals and command control areas. This opened another gap of knowledge to investigate the relationship between information sharing and situational awareness in an under-investigated context.

The third area is the abstract and material tools utilised to facilitate and regulate information sharing. Within the cognitive engineering and information behaviour fields (connected to this research), there is little research that relates to these tools. For example in the cognitive engineering field, it is considered that if individuals have the right collaborative tools (represented by ICTs) at the right time, they can be more likely to produce and retain situational awareness at a high level in collaborative duties (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005). Nonetheless, those tools are not evaluated in terms of efficacy and efficiency within the

information sharing process for creating and maintaining situational awareness. This provides an opportunity to investigate what tools are used and their efficacy and efficiency in context. In the information behaviour area, certain researchers uncovered that information technologies mediate well information sharing towards situational awareness (Sonnenwald et al., 2008; Sonnenwald et al., 2004; Sonnenwald, 2006). Nevertheless, signs or abstract tools are undervalued. As Allen et al. (2011) revealed, information practices are mediated and controlled not only by material or physical tools but also by signs or abstract tools towards the realisation of objects, both types of tools are not mutually exclusive. In this study, information sharing is directed to create and maintain situational awareness in the context of routine operation and incident management at major events. So, this illustrates the relevance to consider both kinds of tools in order to gain deeper understandings of how tools work in the information sharing process for creating and maintaining situational awareness.

The last area is situation awareness. This is studied in various contexts such as management of complex systems; coordination on disaster response; emergency management; safety and performance; scientific collaboration, and command and control areas among others (Endsley, 1994b; Kaber and Endsley, 1998; Fan et al., 2005; Harrald and Jefferson, 2007; Adams et al., 1995; Cuevas and Bolstad, 2010; Desourdis and Contestabile, 2011; Sonnenwald et al., 2004; Sonnenwald and Pierce, 2000). In addition, precise enquiry is mostly focused on determining situational awareness in controlled contexts (Tenney and Pew, 2006; Endsley, 1994b; Endsley and Jones, 2001; Endsley, 2001; Betts et al., 2005). Furthermore, there are other studies where situational awareness was only analysed within information behaviour and communication perspectives in restricted contexts (Millward, 2008; Söderholm et al., 2008; Sonnenwald et al., 2004; Sonnenwald et al., 2008). Nevertheless, situational awareness is still under-investigated in the information behaviour area (Talja and Hansen, 2006; Widen and Hansen, 2012), particularly in the context handled here. This offers a gap to investigate situational awareness as a product of information sharing.

2.5.2 Methodological Considerations

Most of the research in dynamic environments is done in naturalistic contexts where the variables are relative uncontrolled (Rozakis, 2007; Contrast, 2012; Cooper, 2012; Sedgwick, 2010; Alexander, 2002; Altay and Green III, 2006; Dantas and Seville, 2006; Muhren et al., 2008; Paton et al., 1998). However, there are other investigations in which researchers control the contextual variables to measure the phenomena in study (situational awareness as product of information sharing) within the information behaviour and communication perspectives (Millward, 2008; Söderholm et al., 2008; Sonnenwald et al., 2004; Sonnenwald et al., 2008). Alternatively, there are novel investigations of information sharing within emergent contexts (Hassan Ibrahim and Allen, 2012; Mishra et al., 2011b) in which the variables were not controlled as the context handled here. For this reason, the case study as a strategy utilised in those novel studies provides advantages in investigating that phenomena in strong relation with the context. For instance, it offers the chance to expand the theory for gaining deeper insights about them (Yin, 2009). Thus, case study is seen as a feasible strategy to study information sharing and situational awareness in this context, see section 3.4. This also offers flexibility to answer the research questions presented in section 1.2.

Furthermore, from the literature gaps it is inferred that it would be necessary to investigate the phenomena in a holistic way. That is, the gaps can be researched to converge in a frame that provides methodological advantages over past research. A framework that would help is activity theory. Some researchers (Hassan Ibrahim and Allen, 2012; Mishra et al., 2011b) used this frame to investigate information sharing in dynamic, time constrained and uncertain contexts. In these investigations, the frame provided methodological advantages because it offered flexibility for investigating separately and holistically the phenomena and in close relation with the context. Consequently, the insights gave the opportunity to discover the great importance of tools and to evaluate them in context (Mishra, Allen and Pearman 2011b). Similarly, they suggest the significance for dealing with the cognitive and social motivations for sharing information. This serves

to corroborate information sharing as a collaborative activity. Additional methodological considerations are presented in sections 3.1 and 3.2.

2.5.3 Key Points

Information sharing was defined as a two-way process (Talja, 2002) focused on to create an understandable image of the world (Sonnenwald, 2006). Moreover, motivations for information sharing were informed from cognitive and social perspectives (Pettigrew et al., 2001). These permitted to uncover valences of motivations (Elliot and Covington, 2001) which may similarly uncover desirable or undesirable results. Furthermore, sense-making (Dervin, 1996; Weick, 1995), social meanings (Miranda and Saunders, 2003; Maines, 2000); common ground (Sonnenwald, 2006; Hertzum, 2008) and situational awareness (Endsley, 1995; Endsley, 1995b; Endsley et al., 2003; Sonnenwald and Pierce, 2000; Sonnenwald et al., 2004; Betts et al., 2005) were presented as outcomes of information sharing denoting diversity in its motivations. Moreover, four typologies of information sharing were proposed by O'Day and Jeffries (1993), Erdelez (1997), Talja (2002), Richardson and Asthana (2005); Richardson and Asthana (2006) and Bao and Bouthillier (2007) uncovering its dimensions, tools used and social interactions in context. Consequently, one implication of this research is to discover the motivations for sharing information in context considering its outcomes, tools used and social interactions within its process.

Tools mediate and control the activity studied (Allen et al., 2011), specifically information sharing as the subject matter of this research. In this line, abstract and material tools were uncovered, presented and discussed. Language, expertise, training, exchange ideology orientation, networking and shared meanings of symbols and implications of information were categorised as abstract tools. These were clearly exhibited or implied in past research. Material tools have principally been represented by ICTs and the command and control areas, video, maps, tables, visual cues, log book, among others. The abstract tool, on the other hand, was clearly stated as mediators of information sharing. Thus, one implication of this research is to uncover the tools that mediate and control information sharing in context.

Situational awareness represents what is going on in situations at an individual level. It is studied as a product and as a process for creating and maintaining situational pictures. Moreover, it is informed from information processing and ecological approaches. Notwithstanding, in certain situations, collective situational awareness was achieved. This resulted in varied types of shared situational awareness. This collective situational awareness was represented by creating overlaps between at least two individuals about what is going on in the surroundings of situations, but in consideration of what is happening around those actors themselves (Millward, 2008). Consequently, three elements are considered relevant in that shared situational awareness: who creates those situational understandings, what are their positions in context and what tools do they use in collaboration and communication (or information sharing) as organisational processes. Thus, the last implication is to investigate how information sharing influences situational awareness.

Lastly, collaborative information behaviour was found as a research area of information behaviour because collaborative work has natural occurrence in work practices (Talja and Hansen, 2006). An example is information seeking that gives partly a picture of what is happening in the work practices, but the rest is found in the information use (Reddy et al., 2001). Another interesting point is that information sharing is found as a crucial element within that collaborative work. This is seen in the model presented in section 2.4.2, which provides insights about the changes from individual information behaviour to collective information behaviour due to trigger occurrence. Moreover, this model uncovers technology as primordial mediator in that collaborative work represented by this behaviour.

CHAPTER 3
METHODOLOGY

This chapter presents the methodological approach adopted in this research. This approach is based in the social constructivism tradition (Jacob and Shaw, 1998) focused on answering the research questions indicated in section 1.2. It permitted to deal with the domain constructed by those individuals serving as incident responders. They consequently utilised information sharing in creating and maintaining situational awareness required by themselves in the naturalistic context of routine operation and incident management at major events. Within this tradition, activity theory is employed to frame and understand systematically and contextually information sharing and situational awareness in context. Furthermore, this frame provides a unique potential as explanatory tool (Wilson, 2008; Hassan Ibrahim and Allen, 2012; Mishra et al., 2011b; Widén-Wulff and Davenport, 2007). In addition, it offers a broad level of understanding and analysis of activities to gain in-depth understanding of social phenomena (Bardram, 2000). Insights of both social phenomena were generated under the interpretive paradigm, utilising the case study as a research strategy to pay attention to the methodological considerations commented in section 2.5.2.

This chapter starts by describing the meta-theoretical position. Activity theory is then presented as the framework to guide this research and fits the meta-theoretical position of social constructivism. It is followed by the rationale for adopting an interpretive paradigm. Next, the case study method is reported as the strategy adopted in this research. Subsequently, the research strategy is portrayed. It contains explanations of the case study, data sources and its collection, and how data was condensed and analysed. After this, the ethical issues that were tackled in the investigation are discussed. Following this, the evaluative criteria of qualitative research are addressed. The chapter finalises with a summary of the research method.

3.1 Meta-theoretical Position

A meta-theory is “the analysis of the presumptions of a field of knowledge or practice” (Vickery, 1997, p.457). According to Hjørland (2005), meta-theories “deal with how the knowledge is understood and acquired and are important in discourses of the foundations of any domain” (p. 5). Its general interest focuses on how the problems are tackled considering the philosophy of science and recognising that “philosophy is a valid source of new hypotheses” (Hjørland, 1998, p.606). However, in the community of library and information science there is a limited interest in meta-theories (Hjørland, 2005) in which a small number of publications addressed the “basic epistemological approaches” (Hjørland, 2005, p.7). Notwithstanding, these studies showed diverse epistemological approaches addressing those philosophical aspects and dealing with a great number of divergent, convergent and overlapping viewpoint. Critical realism, pragmatism, neo-pragmatism, sociocultural theory, phenomenology, structuralism, port-structuralism, hermeneutics, grounded theory, empiricism, rationalism, positivism, constructivism, collectivism and constructionism (Hjørland, 2005) are examples of those approaches. Thus, selecting an appropriate approach was a challenge (Myers, 1997) because the range of choice (Bates, 2006).

In this line, Talja et al. (2005) suggest that meta-theories should serve to contribute with novel understandings of phenomena. She compared three meta-theories employed to gain insights of information seeking, retrieval and knowledge formation, nested elements of human information behaviour (Wilson, 1999). Constructivism or cognitive constructivism, collectivism or social constructivism, and constructionism were those meta-theories. Each of them was scrutinised under their major features, philosophical influences and actual representatives. Similarly, these were reduced in cognitive, social-cognitive and discourse approaches respectively to exhibit their source of understanding (Talja et al. (2005). This means that the constructivism is based on cognitive approaches. This approach states that individuals create knowledge for organising the internal and external reality perceived by them based on experience, observation, history and social relationships (Talja et al., 2005).

The social-constructivism is based on socio-cognitive approaches. These state that individuals create knowledge with a social origin in a world constructed in strong relation with collective rules, history and collaboration including other individuals (Talja et al., 2005). In this approach, the "individuals seek understanding of the world in which they live or work" (Creswell, 2007, p.20). Individuals also create subjective implications of their experiences about determined objects or things. Moreover, these implications are not only individual creations but also collective creations. For example, this could be the case in which individuals create and maintain individual situational awareness, but for consideration of others, shared situational awareness is also created and maintained. This involve individuals from diverse organisations (Boyle, 2007) creating shared situational awareness (Creswell, 2007). So, the social-constructivism tradition is positively valued through the socio-cognitive approach.

Finally, the constructionism (discourse approach) is not considered in this thesis because "the primary emphasis is not mental, but on linguistic processes" (Talja, Tuominen and Savolainen, 2005, p.89). This is because information sharing is considered as a two-way process within the information behaviour approach but not within the communication approach as noted in section 2.1. Thus, information sharing and situational awareness can be studied within the constructivism (cognitive approaches) and/or social constructivism (social-cognitive approaches) as noted in sections 2.1 and 2.3. This means that information sharing and situational awareness are assumed to be mental constructions demanded in context so that they can be studied from the cognitive and/or social-cognitive approaches.

Nonetheless, it is important to mention that one meta-theory or tradition which captures both the cognitive approach and the social approach is activity theory (Talja et al., 2005). This theory states that knowledge is constructed through continuous interaction of the individuals and the external world (Talja et al., 2005). The "activity theory suggests that individual lives within a world that is at once physically, socially and subjectively constructed, and that living and acting in this world constitutes knowledge" (Jacob and Shaw, 1998, p.142). For this reason, it was assumed that individuals created and maintained individual situational awareness (the

cognitive approach) and it is assumed that individuals created and maintained shared situational awareness with others using information sharing as the means to achieve it (the social-cognitive approach). In addition, it is argued that activity theory is a suitable means in the constructivism and social-constructivism traditions to study information sharing and situational awareness. Moreover, This theory stated that the unit of analysis is action because “knowledge is constructed through – and embedded within - action, it provides and internal determinant for subsequent actions, which in turn modify the internal knowledge of the individual” (Talja, Tuominen and Savolainen, 2005, p.86). As a result, activity theory provides a frame to gain in-depth understanding of both phenomena in study. Methodological considerations of activity and their levels of analysis are discussed in the next section and chapter 4.

3.2 Activity Theory

Activity theory under the constructivism and social-constructivism traditions is not free of criticism concerning with the uses and implications in the library and information science research (Talja et al., 2005). Therefore, this section presents additional aspects to show this theory appealing as a theoretical frame for investigating information sharing and situational awareness.

3.2.1 A Brief Introduction

Activity theory or cultural historical activity theory (CHAT) had its origin in the Soviet Union and its roots were from three sources: the work of Marx and Engels; the work of Vygotsky, Leont’ev, and Luria; and the work of Ilyenkov (Spasser, 2000; Bedny et al., 2000). This theory was proposed as a “new psychology based on Marxist philosophy” (Rajkumar, 2003) and stated that “consciousness is formed through activity” (Wilson, 2008, p.120). Here, consciousness is defined as “the product of an individual’s interactions with people and artefacts (tools) in the context of everyday practical activity” (Kaptelinin and Nardi, 2006). In this line, Vygotsky (1978) argued that consciousness or reality is subjective and is influenced by social and cultural

understanding. In other words, the individual understanding or awareness is a product of the experiences and interactions with other individuals and tools within the routine life in which individuals are immersed.

Moreover, activity theory proposes that reality and activity are united (Kaptelinin and Nardi, 2006) and the activity is object-oriented, but it cannot be separated from reality. Here, reality is objective in an expansive perception and it can be explained in terms of both natural science properties and cultural/social properties. This means that the reality of individuals is in a broad sense because of “the human subject is social in nature, shaped by culture, and influenced by language, acting with or through other people in organisations, groups, and communities” (Allen et al., 2011, p.780). At this point “the central concerns are the relationships between material action, mind and society; the approach explores links between thought, behaviour, individual actions and collective practices” (Blacker, 1993, p.867). Consequently, it is considered that practices are arrays of human activities or routines patterns of such activities (Schatzki, 2001; Schatzki, 2002). Here, the unit of analysis is activity, which similarly is composed of three levels of activities, actions and operations that are oriented towards the achievement of objects, goals and conditions respectively (Leont'ev, 1978), as shown in figure 3-1.

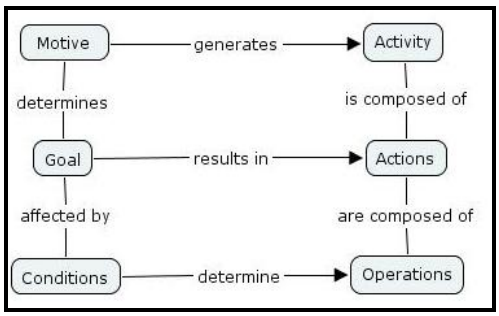

Figure 3-1 Activity, actions and operations (Wilson, 2006)

However, Engeström (2001) argued that activity as the unit of analysis should be expanded to make feasible the analysis at individual and collective levels and the consideration of different traditions or perspectives. These claims generated diverse forms in how activity is analysed. Engeström (2001) argues that these perspectives can be summarised in

three generations of activity theory. The first generation is centralised in the idea of mediation and materialised schematically in a triangular model stating the relationships between stimulus and response. However, this was reformulated as an inverted triangle from the initial model presented byVygotsky (1978a). That model considers that activity is culturally mediated exhibiting “the triad of subject, object, and mediating artefact” (Engeström, 2001, p.134), as shown in figure 3-2. At this point, the mediators can take the form of signs and language (abstract tools) (Vygotsky, 1978a) and real and physical artefacts (material tools) (Leont'ev, 1978).

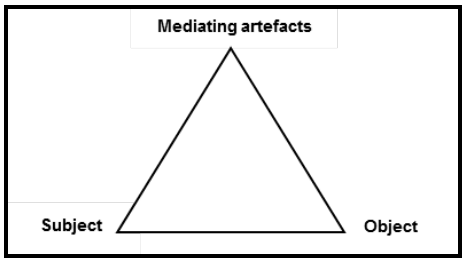

Figure 3-2 The basic activity theory (Vygotsky, 1978a)

The second generation is based on the concept of “primeval collective hunt” (Leont’ev, 1981, cited in Engeström, 2001, p.134). This means that there is a “crucial difference between an individual action and a collective activity” (Engeström, 2001, p.134). So, a model was developed by Engeström (1987), shown in figure 3-3, to state that in a collective activity the subject with the help of others (community) is motivated to act on objects mediated by tools and signs. But at the same time, activity is moulded and restricted by cultural factors which include conventions (rules and norms) and social division (division of labour). This model received the name of human activity system to differentiate it from the initial model.

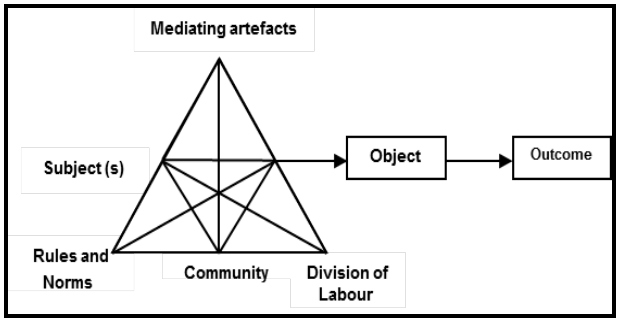

Figure 3-3 The structure of a human activity system (Engeström, 1987, p. 78)

The third generation of activity theory emerged as a necessity to deal with “questions of diversity and dialogue between different traditions or perspectives” (Engeström 2001, p.135), as shown in figure 3-4. Engeström (2001) argued that this generation should be employed to understand “dialogue, multiple perspectives, and networks of activity systems” (p.135). However, he recognised that new conceptual tools should be developed to confidently use it. Consequently, it is argued that activity theory can be useful to deal with the diverse perspectives of information sharing for creating and maintaining shared situational awareness in context. Similarly, it can also permit to investigate coordination and collaboration to expand the transitions within and/or between these processes (Engeström et al., 1997). Furthermore, it can serve to differentiate and analyse information sharing and shared situational awareness, presented in sections 4.3.1 and 4.3.2.

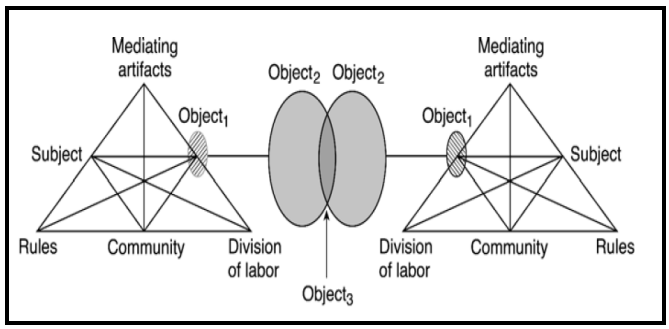

Figure 3-4 Third generation of activity theory, at least two interacting activity systems (Engestrom, 2001, p.136)

3.2.2 Principles

Five principles reveal the current status of activity theory (Engeström, 1999) as follows:

a. The first principle is that of a collective, artefact-mediated and object oriented activity system. The background of the entire activity system provides foundations to interpret and understand the individual and collective goal-directed actions and operations as unit of analysis.

b. The second principle is the multi-voicedness of the activity systems. The activity system is a cultural and historical community and a source of innovation consequent to the negotiation between the individuals included on solving troubles in the community.

c. The third principle is historicity. The activity system is a product of transformations accumulated over time.

d. The fourth principle is the central role of contradictions as sources of change and development. The activity system is continuously shaped by tensions within and/or between activity systems generating its transformation and advance. Additional explanations about tensions and contradictions are presented in next section.

e. The fifth principle is the possibility of expansive transformations in the activity system. This system is transformed in a long series of qualitative alterations, a consequence of reconceptualising the initial object and motive of the system permitting a wider horizon of options in the journey.

The principles help in interpreting and understanding information sharing and its importance; finding the individuals using information sharing; discovering the transformations behind the information sharing and tools employed, and uncovering the reasons of why information sharing has suffered transformations over time and the trends in using information sharing and its tools within the context in study. These tasks are done during the discovery of the activity system elements and its tensions and contradictions and their analysis. Additional information is presented in sections 3.2.3, 3.3, 3.4, 3.5.3 and chapters 4, 5, 6 and 7.

3.2.3 Tensions and Contradictions

Tensions and contradictions are the source of change and development in the activity system. That is “contradictions are accumulating structural tensions within and between activity systems” (Engeström, 2001, p.137) that result in innovation. These can be seen as “the root of the causes of the problems” (Engeström, 2000, p.966) and are “best recognised as frictions amongst the elements of the activity system” (Barab et al., 2002, p.80), finding them in diverse areas of that system. Moreover, these can provide insights on those changes and developments required in terms of sharing

information for creating and maintaining situational awareness. Moreover, Engeström (1987, p. 87) indicates that there are four levels of contradictions, schematically presented in figure 3-5:

a. Level 1. Primary inner contradiction (double nature) within each constituent component of the central activity.

b. Level 2. Secondary contradictions between the constituents of the central activity.

c. Level 3. Tertiary contradiction between the object/motive of the dominant form of the central activity and the object/motive of a culturally more advanced form of the central activity.

d. Level 4. Quaternary contradictions between the central activity and its neighbour activities.

That is, tensions and contradictions are the source of transformation of information over time. For example, it is seen in the use of the abstract and material tools in context, specifically, when individuals preferred the use of radio over other tools to share information.

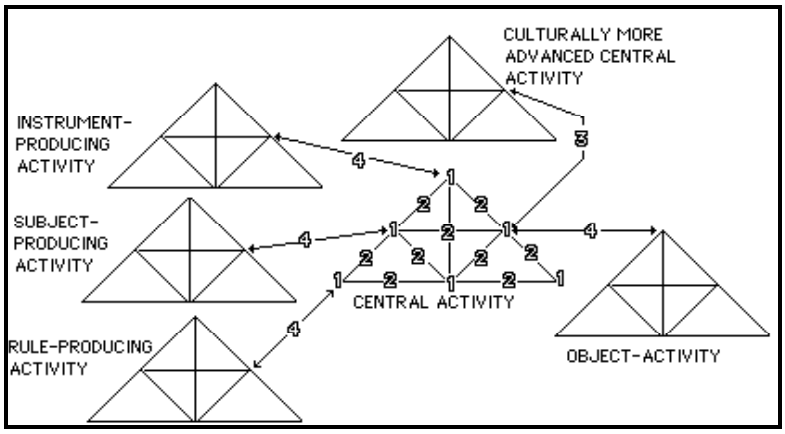

Figure 3-5. Four levels of contradictions within the human activity system (Engeström, 1987, p. 87)

In a few words, they will aid with explanations related to the changes within the activity system, in this case, the information sharing activity system. Here, this process is considered a collective activity because at least one individual serving as information provider and one individual serving as information receiver are required for creating and maintaining

situational awareness at individual and collective levels. Furthermore, they could uncover those changes and developments of that activity system. Thus, the resolution of these gives subsequently the rise of new forms of activity with qualitative characteristics in the activity system (Engeström, 1987). Moreover, these provide new challenges for achieving and giving a basis for innovating the activity system itself in context.

3.2.4 Alternative Frameworks

During initial stages of this research, situated action (Nardi, 1996), distributed cognition (Hutchins and Lintern, 1995; Flor and Hutchins, 1991; Garbis and Artman, 2004; Nardi, 1996), actor-network analysis (Callon, 1987; Latour, 1991; Tatnall and Gilding, 1999), symbolic convergence theory of communication (Bormann et al., 2003; Bormann, 1972) and activity theory (Engeström, 1987; Nardi, 1996) were considered feasible theoretical frames. However, after a rigorous analysis of them and in consideration of some criteria, activity theory was chosen as the feasible frame as depicted below.

In agreement with the criteria, those frameworks utilise cognitive, social-cognitive and discourse approaches to understand phenomena, as noted in section 3.1. Thus, the symbolic converge theory of communication was not considered because it is based on discourse approaches, not considered in this research. Another criterion is the understanding of in-depth unique events or a sequence of chained events. Here, situated action can provide a basis to understand in-depth activity but in unique situations (Nardi, 1996); contrarily, activity theory can enable the understanding of a sequence of situations by analysing chained activities, as the context treated here. An extra criterion is related to the acceptance of multiple viewpoints in context. In this line, actor-network analysis enables the analysis of the strength of the relationships between human and non-humans actors forming a net (Latour, 1987). These relationships are based on similar considerations of conditions to avoid conflicts as a consequence of diverse viewpoints of individuals (Tatnall and Gilding, 1999). Nonetheless, activity theory enables the consideration of multiple viewpoints in context. In fact, its second principle states that the activity system is a community solving

problems through negotiations between their members, as stated in section 3.2.2. This is the acceptance of diverse viewpoints in the activity system. An additional criterion is associated with the object of the matter of study. According to Nardi (1996), distributed cognition and activity theory are frames which “are very close in spirit” (p.44). Both approaches utilise the concept of object. However, distribution cognition states the object in terms of system goal. This enhances an understanding of system goals as “an abstract systemic concept that does not involve individual consciousness” (Nardi, 1996, p.39). It consequently puts itself outside considerations of the nature and essence of activity theory in terms of unity of consciousness and activity, commented in section 3.2.1. At this point, it is clear that the interest is the information sharing of incident responders and not the capability of the system which respond to the necessities of those responders. Overall, activity theory provides advantages to deal with both cognitive and social approaches at the same time, as shown in section 3.1; with the analysis of sequences of activities over time; with the varied viewpoints and with the unification of consciousness and activity. Similarly, activity theory can offer a holistic understanding of those social and cultural aspects that shape the activity in study thus allowing this research to fill the gaps of knowledge discovered and stated in sections 2.1.5, 2.2.3, 2.3.4 and 2.5. Additional benefits are presented and discussed in the following section.

3.2.5 Uses in the Study

The rationale for using Activity Theory is based on its suitability as framework and analytical tool for the research under the information behaviour approach. According to Wilson (2006), it “can be quite a powerful analytical tool and conceptual framework of inquiry” (p.9). Specifically, this framework is found useful to study information sharing (Widén-Wulff and Davenport, 2007; Hassan Ibrahim and Allen, 2012; Nowé and Wilson, 2007) and gives the opportunity to study the human activity in everyday practice pondering the cultural and historical context and the individual and social levels (Wilson, 2008). This is because the “human mind emerges, exists, and can only be understood within the context of human interaction with the world, and this interaction, that is, activity, is socially and culturally

determined" (Kaptelinin et al., 1999, p.28). This means that the object of information sharing, as object-oriented activity, helps to "understand not only what people are doing but also why they are doing it" (Kaptelinin, 2005, cited in Nardi, 2005, p.38).

Moreover, activity theory serves to discover and frame the anatomy of actions and operations taken in context in succeeding and temporary moments of a wider and steadier system of a communal activity (Engestrom, 2000). This permits to consider relevant aspects as purposes of individuals; associations between individuals; historical and cultural developments of human activity; inherent and clear social routines of the environment where human activity is carried out; active configuration of human activity; and matters enclosed in the improvement and use of tools and artefacts which bear that human activity (Mwanza, 2002). In addition, it offers advantages in describing how activities are and in identifying needs to upgrade current practices to develop those routines (Korpela et al., 2002). Similarly, it provides the foundations to understand information sharing from past to present and to postulate trends in its use and improvements.

Activity theory as an analytical tool enables the understanding of the context where information sharing is studied. Engeström (1993) pointed out that context is an integrated whole in which there are integrated the subject, the object, the tools and artefacts and inclusive, communities, rules and norms, and divisions of labour of the activity system; but context is not basically a repository or a formed experimental place. In addition, it supplies a complementary instrument to facilitate the identification of the activity in study in context (Engeström, 1993). This implies the analysis of the collected data initiating with clarifying the activity elements; following with exploring those elements with the lens of the activity principles; and finalising with discovering inner contradictions that entail tensions on situations involving subjects that consequently change the nature of activity to overcome those strains (Engeström, 1987).

Therefore, activity theory permits to study in detail relationships between subjects and the object as well as the mediation of other elements of the activity system (tools, rules and norms, community and division of

labour) (Engeström, 1987). The understanding of those relationships and their mediation is facilitated with the analysis separately of each element and after as a whole. Otherwise if one tries to analyse the whole system, this insight might be complicated and/or confused. At the same time, it allows the analysis of the human activity within the historical and cultural context where the activity is carried out. Moreover, it enables the micro analysis (Mishra et al., 2011b). This is a wide-ranging approach to decomposing information sharing in its actions and operations. Consequently, these exhibit some insights on facilitating the understanding of it. Its deconstruction gives also advantages for analysing in detail information sharing as well as in gaining insights in how information sharing influences situational awareness and how it impacts on the changes relative to goals and conditions of actions and operations in context.

Notwithstanding, there are some considerations that are required to pay attention to avoid criticism in its use such as the confusion in the activities object/oriented and subject/oriented, the terms object and goal and the language employed. Initially, it is important to differentiate between activities object/oriented and subject/oriented (Bedny and Harris, 2005). The former is related to the use of tools for achieving a material object and the latter is concerned with the social interactions between subjects exchanging information on it.

Referring to the notions of object and goal of activity and action respectively, Bedny and Harris (2005) argued that objects are concerned with modifications and explorations from individuals on achieving the goal of the activity. This means that subjects put in a superior level the object of exploring possibilities of the activity to achieve goals that are “conscious cognitive representation of the desired result of activity” (Bedny and Harris, 2005, p.131). Although, the object of activity is considered as a synonym of objective in current research (Mwanza, 2002; Bellamy, 1996), in this study, the object of activity concerns the role of individuals achieving organisational goals; contrarily, goals of activity are in relation to the actions taken in using information sharing to confirm the role of individuals and the forms in which they comprehend situations to facilitate subsequent tasks in context. That is, it is founded by framing temporary sequences of the “continuous

transformation into one another" (Bedny and Harris, 2005, p.130). This means that the object of activity is transformed in the goals of the activity related to the states of the situations. In certain situations, the objects are transformed in the goals and vice versa over time according to the situations. For this reason, the uses of the generations of activity theory helps in dealing with those transformations as well as in comprehending and applying the definition of information sharing.

Related to language used in the activity, on occasions it is not clear generating confusion in its usage (Rajkumar, 2003). Distinctions between levels of activity and their constant development and transformations between one another are examples of the confusions in the use of language. Nonetheless, to avoid these misunderstandings, the development of the schematic activity system helps to frame interpretations of each element of the activity system by both the subjects and the researcher.

3.3 Adopting an Interpretive Paradigm

In this study, a qualitative research approach is chosen as feasible approach for answering the research questions depicted in sections 1.2. It was inferred from past research that qualitative approaches are suitable ways to gain in-depth understandings of phenomena (Hassan Ibrahim and Allen, 2012; Mervyn and Allen, 2012; Karanasios et al., 2011; Allen et al., 2011). This is because it includes "an interpretive, naturalistic approach" (Denzin and Lincoln, 2000, p.3) and choosing this is based on two reasons. The research is focused on gaining in-depth understanding of social phenomena in the naturalistic context of routine operation and incident management at major events, which is "little known" (Denzin and Lincoln, 2000, p.3). So, this approach allows gaining appreciations of the context and its influences on information sharing and situational awareness that in other conditions could not be possible. Similarly, it implicates multiple methods providing additional advantages on that understanding.

This investigation also gives the opportunity to gain in-depth understandings of the reality created, maintained and employed by

individuals in context through the use of information sharing for creating and maintaining situational awareness. This knowledge is associated with the personal subjective and inter-subjective meanings while they interact with the world around them (Malterud, 2001). Reality is a social construction of individuals that similarly includes other realities, a consequence of continuous interaction between them (Guba and Lincoln, 1994). Hence, these multiple-voiced constructions permit to access the meanings of individuals shared between them (Denzin and Lincoln, 2005) in terms of uses of information sharing for creating and maintaining shared situational awareness. The research also captures the unpredictability of situations through the meanings given by individuals (Klein and Myers, 1999) offering extra understandings of the context handled here.

3.4 Case Study Approach

The case study has gained many supporters because “this scheme may be overlapped with another or others methods of selecting data sources” (Blaikie, 2010, p.186). It also supports the forms in how data is collected and interpreted (Willis, 2007) by bounding the phenomena in study within its context. So, the adoption of case study is based in two motives. The study is focused in the naturalistic context of routine operation and incident management at major events. This implies to be involved in real situations in which information sharing and situational awareness are exhibited by the individuals in context. Here, case study involves “contemporary events where behaviours cannot be manipulated” (Yin, 2009, p.11). Moreover, it works well in fuzzy contexts where there is little understanding and includes dynamic processes and multiple variables and relationships difficult to overview and predict (Thorpe and Holt, 2007; Sonnenwald and Pierce, 2000). For example, uncertainty and complexity in context are added by the spectators’ behaviours that are unpredictable (Bowdin et al., 2006).

The case study permits in-depth and holistic insights into of the phenomena under study. Being immersed in the context enabled better comprehension of the phenomena uncovering new meanings of them. In addition, uses of multiples sources of information enabled the facilitation of

triangulation to consequently gain those insights about phenomena (Widén-Wulff and Davenport, 2007). For instance, it facilitates to understand the nature of information sharing as a two-way process (Talja, 2002). Furthermore, deep insights allow that generalisations, concepts and hypotheses emerge (Willis, 2007) consequent for being exposed to those phenomena. Examples of these insights are presented in the actions and operations of information sharing, stated in section 4.3.1. Moreover, the insights aided to understand the relationships between individuals and how information sharing influences situational awareness, as noted in chapter 7. Here, tensions and inner contradictions were important to examine those effects and how individuals resolved their differences (Engeström, 1987); in this case, for creating and maintaining situational awareness in context.

However, the case study approach is criticised in principle by some researchers who prefer quantitative approaches (Willis, 2007). Their principal claims are associated with objectivity in the research process. For this reason, those investigators stated that comparison of variables in controlled environments is one suitable way to achieve objectivity. They expect to manipulate and control the variables to obtain hard data facilitating their analysis. In the same way, these methods permitted selectivity to control the variable or variables in study facilitating the entire process for generalising the relationships between those variables (Gray, 2009). They also argued that only through quantitative methods can objectivity be achieved and the correlation between variables established. Nevertheless, Yin (2009) argued that the goal of a case study is “to expand and generalise theories (analytic generalisation) and not to enumerate frequencies (statistical generalisation)” (p.15). For this reason, the sections 3.6.2 and 3.7 present and discuss objectivity through the research biases and evaluative criteria of an accurate qualitative research. Consequently, case study is seen a feasible approach to expand the theory of information sharing and situational awareness in the context treated here.

3.5 Research Design

This part explains the research design utilised to translate the research questions into plans (Robson, 2011). It contains the case of study, the sources of information and the methods employed to gather data and those techniques utilised to prepare and analyse the collected data.

3.5.1 The Case Study

In the initial stages of the research, information sharing was proposed to be studied in the context of routine operation and incident management at football matches and baseball games (as major events) in Mexico. However, at that moment, the football teams are located in cities that did not offer the security and safety conditions to gather data. For instance, the access was solicited to one football team located in the north of Mexico, but this was not granted. Their arguments were based on the same issues. Thus, the contexts were changed and the new targets were concerts and baseball matches. Consequently, access was solicited to the concerts organised by the local authority in one city (named city 1) at the north of Mexico and to the baseball games organised by private companies in two cities (named city 2 and 3) located in the northwest of Mexico. As a result, access was granted by them, which consequently facilitated the access to other organisations that supported them.

For instance, in concerts, seven participants organisations agreed to contribute to this research. These included the organisers (the local authority), emergency services, volunteer organisations and private organisations that supported the routine operation; additional information is presented in the appendixes C and D. In the baseball games, three participant organisations per each team contributed to this study. These included the organisers (the private companies) and their support organisations; additional information is presented in appendixes C and D. It is important to remark that each organisation at major events exhibited different forms of organising and coordinating the participant organisations according to their organisational goals; nonetheless the goal of preventing casualties and reducing their impact on infrastructure in terms of safety and

security remained the same in all major events. This is because the organisers use a policy concerned with the operation of any major event in Mexico. This policy is included in the General Law of Civil Protection (Estados-Unidos-Mexicanos 2012) and is mandatory. As a matter of detail, that policy suggests a general form to organise, coordinate and control the individuals in the routine operation of major events. In addition, it recommends some procedures and protocols of communication to be used during incident management. However, each major event has its particularities, hence each event and incident is considered unique in space and time, increasing the challenges commented in section 1.1.

Therefore, in order to gather data in the three major events, a three-stage plan was developed, as stated in the following sections. Besides, during the process of data collection, a journal was employed to record the experiences, ideas, fears, mistakes, confusions, problems, etc., that were faced during the research (Lincoln and Guba, 1985). Furthermore, memos were developed to recognise patterns characterised by similarity, difference, frequency, sequence, correspondence and causation (Saldaña, 2009; Hatch, 2002). They were coded to assure confidentiality in the form “Memo#”. In addition, notes from the review of organisational documentation, interviews and observation of routine operation and incident management were done. These notes were alphanumerically coded to ensure confidentiality and the codes were in the form “NotDoc#”, “Note#” or “NotObs#” respectively, as noted in sections 3.5.2.1, 3.5.2.2 and 3.5.2.3. These documents took an electronic form to facilitate their reduction and analysis, as shown in section 3.5.3.

3.5.1.1 Phase 1. Concerts: part one

In this phase, the data collection started with the organisers of concerts. The initial contact was with the director of the department of the local authority at that moment. He instructed the sub-director to facilitate the access to other members of the department, who included personnel at tactical and operational levels. Afterwards, they opened the opportunity to access the Civil Protection Department and the company that gave the service of private security. In both organisations, access to the personnel at tactical

and operational levels was obtained. In addition, access to observe the operation in two concerts was granted. There, the researcher was assigned to a specific place in the venue and from that static position observed two incidents. At this stage, three participant organisations contributed to the research and 32 documents were provided by those organisations. The final numbers were 17 interviews reporting 39 incidents and 15 hours of observations in two concerts. The duration of this stage was two months and a half. Details of the events and gathered information are presented in section 3.5.2 and appendixes C, D, E and F. In addition, this stage served as a pilot study because it helped to evaluate the strategy and data collection methods (Yin, 2009) for continuing gathering data in other events and organisations. At this point, the researcher moved to the cities where the baseball games took place.

3.5.1.2 Phase 2. Baseball games

In this phase, it was agreed with the managers to observe and interview their personnel during the games who were in the regular role. In addition, these managers permitted access to the restricted areas and the continuous movement throughout the venues over time. As a matter of detail, this continuous movement permitted to observe diverse incidents and personnel managing those incidents. In addition, joining routine patrols allowed to corroborate the procedures stated in protocols and procedures and/or commented on by tactical and operational personnel in the interviews.

Once the regular role was finalised, surprisingly both teams that participated in this research passed to the semi-finals confronting each other, but only one team passed to the finals of the league. These situations offered additional insights in the context of study because the large number of spectators who attended the games increased the number of incidents during the matches. In city 2, five interviews were done and eight games were observed accumulating 36 1/3 hours. 17 incidents were noticed and eight incidents were reported verbally. Three organisations participated in the study and 44 documents were revised. In city 3, 14 interviews were done and 11 games were observed accumulating 47 ½ hours. 37 incidents were noticed and 22 incidents were reported verbally. Three organisations

participated in the research and 49 documents were reviewed. The duration of this stage was two months. Details of the events and gathered information are presented in section 3.5.2 and the appendixes C, D, E and F. Once the baseball season finished, the researcher came back to the city 1.

3.5.1.3 Phase 3. Concerts: part two

In this phase, the director of the organisers served as mediator with other directors and managers of other participant organisations. These were the emergency services and their support organisations; however, some employees refused to participate in the research. In order to convince them, the clarification of the aim of the research was critical, indicating that this research had only academic aims and not against their information practices. For instance, the verb investigate has the same meaning in English and Spanish, but in Mexico it can be interpreted as legal investigation. Thus, two or three times it was required by the researcher to explain the aims in the initial contact and before the start of the interviews. This phase was also challenging in terms of logistics, because some interviews required at least two visits to confirm the participation of the individuals and in two times the meetings with the interviewees were rescheduled. Furthermore, seven members of the emergency services refused to participate cancelling the meetings at the last moment. This phase finished with 19 interviews done and 22 documents reviewed. 59 incidents were reported and four organisations participated in this stage of the research. The duration of this stage was two months. Details of the events and gathered information are presented in section 3.5.2. and the appendixes C, D, E and F.

3.5.2 Data Sources and Collection

Three methods were employed to systematically gather data during the fieldwork: review of organisational documentation, observation of routine operation and interview of personnel of the participant organisations. The focus on organisational documentation was to identify and understand the routine operation and procedures during incident management. In addition, attention was placed on the policies and regulations associated with the

operation of major events and the legislation associated with incident management. These documents included their goals, tasks and related knowledge connected with the aim of the research (Sonnenwald and Pierce, 2000). Although, most of this organisational documentation is in relation to the management of emergencies in the normal and routine life within the cities, they were utilised in the context handled here. Little documentation was found on concern with this context. So, this point is treated and discussed as a practical implication in section 8.3.1. Concerning the observations, the focus was to corroborate current work practices comparing information obtained in the review of organisational documentation and the work practices of incident responders in context. Finally, interviews were done with the aim to comprehend practices during routine operation and incident management from individuals' viewpoint and to discover the significance of their practices in this context. A summary of the gathered data is presented in the table 3-1 and details of the events and gathered information are presented in appendixes C, D, E and F.

Table 3-1 Data gathered in the fieldwork.

	Observation		Interviews			Revision of	Participant
	Hrs. spent	Incidents observed	Written Consent	Verbal Consent	Incidents reported	Organisational Documentation	Organisations
Concerts	15 (two concerts)	2	34	2	98	54	7
Baseball matches **- Stadium One**	36 1/3 (eight games)	17	5	-	8	44	3
- Stadium Two	47 ½ (11 games)	37	7	7	22	49	3
Total	**98 5/6**	**56**	**46**	**9**	**118**	**147**	**13**
			22 Tactical	***33 Operational***			

3.5.2.1 Review of the Organisational Documentation

During the fieldwork, different sources of documents were consulted to gather data concerned with the organisations. The sources were organisers, local governmental offices related to major events, websites of local governments and libraries of local universities. Moreover, photographs taken during the events were considered in this category. They helped to gain insights where participant organisations and their personnel were located inside and outside of venues. Moreover, they helped in discovering the

position of members and the types of uniforms as well as the geographical proximity between those members and the public. 20 photos were taken in the concerts and 45 in the baseball games. Permission to take pictures was granted by the participant organisations and their personnel.

Finally, 147 documents were gathered and analysed later. Moreover, when it was permitted, the diverse documentation was photocopied or pictures of documentation were taken in order to have an electronic copy. This allowed greater portability for research purposes. All documents were alphanumeric coded to assure confidentiality and anonymity and the code was in the form “Doc#”, coding them progressively from Doc1 to Doc147. It is important to remark that the principal legislation concerning major events is the General Law of the Civil Protection (Ley General de Proteccion Civil)(Estados-Unidos-Mexicanos, 2012) that pointed out the importance of being preventive in managing threats and hazards to prevent casualties and impact on infrastructure. This law is interpreted and carried out in relation to the type of event, capacity of venues and resources that organisers have. Details of the organisational documentation are presented in appendix E.

3.5.2.2 The Interviews

The critical incident technique (Flanagan, 1954) and a variant of it (Chell, 2004, p.45-60) were employed to guide the interview, as shown in appendix A. This technique consists of a set of procedures for collecting direct observations of human behaviour facilitating their potential usefulness in solving practical problems and developing broad psychological principles (Flanagan, 1954, p.1). Moreover, to complement the guide, the eight-step model (Mwanza, 2002, p.128) was employed to develop additional questions in relation to cultural and historical issues and future states in the context handled here, see table 3-2. This model is also employed to analyse the information, as presented in section 3.5.3.

Furthermore, the critical incident technique was mixed with in-depth semi-structured interviews. This mix was principally to give flexibility to the process of gathering data from individuals. Similarly, the verbal interchange of information provided richer and deeper insights of those issues concerned

with the research that normally are not commented on outside of the environment (Barriball and While, 1994). In other words, it is “useful for getting responders to talk about conflicts and failures, which are often considered to be private in organisational cultures and not to be discussed with outsiders” (Sonnenwald and Pierce, 2000, p.466). This is also in line with the critical incident technique because it gets insights in behaviour at unusual situations (Flanagan, 1954). Moreover, this technique has proved a feasible tool in studies of information sharing and information behaviour (Sonnenwald and Pierce, 2000; Hassan Ibrahim and Allen, 2012; Mishra et al., 2011b). Although, this type of interview served to reduce the bias of interviewees (Al-Alawi et al., 2007), this is not completely sure that this happens because the behaviour is unpredictable.

Table 3-2 Eight-step model (Mwanza, 2002, p. 128)

Step	Activity System component	Questions to ask
1	Activity	What sort of activity am I interested in?
2	Object-ive	Why is this activity taking place?
3	Subjects	Who is involved in carrying out this activity?
4	Tools	By what means are the subjects carrying out this activity?
5	Rules and Regulations	Are there any cultural norms, rules and regulations governing the performance of the activity?
6	Division of Labour	Who is responsible for what, when carrying out this activity and how are the roles organised?
7	Community	What is the environment in which activity is carried out?
8	Outcome	What is the desired outcome from this activity?

Another point is concerned with assuring that the interviewees were the ideal participants for the research. For this reason, a procedure was developed to approach potential participants. As an initial criterion for this procedure, the potential participants have participated in the routine operation at major events, specifically on managing incidents. In the initial stage, the leaders of the participant organisations suggested potential participants, but once the fieldwork continued, the interviewees suggested other potential participants from same or other organisations. These individuals were suggested because the leaders and/or the interviewees knew the abilities and knowledge of the participants in context, regardless of from which they come. In other words, the criteria for approaching the

potential participants are a mix of purposive and snowball reasons giving additional flexibility to the research. The purposive criterion is focused on approaching and inviting only individuals with experience in the context handled here. The snowball technique was employed to discover potential participants who subsequently were approached. Thus, the criteria are in close relation with the matter in study and permit gaining an in-depth insights into it (Robson, 2011). In this line, the interviewees also perform roles at tactical and operational levels and clearly expressed their interest in contributing to the research. Other individuals showed similar interest, but they were excluded because they did not have experience in context.

In the second stage, the potential participants were approached to ask them to participate. To do so, the researcher moved to their workplaces. Next, they received a formal invitation to participate and a meeting was agreed to be interviewed. At least one day was given to individuals to allow them to consider their participation, but certain individuals solicited at least two days. This was the case of nine potential participants. Here, ethical considerations were taken into account during the process of recruitment and one day was the minimum time granted to consider participation, see section 3.6 for additional information. In the third step, individuals were interviewed following the procedure set out within the ethical approval, stated in section 3.6 and appendix A and B. 55 interviews were done and a summary is presented in the table 3-3 and appendix D and E.

Table 3-3 Results of interviews

Event	***Organisation***	***Number of Interviews***	***Hierarchical Level***	***Written and/or Verbal Consent***
Concerts. City 1	Public Relations Department	2 3	Tactical Operational	All Written
	Civil Protection Department	2 3	Tactical Operational	All Written
	Firemen	4 2	Tactical Operational	All Written
	Commercial Police	2 4	Tactical Operational	Four written and two verbal
	Voluntary Groups	1 2	Tactical Operational	All Written
	Red Cross	2 2	Tactical Operational	All Written
	Security Company	3 4	Tactical Operational	All written
Baseball Games. City 2	Organisers, Safety and Security Coordinator	1	Tactical	Written
	Security Company	1 1	Tactical Operational	All Written

	Commercial Police	1 1	Tactical Operational	All Written
Baseball Games. City 3	Organisers	2	Tactical	All written
	Security Department	1 8	Tactical Operational	Five written and four verbal
	Civil Protection Unit	1 2	Tactical Operational	All verbal
	Total	**55 interviews**	**23-Tactical 32-Operational**	**46 Written Nine Verbal**

Another point is that during the interviews, a written or verbal consent was obtained from the individuals. The difference is that in the written consent the individuals signed an authorisation to be interviewed; contrarily, in the verbal consent the individuals gave verbal authorisation. Moreover, the duration of the interviews was connected with the type of consent obtained. The interviews with the written consent ranged from 40 to 80 minutes and the average was 55 minutes; on the other hand, the interviews with the verbal consent ranged from 15 to 30 minutes and the average was 20 minutes. Nonetheless, interviews with the written consent were preferred by participants; but the verbal consent was convenient for the research to focus only on particular incidents concerned with the research. That is because the written consent is considered common practice, but in contrast, the verbal consent is considered implicit consent (Emmel et al., 2007). For instance, individuals with major experience in context preferred to be interviewed giving the verbal consent. This permitted to focus the interview on the points related to the networks developed in context (sections 4 and 5 of the interview guide, as shown in appendix A).

All interviews were recorded using a digital voice recorder and were transcribed verbatim in order to upload to the NVivo9 software. This software was employed in the analysis, as shown in section 3.5.3. In addition, the interviews were alphanumeric coded to guarantee confidentiality and anonymity. The code shows the participant organisation, the progressive number of the interview, the date when the interview was conducted and the role of the participant organisation at major events on which the interviewee works, and the role of the interviewee within the participant organisation. This code takes the form of “participant-organisation,e#,date-of-interview,role-of-organisation,role-of-interviewee”. Details are presented in

appendix F. Furthermore, notes of the interviews were elaborated and coded taking the form “Ne#” to refer to the progressive number of the interview.

3.5.2.3 Observation of the Routine Operation and Incident Management

Observations were done in the context of study and with the consent of organisers, directors of departments and managers and owners of the baseball teams. As a matter of detail, the administrators notified their personnel, at tactical and operational levels, that a researcher will observe their tasks. Thus, they introduce him to them and, afterwards the personnel permitted the access to the venues and to the restricted areas. Then, one individual from the tactical level in each participant organisation gave the researcher an overview of the routine operation and the tasks done in incident management. This generally included an induction about particular tasks during events, familiarisation with tactical and operational personnel and visits to different areas of the venues.

Later, the researcher adopted the observer-as-participant identity (Waddington, 2004). This means that the observer can ask the individuals without interfering in their routine tasks. This identity helps in gaining extra insights from the routine work. For instance, various guided visits to restricted areas were done under the supervision of one tactical member of the participant organisations because those areas were considered dangerous. Specifically, if individuals can infer that criminal behaviours could be exhibited by spectators, they collocated the researcher in a safe area to observe how they managed the incidents. At that point, five incidents were observed with these characteristics and the personnel promptly managed the incidents adopting precautionary behaviours and no injured people resulted. In addition, minor incidents were observed as fainting, attempts at fighting, changes in the risk system and operations of external organisations. They were managed by two to eight individuals. This was the case when the Governor of the state arrived to observe the finals of the baseball league. That day, the risk system was modified to offer him greater security.

Moreover, during the observations, note taking was carried out to discover the incidents and their participants, events, information flow, etc.

(Ely et al., 1991). All notes were done in a notebook, afterwards they were transcribed electronically to facilitate their mobility and subsequent analysis. These were also alphanumeric coded to guarantee confidentiality and anonymity and the code was in the form “Obs#”, coding progressively each incident from Obs1 to Obs56. Additionally, note taking was done in the preparation, at the middle and the last state of the events. Each observation was coded progressively from NotObs1 to NotObs63 accumulating 98 5/6 hours in 21 events. Details are presented in the appendix E.

3.5.3 Data Analysis

Two things were considered before the initial stages of the data analysis: what tool can help in that task and what language was convenient in the analysis because the majority of the data gathered was in Spanish. Referring to the tool, NVivo9 was chosen to facilitate the handling, management and analysis of qualitative data. This was because this software showed major benefits in terms of interactivity, code and retrieval functionality, data organisation among other technical issues (Lewins and Silver, 2009). Consequently, the data was uploaded to this software. Related to the language of analysis, the majority of data was collected in Spanish, so translating these materials to English could be a challenging and demanding task. Thus, the decision on using Spanish as the natural language in the analysis was made. In this respect, some researchers argued that work with transcripts of naturally occurring data give advantages to bring transparency of the phenomenon under study (Li et al., 2007; Shin et al., 2007). Consequently, only small pieces of data were translated to English in order to be used as quotations in this thesis. That was because translating data extracts incorporated varied practical and ideological questions in relation to “the level of detail chosen in the transcription, and of the way in which the translations are physically presented in print” (Nikander, 2008, p.226). Therefore, the extracts utilised the code of the interview to exhibit their source, as noted in section 3.5.2.2.

Continuing with the analysis, an inductive approach was followed to permit the discovery of “frequent, dominant, or significant themes inherent in

raw data, without the restraints imposed by structured methodologies" (Thomas, 2006, p.238). This also aided to link the concepts and themes (Rubin and Rubin, 2011) as explained in subsequent parts of this section. Initially, the data was revised meticulously to ascertain that they were properly prepared to be used in the analysis. Details in the form of the materials, the structure of the sentences, the verbs employed and their tense and the data were properly alphanumeric coded were some of the issues considered in this preparation. At the same time, the interviews, the observations and the notes of both interviews and observations were categorised in relation to the number of incidents handled and the richness in their description. This categorisation was done per each participant organisation considering the roles of the interviewees and per the daily events so that 30 documents were considered in this step. The aim of this categorisation was to facilitate the subsequent analysis and the "detailed readings of raw data to derive concepts, themes, or a model through interpretations made from raw data" (Thomas 2006, p.238).

The coding process was then the next step. This is "a process of simultaneously reducing the data by dividing it into unit of analysis and coding each unit" (Calloway and Knapp, 1995, p.2). The process started using the open coding procedure in which data were coded interpretatively (Strauss and Corbin, 1998; Saldaña, 2009) and using the constant comparative method (Strauss and Corbin, 1998). Word by word and their relationships with the context were explored in this stage (Paul et al., 2008a; Reddy et al., 2008). This procedure particularly enables the discovery of the codes required to answer the research questions shown in section 1.2 and those needed to uncover the elements, tensions and disturbances of the activity systems mentioned in section 3.2.4. This procedure was iterative until saturation was reached in each category. Subsequently, the rest of the data were reviewed using the codes discovered in the first stage until new codes were not discovered, so open coding was considered saturated at this point (Strauss and Corbin, 1998). Here, 25 documents were also reviewed and the surplus corroborate the categories found. Information sharing, providers and receivers; trust in uniforms and individuals; role of information

providers and receivers; controlling the information and organisational goals are some examples of the categories emerged in this step.

The process of axial coding was the next step. This is related to linking categories at the level of properties and dimensions until the point of selective coding is reached (Strauss and Corbin, 1998; Saldaña, 2009). This means that no new properties, relationships or dimensions emerged from the analysis (Pickard, 2007). Although, the process of coding was done iteratively, one piece of data has served to compare others in order to develop conceptualisations (Strauss and Corbin, 1998). Similarly, following the same process memos were extensively written and used. These permitted to gain insights of the relationships between codes (Miles and Huberman, 1994). Here, preliminary themes and activity elements as secondary codes emerged in the light of contextual attributes. In this way the themes provided crucial insights aiding with making sense of relationships.

For example, the trust in uniforms and the role of the information providers and receivers using uniforms were themes that were selective categorised in the theme of surface credibility as motivation for sharing information in face-to-face interactions. The interviewees stated that during incidents, it was easy to be aware of individuals from other organisations because they wore uniforms that were easy to discover inside the crowd. This facilitated information sharing in incident management and the interaction was in connection with the type of incident in progress. Consequently, it was inferred that individuals valued the expected abilities of other individuals using uniform that shows the organisational objective. Moreover, being aware of the individuals using uniforms and the role of individuals were also themes which were selective categorised within the theme situational awareness as a tool in mediating and controlling information sharing. This case provided insights about the abstract tools used by the individuals in the routine operations and principally in incident management at major events. The insight was uncovered in considering the types of abilities required in incident management, hence, individuals chose to share information in face-to-face interactions with those individuals who have determined abilities required in incident management.

In addition, the role of information providers and receivers, type of information received, the motivations for sharing information and individual situational awareness were themes that were selective classified inside of the theme collaborative situational awareness as an outcome of information sharing in face-to-face interactions. Specifically, the themes in collaborative situational awareness were linked with the motivations for sharing information, the role of the information providers and receivers and the abstract and material tools used. For instance, if individuals shared information with other individuals from the same organisation using their situational awareness and specialised language as abstract tools in face-to-face interactions, they created intra-organisational situational awareness as an outcome of information sharing. The final version of themes and subthemes is presented in figure 3-6.

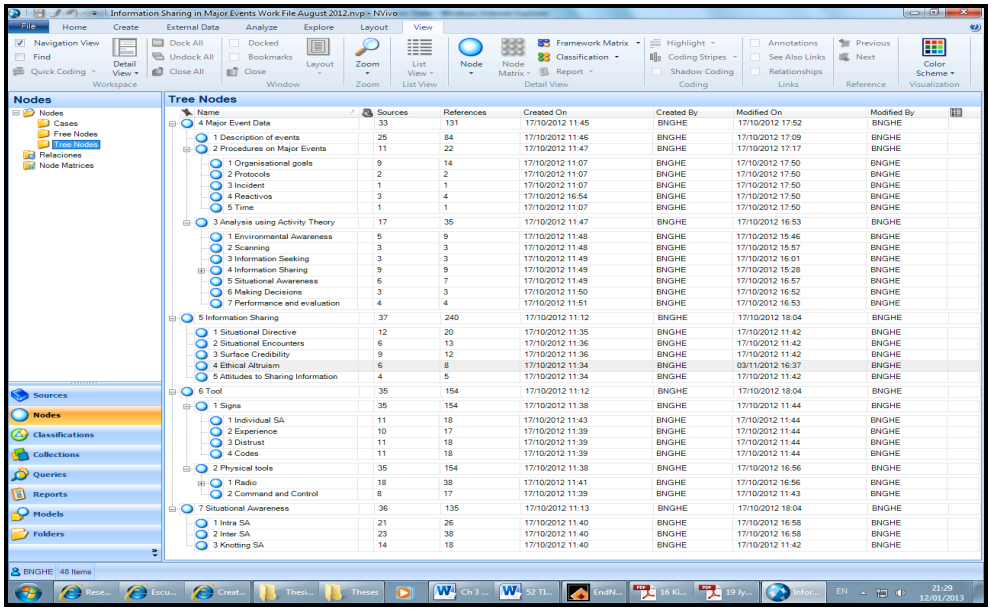

Figure 3-6 Free nodes to themes resulted from the coding process.

3.6 Ethical Issues

The research was conducted “according to the principles of academic excellence, community, integrity, inclusiveness and professionalism” (University of Leeds, 2009, p. 20). Following these principles, the ethical approval was granted by the AREA Faculty Research Ethics Committee of the University of Leeds (presented in appendix B). Furthermore, the

approval suggested the University's code of practice to safeguard data. To follow this practice, the electronic files were uploaded to the secure hard drive provided by the University of Leeds. Doing this, the data was secure and protected. Moreover and as matter of detail by following those principles, it was not required to receive an additional ethical approval by any organisation in Mexico. Approval was only needed from the organisers of concerts and baseball matches, the leaders of participant organisations and the diverse personnel involved in this research, including the interviewees and those who agreed to be observed and photographed.

3.6.1 Confidentiality

The ethical issues related to confidentiality were treated at the organisational and individual levels. At the organisational level, and as a part of the agreement with organisers, directors of departments, managers, owners of venues, or leaders of organisations, the individual or organisational identities were not revealed. Individuals' names, organisational titles, organisational names and name of cities were anonymised with alphanumeric codes, as explained in section 3.5.2 and presented in appendixes C, D, E and F. Additionally, permission was solicited to gather data from interviewing their personnel, observing their routine operation and incident management at major events and reviewing their organisational documentation. Furthermore, a technical report (organisational diagnosis) was delivered to each participant organisation for granting the access. In these reports, names, positions or relevant information about them were not disclosed and each diagnosis was written in a form to ensure confidentiality.

At the individual level, participants received an invitation to be interviewed given at least one day in advance to respond to this invitation. During the invitation, an explanation of the aim of the research and aspects related to confidentiality and protection of the data were given to them. These were included in the Research Information Sheet provided in this first contact. In the second contact, the interview was done. At its initial stage, the points exposed in the first contact were described again. This was to confirm the aspects concerned with confidentiality and to obtain the written

or verbal consent; additional information is shown in sections 3.5.2 and appendixes B and E. Names, positions and roles of the personnel who agreed to be observed and photographed and the notes and photos of the observations were also coded to ensure confidentiality.

3.6.2 Research Biases

An important ethical consideration during research is objectivity (Miles and Huberman, 1994). That is because objectivity affects the integrity of the researcher and accuracy of the findings (Saunders et al., 2009). Consequently, the researcher put objectivity at the first level and it was sustained during this study. For example, considering that certain information provided by the participants organisations and their personnel could be inaccurate, triangulation was used to achieve confirmation (Denzin and Lincoln, 1998). Moreover, as the only valid goal of the researcher was to research on information sharing and situational awareness, it was expected that the research outcomes contribute to the knowledge of the information science field and related areas. For this reason, the interference of personal beliefs in the study process and the influence on answers of interviewees and their behaviours were avoided by putting a social distance, i.e. remaining detached from the context during the fieldwork. For instance, this was facilitated by coming from a different background and exhibiting a professional attitude during the fieldwork. This is discussed further in the section 3.7 related to the evaluative criteria of the research.

3.7 Evaluative Criteria

There is a debate in the current research about what is considered an accurate qualitative research (Cohen and Crabtree, 2006). Principally, this debate is centred on the epistemological position, the standards of excellence, the consideration of readers and trustworthiness. Although, there are multiple sets of criteria to evaluate qualitative research (Cohen and Crabtree, 2006), Lincoln and Guba (1985) provide a criteria in reference to

the standard to be achieved in this type of research, specifically trustworthiness. It involves establishing:

- Credibility (internal validity). It refers to the confidence in the truth of the findings.
- Transferability (external validity). It means that findings have applicability in other contexts.
- Dependability (reliability). It is related to the idea that the findings are consistent and could be repeated.
- Confirmability. It refers to the degree of neutrality or the extent to which the findings of a study are shaped by the responders and not by researcher bias, motivation, or interest.

Consequently, as suggested by Lincoln and Guba (1985), each of these criteria may be achieved through diverse techniques. For example, credibility was fulfilled through the extended engagement in the context of study (Lincoln and Guba, 1985). This permitted the researcher to learn and understand the multiple cultures and social relationships between individuals and their organisations and to gain in-depth insights into the phenomena in study. Various aspects of the context were also uncovered using several methods to gather data enabling triangulation (Lincoln and Guba, 1985 ; Silverman, 2005), described in section 3.5.2. This ensures a rich, comprehensive and well-developed research.

In addition, transferability was met through thick description (Lincoln and Guba, 1985) in order to gain in-depth understanding of the phenomena. Thus, conclusions could be transferable to other times, contexts, situations and people. Moreover, thick description helped to uncover cultural and social relationships in reference to the context in study (Holloway, 1997). This was related with the implications, strengths and limitations of this study and the directions of future work, as noted in sections 8.3, 8.4 and 8.5 respectively.

Furthermore, dependability and confirmability were reached through an audit trail (Lincoln and Guba, 1985). This permitted to assure that written accounts, reports and reflections were left during the research process. For instance, the elaboration of the journal of investigation (Lincoln and Guba, 1985) from the start until the final days of the research allowed to

recapitulate stages of it and to know how the process was carried out, as noted in section 3.5. These were traces that could be audited and the memos can also be employed with this aim, as noted in section 3.5. Furthermore, confirmability is also achieved by employing the triangulation technique (Lincoln and Guba, 1985) using diverse methods to gather data, as noted in section 3.5.2.

Finally, these data were corroborated and discussed with leaders of participant organisations to validate findings and establishing trustworthiness. Similarly, this was done assuring confidentiality and anonymity in all materials presented. Nonetheless, this was controversial (Lincoln and Guba, 1985) because complex issues were treated. The lack of adequate material tools, training and rules for information sharing were examples of those issues. Consequently, some issues interested them so that they added to their information practices.

3.8 Summary of Methodology

This research is based upon the social constructivism tradition to deal with philosophical issues and to serve as a source of novel hypotheses (Hjørland, 2005). This tradition implies presumptions in relation to the field of knowledge (Vickery, 1997). Within this tradition, activity theory was found useful as a conceptual framework and an analytical tool. This is because it helped to explain what people do and why they are doing it (Nardi, 2005), specifically employing information sharing for creating and maintaining situational awareness in context. Similarly, it helps in dealing with cognitive and social elements of information sharing, precisely for answering the research questions depicted in section 1.3 and presented and discussed in chapters 4, 5, 6 and 7.

Besides, this research adopted an interpretive paradigm that permitted to gain in-depth insights about social phenomena in naturalistic environments about which is little known (Denzin and Lincoln, 2000). This paradigm specifically allowed to gain insights of information sharing for creating and maintain situational awareness in the context treated here, which is unexplored. This paradigm also provided flexibility to understand

the phenomena that cannot be comprehended from outside (Denzin and Lincoln, 2000) as a consequence of the unpredictability of the situations in context (Klein and Myers, 1999). Here, the value of case studies was exhibited for permitting the involvement in that context and providing advantages of uncovering the meanings of information sharing and situational awareness, as stated in chapters 4, 5, 6 and 7.

Thus, the research employed three methods to gather data during three stages, stages that were carried out in two major events located in three cities in Mexico. To assure ethical issues within the process of gathering data, the ethical approval was granted by the AREA Faculty Research Committee of the University of Leeds and confidentiality and research biases were deeply taken into account. Once this process was finalised, the data was prepared and uploaded to the software package NVivo9 to facilitate its analysis. This analysis was done using an open, axial and selective approach (Strauss and Corbin, 1998). In addition, this study achieved standards of trustworthiness (Lincoln and Guba, 1985) establishing credibility, transferability, dependability and confirmability during the process of gathering data and data analysis. This was in line with the tradition used, the paradigm adopted, the framework utilised and the methods employed to gather data so that activity theory exploited them in the analysis, as noted in sections 4.3 and 4.4, referring to information sharing and shared situational awareness respectively.

CHAPTER 4
MAJOR EVENT DATA

This chapter presents the analysis of the data collected during the fieldwork undertaken at concerts and baseball games. A detailed description of them is given that subsequently serves to illustrate the context of routine operation and incident management at major events. This description helps on discovering that organisers, owners and managers of concerts and baseball teams followed the General Law of Civil Protection. This policy suggests the creation of risk systems including the participant organisations and their personnel. The goal of them is to offer security and safety to spectators by preventing and/or managing potential or contingent incidents so that “white balance” or zero casualties is the expected outcome in the operation of major events. Diverse activities were discovered in context facilitating the analysis under the activity theory lenses. Here, the information sharing and situational awareness activities were the focus of this analysis. Nine actions and three operations were revealed in the information sharing activity. Furthermore, two actions and one operation were uncovered in the situational awareness activity.

The chapter initiates presenting an overview of the major events where the fieldwork was carried out. The general and specific procedures in the operation of the major events are then listed. It continues with the analysis of activity systems uncovered in the context of routine operation and incident management at major events. The chapter closes with a summary.

4.1 An overview of the Major Events

This part provides an overview of the major events where this research was conducted. These were concerts and baseball matches taking place in three different cities in Mexico and gave access and conditions to gather data. The concerts were organised by the local government in one of the cities situated

in the north of Mexico. There, as mentioned in section 3.5.1, data was gathered in two concerts. These concerts had an audience of 25,000 and 55,000 spectators respectively and included at least 10 different organisations, but only seven participated in this research. Moreover, the concerts lasted three hours each and the observations were carried out before, during and after the concerts. Additional information is presented in appendixes C, D and E.

The baseball matches were organised by private organisations in two different cities that are situated in the northwest of Mexico. The audience in those events varied from 5,000 to 8,500 spectators and included at least five different organisations in each match. Nonetheless, only three of those organisations participated in this research. The duration of the events ranged from three to five and half hours and the observations were done before, during and after the events. The final number of matches observed was 19. Additional information is presented in appendixes C, D and E.

It is important to remark that the characteristics of the major events are associated with the type of events, the venues and their localisation, the duration of major events and the risk system deployed. This was stated by diverse individuals who participated in the research and the different documentation consulted. For instance, the concerts and baseball matches are categorised in association with the threats and hazards that enclosed them. According to the organisers of concerts, those threats and hazards are minimised by the risk system deployed, as explained below and in section 4.2.1.1, and by the type of venue, preferring the open ones. On the other hand, the managers and owners of the baseball teams minimised those threats and hazards forming a risk system, using an open venue and permitting the access to the radio frequency to the diverse emergency services of the city, specifically to the Police, firemen and ambulances and hospitals, as explained below and in section 4.2.1.1. The open venues are those that do not have ceilings but have large extension of land. This provides advantages in safety and security issues in case of fire or panic facilitating the fast entrance of the emergency services.

Relating to the localisation, the majority of those venues chosen by organisers are localised near to the city centre where the majority of the emergency services are located. Consequently, the organisers evaluated these factors by the preventive tasks considered in the routine operation. This means that in case of a major incident, they can ask for additional support from other teams of the emergency services and the hospitals near to these venues. Thus, the fast response from those services and hospitals is extremely desired for reducing the time on obtaining those additional resources in case of requiring their support.

Respecting the duration of the events, the range of duration of the events varied from two to five and half hours and the mean was three and three-quarters hours. According to the organisers and the owners and managers of the baseball teams, the longer the duration of the events, the greater are the hazards and risks. For this, in the routine operation it was usually the case that personnel did patrols around the venues, these patrols were intensified as the event passed over time. This is in the sense of expecting an increase in those threats and hazards during the last stages of the events. Additional information is presented in the section 4.2.

Finally, the organisation formed to deal with threats and hazards associated with major events is denominated the risk system. Its goal is to prevent and manage incidents so that a “white balance” is expected. This means that no casualties is the outcome of the event and this term is usually utilised by politicians for giving the importance to this outcome in the events. The risk system typically followed the General Law of the Civil Protection (Estados-Unidos-Mexicanos, 2012) which applies to the entire country. It is important to remark that the risk system is associated with the size of the events (number of spectators), the size of the venue, the number of participant organisations, the number of personnel from each participant organisation, among other factors. In addition, some participant organisations are hired with the goal of supporting the operation of other participant organisations. For instance, in the concerts, the organisers only hired the security company. Contrarily, in the baseball matches, the organisers in city 1 hired the Police and the security guards and the organisers of the city 2, the security department and occasionally,

volunteers. Furthermore, the organisers, emergency services and volunteers performed their roles in context as a part of their workday. This implied that the risk system varied in size in strong relation to its cost. That is, in concerts the risk system is big because the cost is small; contrarily, in baseball matches, the risk system is small because its cost is high. However, as explained in appendix D, the participant organisations took their role within this routine work despite that this work could be considered unusual for being assigned to one determined area performing their role there. An example of the risk system deployed at major events is presented in the section 4.2.1. For instance, the risk system presented in the figure 4-1 is utilised as a model of analysis because it contains all types of participant organisations performing their roles, exhibiting abstract and material tools and forming internal organisations within the risk system. So, most of the information presented in this thesis came from the concerts, including the quotations. This is because the interviewees showed additional experience in context to those coming from the baseball matches. This is seen in the number of spectators and the size of the risk system deployed in the events.

4.2 Procedures in the Routine Operation at Major Events

In order to operate the routine operation of major events, the organisers and the other participant organisations developed diverse procedures which included varied tasks. These procedures are classified as general and specific. The general procedures are carried out before, during and after events, while specific procedures are developed during major events and are concerned with the routine operation and incident management. It is important to remark that in this thesis the routine operation and/or operation of major events refers to the set of tasks activities, actions and operations that are performed before, during and after the normal operation with the goal of preventing incidents or managing potential or active incidents. Operations in terms of activity theory are unconscious acts determined by the conditions of the activity (Allen et al., 2011), as noted in section 3.2.1. Incident management is the set of tasks that are performed before, during and after the routine or contingent incidents with the goal of preventing

casualties, reducing their impact on infrastructure and returning to a state of normalcy as routine operation.

4.2.1 General Procedures in Major Events

General procedures are those tasks carried out by the participant organisations and their personnel before, during and after major events. According to the organisers and the various personnel interviewed, these tasks are considered as collaborative activities, as described below.

4.2.1.1 Before events

In preparation for the major events, leaders of participant organisations met in a determined area of the venues and agreed different topics concerned with them. The agreements are principally in reference to how they should be organised and collaborate between themselves in incident management. To do this, leaders made inventories of the resources they have at that moment, including the number of personnel and their location; the number and types of ICTs and the number and types of command and control areas. In addition, they agreed what locations were covered by their personnel and what frequencies and codes were employed in the risk system.

The risk system is deployed to prevent incidents at major events and the expected result is a “white balance” that means no casualties during the major events. This system follows guidelines of the General Law of the Civil Protection which covers the major events of the types treated in this thesis. This system also relates to diverse factors such as number of spectators, size of the venue, etc., as noted in section 4.1. In this system, the participant organisations agreed diverse forms of collaboration and use of specific tools for sharing information. In the concerts, for example, the participant organisations were grouped in relation to their roles, stated in appendix D. They used radio frequency spectrums to separate them, making clear which organisations formed those arrangements. For instance, the use of diverse frequencies helped on uncovering which organisations are subordinated to one another. Seven frequency spectrums were utilised in the risk system deployed in the concerts, as shown in figure 4-1.

However, certain organisations have advanced technological tools so that they use radios with the capacity of intercepting the frequencies of other organisations. These organisations also had personnel who were employed as translators in order to be informed what activities were being by other organisations. This was because certain organisations use natural language and others employ codes for sharing information. Three types of codes are used as shown in figure 4-1. The codes are words, numbers or mixtures of words and numbers that mean frequent phrases or words employed in voice interactions by security or safety organisations.

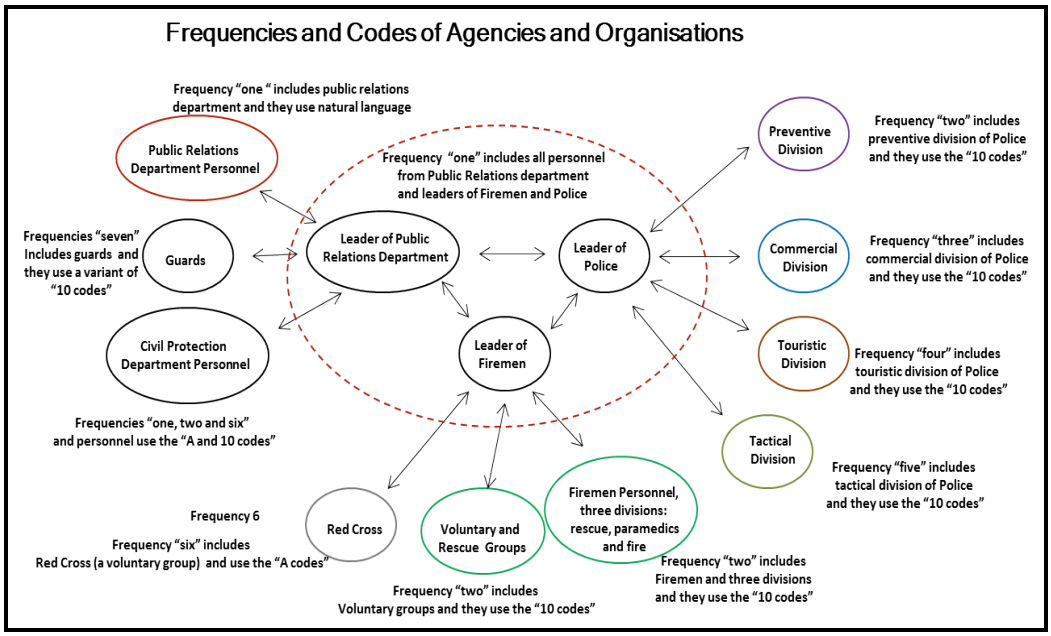

Figure 4-1 The risk system displayed in major events

Moreover, rules and norms and division of labour are other elements considered in those nested organisations in the risk system. This helps on categorising the participant organisations according to their role at major events. Five categories were found, as shown in the table 4-1.

Table 4-1 Categorisation of participant organisations

			Participant Organisations					
Organisational Role	Public Relations Department	Civil Protection Department or Unit	Managers and Security Coordinators	Firemen	Police	Red Cross	Voluntary Groups	Security company
Regulators	*	*	*					
Safety Responder				*				
Security Responder					*			
Safety Supporter						*	*	
Security Supporter								*

Additional information related to the participant organisations and their role in major events is presented below and in appendix D:

1. Public Relations Department (regulators) established tactical and operational control of the security company –guards- (security supporters) and the leaders of the safety and security responders established tactical and operational control of the events.
2. The Civil Protection Department (regulators) supported at tactical and operational levels all organisations, principally to safety responders and supporters.
3. Firemen (safety responders) established tactical and operational control of the safety supporters (voluntary groups and Red Cross).

Three command and control areas were installed to gather and deliver information between organisations. These were managed by the regulators and leaders of the safety and security responders, by the safety and security responders, and by the Red Cross (safety supporters). There, translators were located to facilitate the information sharing between them.

Moreover, uniforms were worn by safety and security responders and by supporters and personnel from the Civil Protection Department. Contrarily, the personnel from the Public Relations Department used plain clothes. Furthermore, individuals were located near to each other and mixed at the same time inside and outside of the venues.

Furthermore, the department of Public Relations used natural language to share information with leaders of the safety and security responders and with the guards. Natural language is “the language that has evolved naturally as means of communication among people” (Collins, 2003). The firemen (safety responders), voluntary groups (safety supporters), all divisions of the police (security responders) used the “10-codes”. These are the word codes utilised to denote frequent phrases or words in voice interactions, specifically by security organisations. The guards used a variation of the “10-codes” to emphasise civil acts. Conversely, the Red Cross utilised “A-codes”. These

are the word codes utilised to denote frequent phrases or words in voice interactions, specifically by safety organisations or health professionals.

It is important to note that the risk system explained above is related to the concerts, which were closely similar to the baseball matches. However, some differences arise referring to the number of participant organisations and their personnel, the use of technological tools and the type of roles of those organisations. For instance, the owners and managers of the baseball teams focused on security issues, opening a gap in safety issues. In this line, they said that they preferred to call the safety services only in case of safety incidents.

The use of technological tools is another difference. This is because the owners and managers of the baseball team in city 1 preferred to use separately the radio frequency of the Police and the security guards in the risk system. They commented that their motives were economic and tactical. Using their frequency helped on the reduction of costs and the control of those organisations. Alternatively, the owners and managers of the baseball team in the city 2, they used their own radio frequency and permitted that other participant organisations and the emergency services of the city to utilise their frequency. Particularly, the emergency services utilise the frequency to listen to what is happening during the events over time but from their headquarters. In case of a major incident, they are prepared to react fast arriving possibly five minutes after their support is requested.

Moreover, the number of participant organisations and their personnel, as noted in section 4.1, influences the cost implied in the size of the risk system. For this reason, the owners and managers of the baseball teams tried to control the costs associated with the services of the participant organisations. According to the owners and managers of the baseball team in city 2, they preferred to ask for the support of these emergency services only when incidents happen; otherwise, they put major emphasis on the security issues so that they selected to hire the services of one section of the Police (Commercial division) and a security company. In addition, they commented that both types of support were chosen because the security guards are focused on the prevention of incidents and the Police officers are

concentrated on supporting the tasks of the security guards being only the last resort in the preventative tasks. Referring to the owners and managers in city 3, they preferred to hire the security guards as an independent organisation and invited as volunteers the other organisations. The objective was to reduce the costs by hiring only the minimal personnel during the baseball matches. In that case, the Police, the emergency services (the firemen and Red Cross) and the civil protection unit use the frequency employed by leaders of the baseball team. They also permitted the sporadic entrance of some of those organisations (Police and the civil protection unit) to do patrols along the venue as preventive tasks. These patrols were done proactively by the personnel of these organisations and when this happened, the owners and managers were informed about them.

4.2.1.2 During events

Individuals developed and performed the operation of the major events which was shaped by the tasks directed to prevent and manage potential or contingent incidents at major events. This was done by diverse personnel covering wide levels of coverage that there were narrowed over time. This means that individuals focused their attention on preventing the potential incident, so as the event unfolds, they also prevented incidents and managed contingent incidents. Moreover, they initially focused on all areas within and outside of the venues, but as the events unfold, they pay attention to certain areas considered problematic. According to the leaders of the participant organisations, the number of potential and contingent incidents increase over time. For this reason, individuals created and maintained an environmental understanding of what happened and what is happening over time; this may help them to infer what can happen during the events. So, this understanding requires various viewpoints shared with/between the individuals and the participant organisations.

Furthermore, certain individuals noted that one important activity is the scanning of the environment at major events. This provides a picture of what is happening and discovers unusual situations during the events. In addition, this permitted to discover the potential and contingent incidents. Here, the

initial point is creation and maintenance of an environmental understanding at the individual level. So, large numbers of individuals were located in determined areas within and outside of the venues with this aim; specifically, in those areas considered as risky. Contrarily, in those areas considered safe, only a minimal number of individuals were located. Additional information is presented in sections 4.2.2 and 4.3.

Lastly, when the individuals discovered unusual situations in their area of coverage, they usually started to share and/or seek additional information from other individuals from the same and/or other organisations. This opened the opportunity to create and maintain shared understandings of what happened, what is happening and what could happen in major events. Additional information is presented in sections 4.2.2 and 4.3.

4.2.1.3 After events

Once the events have finished, leaders of participant organisations met in a certain place at the venues and evaluated results of the operation at major events. According to those leaders, the goal was to improve the operation of major events; specifically the tasks of incident management. Their goal is to manage effectively and efficiently the potential and contingent incidents. Additional information is presented in the sections 4.2.2 and 4.3.

4.2.2 Specific Procedures in Major Events

Specific activities are concerned with the routine operation and incident management at major events on a temporal basis.

4.2.2.1 Routine operation

The aims of routine operation are to prevent or manage potential or contingent incidents at major events. Within this operation, collaboration was considered with/between participant organisations and their personnel. This operation also dealt with the threats and hazards of the major events. According to the personnel interviewed, the climate and behaviour of spectators were commented as the origin of the increase in the number of

those incidents. For this reason, individuals started evaluating the environment and verifying all elements of it. To do this, the individuals obtained information from all available information sources and at the same time, they checked the relationships between the participant organisations to be prepared for how the information can flow during incident management. Once the understanding of the environment or situational awareness was achieved, individuals started scanning the environment to verify the status of the major events. In this stage, the majority of the individuals involved in the events started sharing information to inform to leaders and the command and control areas their environmental understanding thus creating shared environmental understandings with/between them. This was limited to those areas covered by each individual and creating and maintaining environmental understandings for the entire event. In other words, a shared environmental understanding for the entire event was formed by adding individual environmental understanding from the individuals spread across the venues. Most of the time, this individual understanding was proactively shared by individuals; but in other situations, individuals shared upon request by leaders or command areas.

In certain situations, those leaders gave instructions to certain individuals asking them to change their locations. This was because individual environmental understanding of some areas was incomplete or potential threats and hazards were discovered. Furthermore, it was usual that individuals involved in routine operation agreed determined times by creating and maintaining shared environmental understanding. For example, they shared information every 15 minutes with this goal. Here, it was also common that information was shared between the nested organisations formed in the risk system and between those organisations at a higher level when an incident appeared. For instance, the safety individual solicited support from security individuals in incidents with security origin. In addition, all individuals started exchanging assessments of what had happened and what is happening for creating and maintaining a wider picture in incident management. These procedures are presented in the next section.

4.2.2.2 Incident management

The procedures in incident management were performed by individuals for preventing casualties, for reducing their impact on infrastructure and for returning to the routine operation at major events. These started with discovering areas with potential or contingent incidents, as noted in previous sections. Both types of incident were generally managed by security responders and supporters; but if there were casualties, safety responders and supporters can reinforce them assisting the casualties. Contrarily, in certain situations, safety individuals discovered potential or contingent incidents that consequently led them to ask for back up from security supporters to manage them. To facilitate the incident management, incidents were categorised as safety, security or both to make clear the characteristics of the incidents. These were principally associated with their causes and consequences and who should manage them. It was observed that certain organisations and personnel were located near those individuals managing the incidents, so that in case of being required, they were available to support them. In general, the procedure in incident management is:

1. Once the area where the potential or contingent incidents was discovered, individuals shared information adding their assessments of the incidents or problematic situations. That is the case in which the individuals who discovered the incidents shared proactively information or upon request from leaders and command and control areas, if they discovered first.
2. Other individuals were located in areas near the incidents so that they created and maintained an environmental understanding of the situation that helped creating and maintaining a shared environmental understanding with others. After, they shared that information to other responders who can be from the same and/or other organisations and the command and control areas.
3. With information provided about what happened and what is happening, incident responders can infer what would happen in the same situation, thus leaders and personnel from command areas can evaluate the situation to subsequently make decisions. Here, it is

important that individuals make clear to others their environmental understandings of what is happening and what would happen employing the available technological tools.

4. Once decisions were made, these individuals gave instructions to the individuals managing the incidents and to those individuals who will be involved in incident management. Information sharing was employed to pass these instructions that generally were guidelines for how the incident should be managed. Sometimes individuals followed literally these instructions or made changes to fit the tasks to the requirements of the incidents. For example, although, the procedures for managing incidents were stated in policies concerning the management of routine emergencies in cities, the procedures for caring the casualties at major events were changed to efficiently care for the injured. The governmental agencies inferred that casualties at major events could have different characteristics to those during the routine operation in cities. For instance, the majority of the police areas was included in the area of civil protection so that this department was the principal activist on changing these regulations to make clear the procedures to the other participant organisations. In other words, its personnel discovered the gaps in relation to the policies and procedures for managing the incidents in the diverse areas of the cities and in major events.

5. It was common that once the incident was managed, individuals met in a place determined in advance and shared their experience so they can improve the procedures for managing the potential and contingent incidents at other major events. Certain individuals proactively shared their experiences; but contrarily, others preferred to share expertise only upon request by their leaders or by personnel from the command areas. Leaders of the Civil Protection Department stated that these meetings were the source of information to improve the policies and norms related to major events. In addition, the meetings stimulated the sharing of the experiences between the participant organisations and were usual to develop training to tune the skills of the personnel of those organisations. According to these

leaders, the major events exhibited different threats and hazards to those exhibited by the routine operation of the cities. In fact, they mentioned that the risk system was the greatest advantage at major events verifying their relevance in the information flow and the collaboration obtained during the events.

The mentioned procedure was reduced to seven chained activity systems for facilitating its analysis under the activity theory lens. The figure 4-2 schematically reveals the individual and collective tasks in context on a temporal basis.

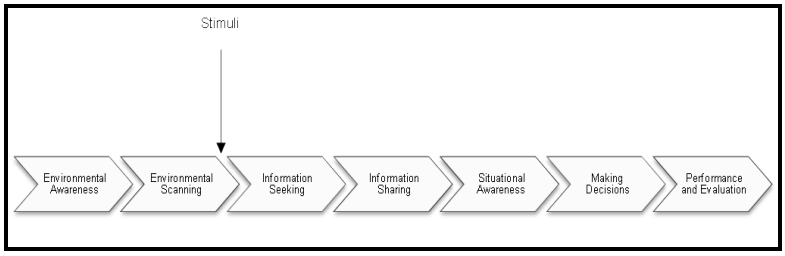

Figure 4-2 The activity systems on a temporal basis within the context of routine operation and incident management at major events

4.3 Analysis Using Activity Theory

The use of the chained activity systems was crucial to provide the basis for analysing the information sharing and situational awareness activity systems, as shown in figure 4-3. These showed the temporal basis in context so that the analysis in detail was centred on them for answering the research questions stated in section 1.2. These systems were examined in greater detail and an expansion of the activity concepts was elaborated on, presented in the following sections.

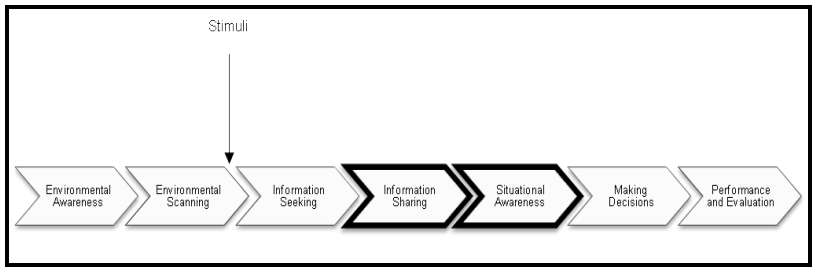

Figure 4-3 The activity systems covered in the research

4.3.1 Information Sharing Activity

Information sharing is principally used to change the image of the world of those individuals involved in context. This activity was achieved by providing information for creating a shared and/or mutual understanding of the situations (Sonnenwald, 2006), hence this gave advantages for making informed decisions. For this reason, the first step in the analysis was developing the information sharing activity system, as shown in figure 4-4. This figure permitted the microanalysis (Mishra et al., 2011a) using the first and second generation of activity theory, as shown in section 3.2.1.

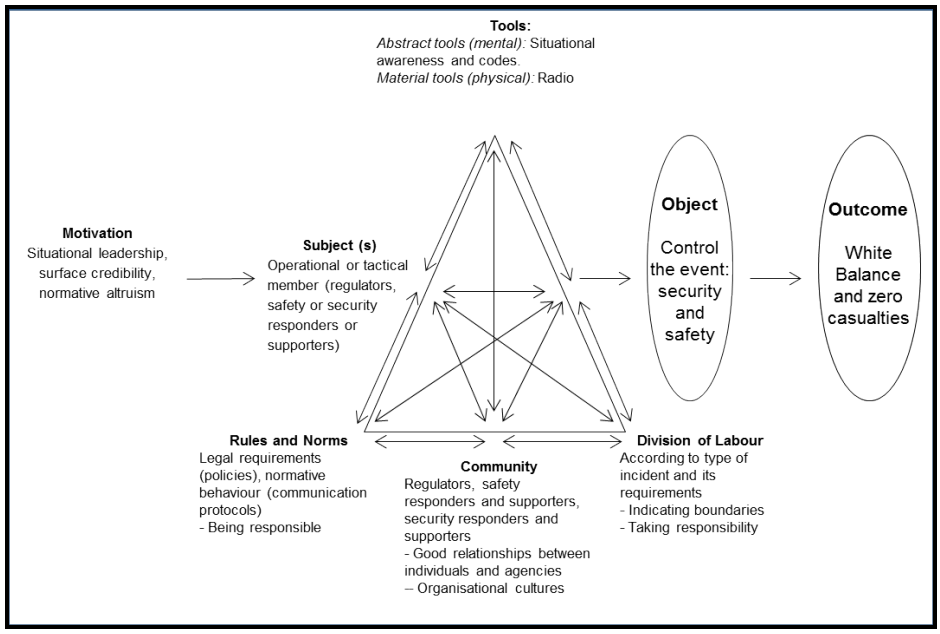

Figure 4-4 The information sharing activity system

Moreover and in order to facilitate the analysis of this activity in which two or more individuals are included in the information sharing activity, two types of analysis were utilised in conjunction with that activity system. The vertical analysis was focused on analysing information sharing in context between at least two members of the same organisation. An example of this analysis is presented in the figure 4-5 and the resulting activity was named intra-organisational information sharing.

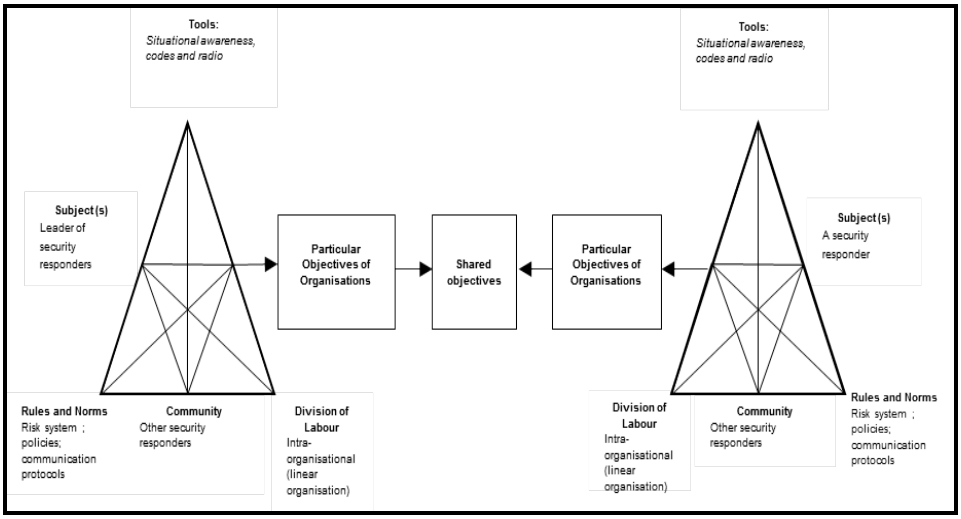

Figure 4-5 The intra-organisational information sharing

On the other hand, the horizontal analysis was related to the analysis of information sharing in context between at least two individuals from at least two organisations. An example of this analysis is exhibited in the figure 4-6 and the resulting activity was named inter-organisational information sharing. Both types of analysis were concerned with the use of the third generation of activity theory, presented in section 3.2.1. This was because it permitted the dialogue of perspectives (Engeström, 2001) on creating and maintaining shared situational awareness in context.

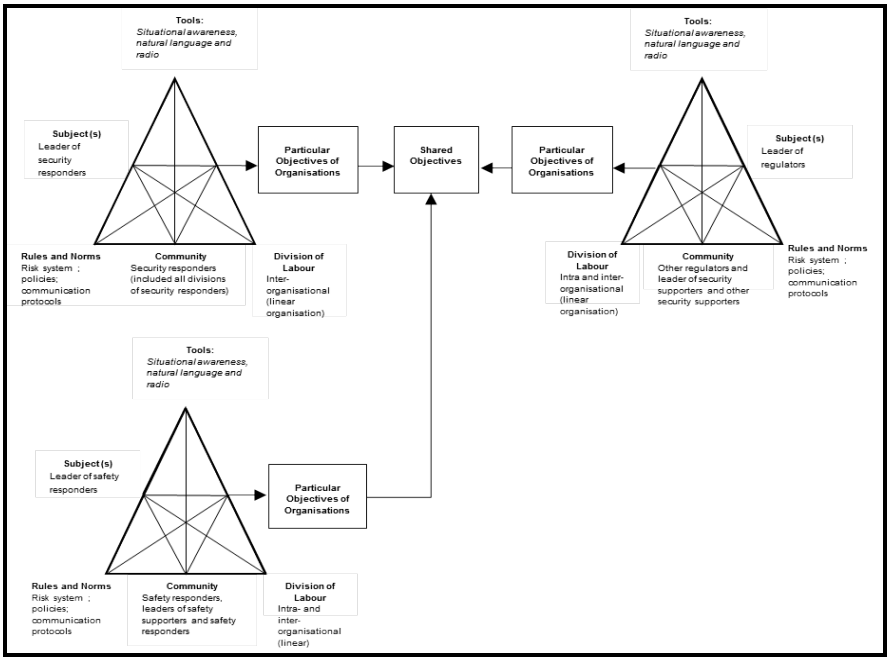

Figure 4-6 The inter-organisational information sharing

In addition, as the activity was composed of actions and operations which were oriented to the achievement of objects, goals and conditions respectively (Leont'ev, 1978), the information sharing activity system is decomposed in their actions and operations, as shown in figure 4-7.

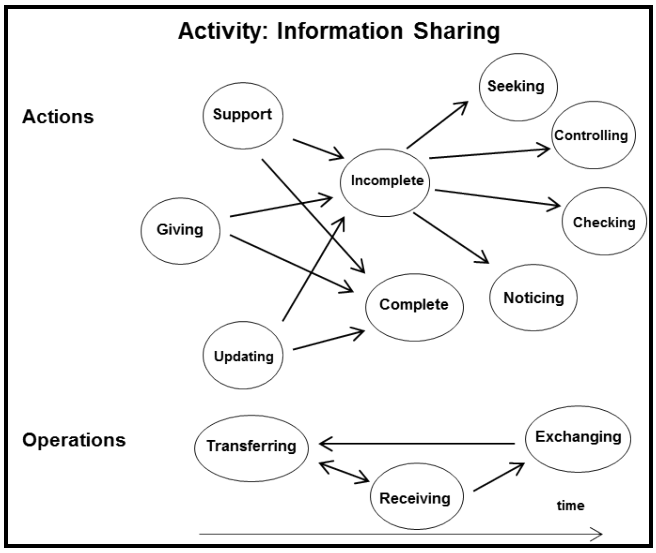

Figure 4-7 Actions and operations within the information sharing activity system

This representation shows that the information sharing activity is principally constituted of nine actions: soliciting support, giving orders, updating, complete reception, incomplete reception, information seeking, controlling information, checking information and noticing. Similarly, these actions are made up of three operations: transferring information, receiving information and exchanging information.

Furthermore, the representation tries to state that an individual may transfer information for soliciting support, giving orders or updating the current situation. If this information is completely understood, it may lead to making informed decisions; contrarily, if information is not clearly provided or understood, the exchange of information is activated through seeking information, controlling information, checking information and noticing in context. This operation can be transformed in one or two of those actions. For example, in certain situations, individuals overlapped actions in the same task. Here, these can be found in the images created, the roles implied in those images and the actions and operations of this activity.

In addition, the representation exposes time as a crucial element in the information sharing activity. This is because the actions and operations passed over time. For example, if the information shared is clearly understood, the receivers can promptly make informed decisions and, thus, fast response can be performed reducing the response time in incident management. Contrarily, if information is not clearly understood, the receivers can need additional information, hence, this can delay the decision making process, which subsequently can delay the response to the incident.

In order to clarify the analysis of these actions and operations, in the subsequent sections each action and operation is discussed further. It is important to remark that the actions are oriented to achieve goals meanwhile the operations are carried out in relation to the conditions of the context. For this reason, the operations are presented first and the actions are depicted subsequently. The conditions in context helped on to uncover the operations and the goals aided to discover the actions of this activity.

4.3.1.1 Operations

Three operations integrate the actions of the information sharing activity, actions that were seen by individuals as operations, but each of them enclosed goals, as stated in section 4.3.1.2.

4.3.1.1.1 Transferring Information

This operation was exhibited by individuals providing information or upon request in context and was the initial stage of information sharing at micro level. Here, the operation was principally exhibited in the routines within their work environment. For this, the analysis considered what abstract and material tools were used, what relationships were implied in this activity, where information sharing took place, who served as information provider and information receiver(s), what rules and norms were involved, what motivations were associated with this activity (it similarly helped on for uncovering the actions of information sharing), how individuals were organised in context, what the object of information sharing was, and what outcomes were expected. For instance, the lack of partial or complete

environmental understanding can activate this operation, transferring situational information to other actors. In this line a member of a voluntary group in concerts said that

> first responders (*safety and security responders and/or supporters*) should give a detailed report to the person in charge of what was going on. This was a good way of passing responsibility for managing the incident (*Voluntary group,e18,15Nov2010,safety supporter, tactical*)

From the analysis of this excerpt, some of the questions noted are answered as follows: the information sharing process was done in a face-to-face interaction between members of at least two organisations (safety and security responders and/or supporters) in context. This interaction was done recognising the norms and rules of interaction by giving a detailed report to the individual who was in charge on managing incidents, which implied passing responsibility and similarly, recognising their responsibility. The individuals used the specialised language utilised by the safety responders and supporters. In this case, the individuals who arrived first to the incidents served as information providers and those individuals who were in charge served as information receivers. In addition, it implied that individuals offered support to those who were arriving and update what was going on in the incidents. Moreover, it may be inferred that the object was to control the incident so that no casualties was the expected outcome. Furthermore, this operation should be done considering time as a unit to measure the effectiveness in creating and maintaining a usable work image in context through the use of information sharing.

4.3.1.1.2 Receiving Information

This operation was exhibited by individuals receiving information from other(s) so that it ensured that the understanding of that information was clearly passed on or understood by them in context. In the situations in which the information was clearly provided and/or understood, the individuals can make informed decisions; contrarily, if the information was not clearly provided and understood, individuals may make misinformed decisions or can start on exchanging information for creating shared

understanding of the incidents. In this case, the individuals can be focused in understanding what happened, what was happening so that they can infer what could happen in context. For example a member of the regulators in the baseball matches in city 3 commented that

> "they (*security guards*) arrived and informed me that they were moving to another area because there was an unconscious person there (*Human resources manager,e23,26Dec2010,regulator, tactical*)".

In this case, the tactical member received information from operational personnel which involved a complete reception of the information provided. Specifically, the guards updated their leader about what was going on at that moment: an unconscious person in a specific area of the venue. The information was shared in a face-to-face interaction which was facilitated by the use of the specialised language of the security guards. This was seen in the utilisation of the word "unconscious person". In addition, the comment related to "another area" where the incident took place and so exhibited full recognition of the venue by the personnel involved. This means that those individuals tried to create and maintain a shared image of what is going on within the venue over time.

4.3.1.1.3 Exchanging Information

This operation was utilised by individuals serving as information receivers to exhibit that information was not clearly provided or understood by them. At this level, these individuals included actions such as information seeking, controlling information, checking information and noticing the current states of the situations. Specifically, the individuals were focused on creating and maintaining those shared understandings of the situations incorporating their past stages and their current status so that individuals can infer what would be the future state of the situations and what environmental and external variables could affect these states. Consequently, the understandings affected the decision making process in incident management. For instance, a member of the Civil Protection Department in concerts said that

> during an incident, the zone was declared as a chaos and that was not a consequence of the injured. This was because a voluntary group (*safety supporters*) arrived first; they did not offer convenient support in terms of personnel and equipment. They arrived and ask for additional support without giving clear data about the incident (*Civil protection department,e6,26Oct2010,regulator,tactical*)

From this excerpt, it could be inferred that some tensions were generated as a consequence of not providing enough data, so that other individuals cannot create a clear understanding of the problematic situation. Nonetheless, it is also clear that additional information was not requested to create that shared situational understanding for making informed decisions. In addition, the dynamic nature of information sharing was inferred because time was a dimension that helped in the effectiveness for creating and maintaining shared situational understanding via information sharing, even though it was not clearly mentioned. Moreover, the use of tools and the type of interaction between individuals following rules and norms and division of labour were other factors considered in this operation.

4.3.1.2 Actions

Nine actions integrated the information sharing activity and were goal directed tasks that were incorporated in the operations exhibited above. These are in association with the situational conditions, as shown below.

4.3.1.2.1 Soliciting Support

This action was in relation to the information sharing utilised to share individual situational understanding which consequently provided the basis to request support from other individuals displayed at major events. This support was associated with the awareness of skills and abilities and the role of the individuals managing the incidents. In certain incidents, individuals had the skills and abilities to perform their roles in managing the incidents, nonetheless, they required additional support from other individuals with the same or complementary skills and abilities. These individuals were from same organisation or other organisations. For this reason, the action is named “soliciting support” because the aim is to manage the incident without

considering if the individuals came from the same or other organisations, but in consideration of their skills and abilities in performing their roles at major events. In this line, the security coordinator of the stadium of the baseball team in city 2 said that

> during the events, we (*security supporters*) are in good terms with policemen (*security responders*). Sometimes, we wanted to show that we could support them in incident management. In addition, we do not want to spend the relationship with them on requesting unnecessarily support, only when it is required. We understood that if there was a minor incident, we should not inform the police. In certain situations, we can manage the incidents without their support. Contrarily, if certain spectators resulted injured from fights, we should inform this to the police because they should arrest the fighters (for example). This is because we cannot arrest people (*Security coordinator,e21,18Dec2010,regulator,tactical*)

In this case, the security coordinator can request support from the Police officers only in situations when their skills, abilities, authority and responsibilities were required. For instance, the authority for arresting people is implied by the role of the Police, but it is not possessed by the security supporters. For this reason, the roles complement to each other. Notwithstanding, the intersections between authority and responsibilities can generate tensions between them and their organisations.

4.3.1.2.2 Giving Orders

This action was concerned with the individual situational understanding and the performance of roles in events. The action was specifically employed by leaders and personnel from the command areas and those individuals who served as situational leaders in incident management. According to the policies, the first group of individuals that arrived at incidents should take the role of situational leader because it is expected that the incident will be promptly managed. Similarly, these policies were applied in context, so the role implied starting on managing the incident and reporting to those individuals what happened in the incident. In addition, the situational leader should share information to control the event, specifically by giving directions on how the incident should be managed. However, it would be used in diverse modes in context that can generate tensions, disturbances and

contradictions within and between individuals and their organisations. For example, an operational member of one voluntary group revealed that

> everybody wanted to control (*the incident*). In other words, everyone did not arrive but said: how can I help you? Only they gave orders. They (*safety or security responders in charge*) forgot that we (*safety supporters*) were volunteers. Sometimes, they did not understand or want to remind that we have leaders (*Voluntary group,e19, 15Nov2010,safety supporter,operational*)

In this case, the action of giving orders was limited to determined situations and individuals and between organisations that cannot respect the organisational boundaries. In cases of crossing boundaries, this probably generates tensions between those individuals managing the incidents. Similarly, one way to avoid these tensions might be using the channels of information sharing between leaders so that they can pass the information to their personnel afterwards. However, this may delay incident management.

4.3.1.2.3 Updating

This action was in relation to the individual situational understanding and the role of individuals in context and was principally used for sharing that individual situational understanding demanded. Specifically, the individuals shared information exhibiting the conditions of the current situations which included the routine operations and/or the management of potential or contingent incidents. Information was shared between those individuals at agreed times exhibiting those conditions. Here, the information served essentially to maintain that shared situational understandings demanded by the individuals located, their leaders and the command areas. For this reason, the use of tools facilitated this action. Nevertheless, if that situational understanding was not shared, some gaps of shared situational awareness were opened and the individuals were not able to make proper decisions about offering support to those individuals managing the incidents. This was because the leaders and the command areas cannot be aware of what was happening or what would happen. For example, an operational member of one voluntary group in concerts explained that

> communication is important between safety supporters. An example is when we (*operational members of voluntary groups*) were involved in incidents and discovered that they (*tactical members*) were capable of solving the incidents…; however, we (*operational and tactical members*) should think in the subsequent stages of the incidents. These stages should be notified to C2 (*command area*). We should notify that we are capable to manage incidents and those subsequent stages of the situations…These helped to understand what was in course. Those actors should also think on those stages to offer support. …Nonetheless, some safety supporters did not say anything (*Voluntary group,e20,03Dec2010,safety supporter,operational*)

In this case, the security supporters updated the conditions of the incident and how it was managed. This information provided individual and collective situational understanding to help others in making informed decisions. However, this generated tensions between those individuals involved for not comprehending completely the problematic situations. Consequently, these tensions can impact on that process so that, for example, certain individuals cannot send the support which was implied in those shared situational understanding.

4.3.1.2.4 Complete Reception

This action was associated with receiving information which was clearly understood for creating and maintaining shared situational understanding in context. Here, the individual understanding was the initial stage and the product of the information sharing was a shared situational understanding between at least two individuals. For example, if individuals believed that information leads to gaining a clear situational understanding and can aid to the subsequent activities, as making informed decisions, then they can stop information sharing. This was because the receiver created and maintained that understanding with the provider or vice versa. Furthermore, it was affirmed by an operational member of the security department in baseball matches in city 3 when information was shared properly

> we (*operational members of security supporters*) supported other guards (*tactical and operational members of security supporters*) when they requested our support. Specifically, in those situations which they cannot restrain the public (*Security department,e37, 24Jan2011,security supporter,operational*)

With this information, individuals were able to make informed decisions in order to support others. Nonetheless, tensions can be generated because the organisational boundaries could be crossed. But in this particular case, security supporters understood the situation of other security supporters providing support by managing the crowd.

4.3.1.2.5 Incomplete Reception

This action was in relation to receiving information which was not clearly understood for creating and maintaining a shared situational understanding in context. This meant that information was not clearly provided or understood by individuals acting as providers or receivers respectively. Most of the time, this action was exhibited by the individuals managing potential or contingent incidents. Consequently, additional information was solicited to create that understanding. In this line, certain individuals commented that when information was not clearly transferred or comprehended, this action can generate tensions, disturbances and contradictions between those sharing information. For instance, this process can be reinitialised providing information proactively or soliciting information from individuals included in context. In this line, a security supporter in concerts described an example of incomplete reception of information as follows

> I (*a security responder*) noticed to the supervisor that we (*security supporters*) were in X3 (*code that means an active incident*). We had a problem in the entrance of the venue. There is a guard who had problems with people (*spectators*). I wanted that Mr P. (*leader of guards*) would understand that the guard was transmitting this; but at this moment, Mr P. did not understand. He ordered me to come back to my position. An organiser (*regulator*) asked me if the information was passed to the supervisor. Finally, she went there and interrupted him in order to pay attention to the incident (*Security company,e4,24Oct2010,security supporter,operational*)

It can be inferred that initially the information provided was not received properly so that it was required to be delivered from another source. This action was proactively carried out by providing information because there was a contingent incident required to be managed. This

misunderstanding provoked tensions between those individuals, specifically between a regulator and the leader of the security supporters.

4.3.1.2.6 Information Seeking

This action was employed by individuals to seek additional information that can help to develop a shared situational understanding as a complementary action in which the information was incomplete. In this case, the individuals started to seek information to create and/or maintain that shared understanding in incident management of potential or contingent incidents. For instance, this action can help in gathering additional information associated with specific elements of the situations as where exactly was located the incident, who were managing the incident, how the incident was discovered and by whom. An example of this action was described by an operational member of firemen in concerts

> during incidents, I (*safety responders –firemen-*) should solicit information from the problematic situations. When …I asked them (*to operational safety responders*) about their 10-5 (*it means: what are the actual work conditions?*). If they answered me that was completely 10-5, I understood that they were fine. However, if they answered that were 10-8 (*revising actual work conditions*), I knew that they were in trouble. ...I knew people and distinguished when they were skilful on their jobs. In occasions, they said that were in 10-5, but the tone of their voice told me another thing. I distrust and approached to the problematic area to corroborate if they were not in danger (*Firemen,e46,22Feb2011,safety responder,operational*)

When individuals seek additional information, they tried to be aware of all elements included in the information provided by other individuals. Seeking additional information on the status of the situations can lead to making prompt and immediate decisions. This can also help in supporting the individuals managing the incidents. However, this can lead to tensions between the individuals because, in certain situations, individual situation understanding was not completely shared so that individuals can make ill-advised decisions. From the example presented the leader of the firemen approached to the problematic area to understand it because the information provided was incomplete.

4.3.1.2.7 Controlling Information

This action confirmed the information provided by certain individuals who were or can be involved in the management of potential or contingent incidents. It was also focused on controlling information in the information sharing process, specifically for those individuals who were or can be involved and/between those individuals serving as organisers, leaders and the command areas for creating and maintaining shared situational understanding. For instance, the information was received from multiple sources so that this information was shared with those who can indirectly or indirectly be associated. This engagement was associated with the role of individuals in the risk system so that shared understanding was created and maintained. This action was principally utilised by the organisers, the leaders and the command areas to rule and coordinate those individuals performing their roles in context by passing specific information to them. In this line, a tactical member of the firemen in concerts commented that

> I (*a safety responder)* received, delivered and distributed information to the guys (*other actors*) during the incidents…we tried to know continuously what is happening in the venues and what was happening with the other organisations. This may help on giving priority to problematic situations (*Firemen,e45,21Feb2011,safety responder,tactical*)

Consequently, the individuals involved obtained information that can aid for creating and maintaining that shared understanding demanded. At this level, the information can also help to make informed decisions. However, this action can generate tensions, disturbances and contradictions between individuals and their organisations because information cannot be provided to certain individuals or organisations. This means that this action can be used to exclude individuals or organisations in context.

4.3.1.2.8 Checking Information

This action was utilised to reinforce and/or confirm the shared situational understanding between individuals in context. The action was also used to gather information from diverse sources to corroborate information provided by individuals responding to those incidents so that they can improve the

decision making process. Furthermore, this action was principally taken by organisers, leaders and command and control areas. For example, a member of the commercial police in concerts serving as first responders in incident management emphasised that

> if we (*security responders*) were noticed about unconscious people, we may arrive first...The first responders should evaluate the situation and notice that this was a real incident or not. That was because this may be a trick to gain the attention of the (*police*) officers (*Commercial police,e52,02Mar2011,security responder,operational*)

Obtaining valuable information from first responders can result in an effective response to the incident because it can provide information to make informed decisions. As was mentioned before, it specifically helped to effectively discover if the first impression was an incident or not. However, this action can generate tensions, disturbances and contradictions between the individuals performing their roles. For example, evaluating the situations in incident management and discovering what it was a real incident can be a challenge, as noted in section 4.3.1.2.6.

4.3.1.2.9 Noticing

This action was exploited by individuals for providing additional information of the incident. This action suggested that individuals utilised it to create and maintain a shared situational understanding with individuals from diverse organisations and/or with the public or spectators. Here, the individual situational understanding or awareness included residues of certain policies and regulations that were not commonly known by the public and/or were ignored by certain individuals of other organisations. Consequently, the shared understanding can provide basis to make informed decisions on those individuals. For example, an operational member of the security department in baseball matches in city 3 revealed that

> during a fight between baseball players in field, some spectators jumped the fence and entered the field. The guards (*operational and tactical members of security supporters*) also entered to protect the baseball players. I (*operational member of security supporters*) dialogued with guards and agreed to form a human fence between spectators and baseball players. We notified to spectators that the fight was only between them (*baseball players*). I also added that we would be involved in administrative problems, if they (*spectators*) hit a

> player. After the police (*security responders*) arrived to support us (*Security department,e29,02Jan2011,security supporter,operational*)

This individual notified to spectators the projections of the situation in case of being involved. Inside of these projections, the individuals introduced the policies related to the operation of major events in the baseball matches. Specifically, they used those policies to denote that in case of continuing with the fight with the baseball players in the fields, the stadium can be penalised or being implicated in administrative problems, if the public participate in the fight. According to that regulation, the principal referee of the match is the mediatory so that this individual is the only one that can intervene and penalise that fight. This individual is also the responsible for all what happened on the field during the match. So, this type of situations can cause tensions, disturbances and contradictions between those individuals involved in incidents, including the public or spectators.

4.3.2 Shared Situational Awareness Activity

The shared situational awareness activity was in relation to the creation and maintenance of shared situational understanding but in relation to the role of individuals and the use of abstract and material tools considering time as a dimension in the creation and maintenance of those shared understandings. Here, being aware of what happened, what is happening, what would happen in case of continuing same conditions and what variable can affect the conditions of those situations were the elements of the individual situational understanding or situational awareness from here forward. This awareness was also associated with the shared situational understanding or shared situational awareness from here forward. This means that individual situational awareness was the basis of the shared situational awareness demanded in context, as stated in section 2.3.3.3. Thus, the utilisation of information sharing was associated with that shared situational awareness as a chained activity, as noted in section 4.3. Furthermore, this overlap aided by creating mental models that reflects the reality of situations on a temporal basis. So, individuals should exhibit the completely information

sharing process in context for making informed decisions. The figure 4-8 shows the activity system created to facilitate the analysis of the shared situational awareness activity.

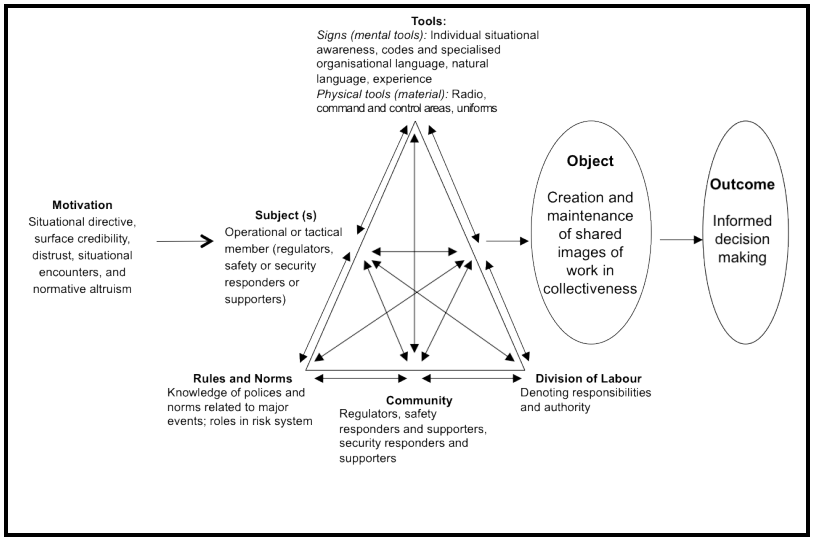

Figure 4-8 The shared situational awareness activity system

In addition, one operation and two actions were uncovered within this activity, as exhibited in figure 4-9. Here, the operation was comprehended through the creation and maintenance of that shared awareness. The actions were understood through the creation and maintenance of that awareness between individuals of the same organisation and/or other organisations, including the public. This was in line with the requirements of the information in context, the motivations of individuals, the rules and norms directing behaviours, the roles of individuals, the use of abstract and material tools and the consideration of time in that process. Consequently, it let to the discovery of two types, presented in the following sections.

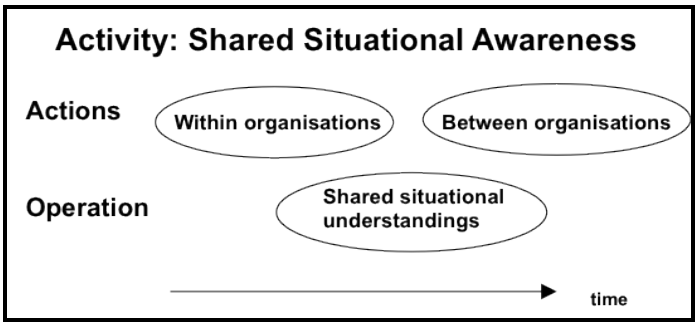

Figure 4-9 Actions and operations within the shared situational awareness activity system

However, it was uncovered that there were differences in shared situational awareness which led to tensions between individuals. This was because the differences resulted from misunderstandings of certain elements of the individual situational awareness shared by individuals in context, as it will be described in the following actions.

4.3.2.1 Within Organisations

This type of awareness concerned by creating and maintaining shared situational awareness between individuals from the same organisations, specifically distributed individual situational awareness with individuals from the same organisation performing roles at operational and/or tactical levels. Consequently, they create and/or maintain shared situational awareness with them. This shared understanding can lead to informed decisions in context, as noted in section 4.3.1. However, differences in the awareness can precede tensions and contradictions between those individuals. For instance, the security coordinator from the baseball team in city 2 said

> I (*a leader of regulators*) like to see baseball, but here I came to work. Guards (*security supporters*) did not pay attention to people's behaviour, nevertheless they solicited certain areas to monitor. They permitted that beer sellers left bottles to the spectators. Bottles may cause danger. After I noticed that, they were angry with me. The important task was to be safe, including guards; but they did not know what may happen if bottles are used as projectiles (*Security coordinator,e21,18Dec2010,regulator,tactical*)

As stated by this member, security supporters were not aware of what was happening around them so that when this security coordinator notified this, tensions were generated. For instance, that was supported by the fact of being angry after he told them that bottles can be used as projectiles. This notification had the objective of being aware of this type of situations because supporters should discover potential incidents to prevent them.

4.3.2.2 Between Organisations

This type of awareness was in relation to shared situational awareness created and maintained by individuals converging from diverse organisations

in context where at least two organisations were linked. These shared understandings were continuously created and maintained utilising information sharing so that individuals can make informed decisions. In this process, the individuals shared their individual situational awareness that included their perceptions, comprehensions, projections and predictions of status from the situations. However, this individual situational awareness had led to tensions and contradictions between those individuals for creating and maintaining shared situational awareness. This can be seen in the use of tools employed in information sharing. For example, a member of the security department from the baseball team in city 3 stated that

> a spectator threw a rocket. I *(tactical member of security supporters)* approached to the guy who used yellow vest *(an operational member of regulators)* to ask for the radio and solicited support from my superior (*manager of the stadium –regulator-*). When they *(manager of stadium and other tactical members of regulators)* arrived, we *(all mentioned)* chatted to know what could happen with this spectator. We made the decision to invite the spectator to leave from the baseball match... That was bothering to ask for radio each time it was required. Most guys *(regulators and safety supporters)* did not want to lend radios and I did not like to borrow them either (*Security department,e24,27Dec2010,security supporter,tactical*)

The use of tools for creating and maintaining shared situational awareness can generate tensions, disturbances and contradictions between them. In this particular case, borrowing communication technology was the source of those tensions between those individuals converging in incident management. This was seen in the fact that some individuals did not want to borrow the radio and other actors did not want to lend it. However, this process had to be done because organisations did not have enough communication technology so the safety supporters knew this and they should lend this technology to other individuals who did not have those tools.

4.4 Summary of Major Event Data

This chapter provided a description of the major events as context in study. Concerts and baseball matches were the major events involved in this study and the fieldwork was done in them. The events had diverse audience

varying from 5,000 to 55,000 spectators. Three cities in Mexico were visited to gather data from two types of events. The organisers, named owners, organisers and/or managers, involved diverse participant organisations whose personnel exhibited different skills and abilities to operate those major events. They also formed a risk system for which the principal goal is to finalise the event with a “white balance” or zero casualties. The organisations were grouped according to their role in this system and to facilitate the analysis of the data gathered from them.

These organisations developed and performed general and specific procedures in the events. General procedures were those tasks done in preparation for the events, during events and after the events. Their aims were to prevent and manage potential and contingent incidents and to evaluate their performance for improving the next tasks in the subsequent major events. Specific procedures were performed similarly in the routine operation and incident management in major events and included the general procedures in concern with the operation of the events. Their aims were to prevent casualties, to reduce impact of incidents on infrastructure and to return to a state of routine operation.

Subsequently, these procedures were translated in terms of activity theory. Seven temporal activities systems described the context of the routine operation and incident management at major events. Similarly, these systems served as a basis to study the information sharing and situational awareness. Tensions and disturbances helped to uncover the principal source of transformations of the activity systems (Engeström, 1987), specifically the activities in study. The information sharing activity was composed of nine actions and three operations, as shown in section 4.3.1. These made available the basis to uncover the motivations for sharing information and the tools mediating and controlling it, presented in chapters 5 and 6 respectively. Moreover, these provided the foundations to unearth that shared situational awareness, as its outcome. created and maintained between individuals from the same organisations and/or from other organisations, as shown in section 4.3.2 and chapter 7. This shared awareness was created and maintained in relation to the conditions of the context and the roles of the individuals involved in this context.

CHAPTER 5
INFORMATION SHARING

The chapter present the motivations for sharing information uncovered in the context of routine operation and incident management at major events. These motivations were discovered by the examination of the actions and operations of information sharing, as stated in section 4.3.1. This chapter also serves to discuss those findings in light of the research question *what motivates information sharing*? Current literature is drawn upon to a position the significance of these findings. For instance, motivations implied strong relationships with existing research studies. Along these lines, the work came across some arguments to display contributions to the area of information science in relation with the incentives for sharing information. It was found that motivations were triggered and directed by interior and exterior bases, denoted respectively by cognitive and social factors. The cognitive factors uncovered the states of individuals' responsibility and the social factors, the organisational boundaries and social impact of individuals' responsibility. Furthermore, motivations were associated with appropriate skills and abilities required to manage potential or contingent incidents. Moreover, the necessity for individuals to provide and receive information such as two-way processes (Talja, 2002) in context was made clear.

This chapter begins with presenting a situational directive as a motivation that is built upon in the requirements for being a situational leader to control and coordinate collective tasks. Thereafter, surface credibility is described as the motivation formed by the perceived credibility created in the inspection of individuals' uniforms. This is followed by normative altruism as the motivation originated for counteracting the tasks from altruistic organisations. The chapter then concludes with a summary.

5.1 Situational Directive

This motivation relates to being the situational leader in incident management. This means that first incident responders were converted to be the situational leaders who should take control of incidents. It was expected that those individuals were engaged in using diverse actions and operations of information sharing to fulfil that role. These helped to control and coordinate efforts of other individuals involved in incident management in context. However, situational leaders came from diverse organisations, and sometimes they were not recognised in those policies that explained that role. The majority of the policies applied at major events come from emergency management at routine life in cities. So, this provoked that they mixed responsibilities and crossed organisational boundaries generating tensions, for example, between individuals and organisations. For instance, a policy stated that while first responders were converted into leaders, once the person in charge arrived, this responsibility should be transferred. For this reason, information sharing was recognised as the way to take control the tasks of first responders, to coordinate efforts of individuals involved and to transfer responsibilities between individuals.

Findings from this motivation helped to uncover additional insights about information sharing expanding the current literature. For example, some actions and operations of information sharing triggered tasks required in incident management in context. These also served to discover that this type of motivation is closely associated with directive sharing as a type of information sharing behaviour (Talja, 2002). This was because individuals shared information with other individuals directing their roles. For example, teachers directed students to achieve goals in terms of knowledge by transferring information to create knowledge in students. This type of behaviour is closely exhibited by situational leaders performing actions and operations in context. That is, first responders employed information sharing as the best way to coordinate and control individuals by creating and maintaining situational knowledge or awareness in other individuals so they can make informed decisions. In a few words, situational leaders changed the situational awareness in other incident responders. Furthermore, the process of information sharing was also uncovered as a two-way process

(Talja, 2002), one that aided reaching goals on being situational leader. In subsequent sections the motivations for sharing information related to being situational leader are presented.

5.1.1 Giving Orders

Leaders should use effectively diverse actions and operations of information sharing to complete two tasks. These should be aligned to manage the current incident bringing additional responsibility to individuals serving as situational leaders. In addition, these should serve to recognise that authority by being capable to coordinate and by giving commands or orders to other individuals. However, in some incidents, individuals in charge delegated their responsibilities and authority to personnel situated at lower hierarchical level. Individuals believed that leaders should have and use superior skills and abilities compared to their supporters. In other words, responsibility and authority were delegated under personnel with fewer skills and abilities required in context, specifically those for sharing information in context. This was perceived as irresponsibility and consequently this situation caused tensions between individuals. For example a member of the firemen in concerts commented that

> anyone who was in the top (*being situational leader*) controlled the incident and ordered everything (*giving orders*) in incident management…It is expected that leaders gave instructions on how the incident should be managed and coordinate efforts of other responders. But, sometimes they failed in the tasks required. Leaders did not control other responders and delegate responsibilities in untrained individuals. Many of these leaders had not learnt to give instructions under pressure (*Firemen,e44,21Feb2011,safety responder,tactical*)

The lack for sharing information was associated with the lack of skills and abilities on managing complex incidents. For this reason, situational leaders should be prepared to align information sharing to change the course of incidents. They should also be capable to control the actions and operations of information sharing, specifically the fundamental action “giving orders or instructions”. In other words, the action implied the recognition of

skills and abilities and authority to control and coordinate tasks of individuals involved in incident management.

Nevertheless, this action generated tensions between individuals who were principally unrecognised as situational leaders for not following defined channels of communication. For example, individuals serving as incident supporters were under the responsibility of responders or regulators. Consequently, they expected that responders or regulators followed those channels within and between participant organisations. This means that supporters expected that information to follow determined ways, precisely between leaders who after they should share with their followers or personnel. This respects the hierarchical levels within and between organisations despite their goals overlapping. In this line a member of a voluntary group (safety supporters) in concerts commented that

> everybody wanted to control (*the incident*). Everyone arrived but they did not say how can I help you? Only they gave orders. They (*safety or security responders in charge*) forgot that we (*safety supporters*) were volunteers. Sometimes, they did not understand or want to remind that we have leaders (*Voluntary group,e19,15Nov2010,safety supporter,operational*)

The tensions were generated because certain individuals did not respect hierarchical levels and organisational boundaries despite the rules of interaction between individuals and participant organisations stated in the risk system. Specifically, tensions were created for not respecting the role which included differences for using the action “giving orders” for information sharing in context, mentioned in section 4.3.1.

5.1.2 Updating

The relationships for sharing information between individuals were focused on situational leaders and first responders. Both leaders and responders had to develop skills and abilities to share information with diverse sources of information including those individuals involved in incident management. Here, the initial sources of situational information were first responders converted in situational leaders until individuals in charge arrive. These

responders should be able to be engaged in information sharing to create a coherent and clear situational understanding about what had happened. This understanding should be created before the individual in charge arrived. A member of a voluntary group in concerts commented in this respect that

> first responders (*safety and security responders or supporters*) should take the control of the incident, but when the person who should be in charge arrived, first responders should give a detailed report to the person in charge of what was going on. This was a good way of passing responsibility to manage the incident (*Voluntary group,e18,15Nov2010,safety supporter,operational*)

However, there was a disagreement precisely on being situational leader because this title implied responsibilities and authority that later it is transferred to the individual in charge. Here, information sharing was the way to discharge that title alleviating tensions between individuals.

The second source of information was the individuals in charge themselves. Being situational leader is stipulated in the policies related to emergency management, as commented in last section. Situational leaders should use the information sharing process and its variations by recognising its actions and operations and organisational boundaries and intrinsic responsibilities of individuals involved in incident management. For this reason, leaders should distribute responsibilities and elements of authority which were continuously included in that situational understanding created. Here, information sharing played an important role in those tasks, as noted by a member of a the Civil Protection Department in concerts

> anyone (*safety or security responder or supporter*) who arrived to the incident should become the (*situational*) leader despite it was not being their final responsibility. For example in a fire, if a policeman (*a security responder*) arrived first, they should be in charge managing the incident until the firemen appeared. Responders should ask for support from other agencies…They had to pass responsibility to others giving all information about what was going on…In another example, in a big fire, Civil Protection Department (*regulators*) may take the responsibility on with coordinating other agencies meanwhile firemen managed the incident (*Civil protection department,e16, 05Nov2010,regulator,operational*)

Although, the policy stated that fires had to be controlled and coordinated by Civil Protection Department, in that case they granted responsibility and authority to firemen conditioned by the incident size and efficient use of resources. They were converted in the incident responders who directly managed the incident and the Civil Protection Department controlled and coordinated other organisations that supported firemen. Specifically, information sharing played a central function for understanding what was happening continuously (updating) and for changing roles during the incident.

5.1.3 Controlling Information

During incident management, first responders should take control of incidents implying that individuals should share all available information from the incident and their situational assessments to command and control areas. Besides, they should pass a detailed report to those individuals who should be in charge. The information should include what happened, relevant information from the incident and their assessments. Here, actions and operations and the two-way process of information sharing were exhibited according to the type of incident and the individuals involved. However, the responders did not act as policies stated. Some individuals did not take responsibility by sharing situational information and/or they took this responsibility transferring partial situational information. That is, certain individuals did not share information but they approached to the problematic area and managed the incident. Contrary, other individuals took partially this responsibility and shared partial situational information. However, this lack of information sharing provoked gaps. These gaps served to infer that there was a lack of situational leadership which as a consequence was the unsatisfactory result. In this line a member of the Civil Protection Department in concerts commented

> the first team (*of safety supporters*) arrived, but they did not control the incident and the disorder began. They did not ask for support and resources to manage the incident and consequently they did not share enough data…The next team came that was firemen (*safety responders*). They instead of controlling the incident, they started on managing the incident, but they did not share anything of the incident.

> The second team was converted into the first responders and started to control the incident. Time was passing from the first team to the second one (*Civil protection department,e7,26Oct2010,regulator, tactical*)

This lack of information sharing led to “a disorder” in incident management. This was because first responders taking the role of situational leaders did not take the control of the incident which implied to share information with personnel of command and control areas. In other words, situational leaders controlled the information. In addition, this lack of information sharing is also associated with the normative altruism as motivation for sharing information, which will be presented in section 5.3.

5.1.4 Noticing

According to procedures for managing incidents, first responders utilised information sharing to control incidents. These included the alignment of procedures to incidents so that they can respond properly to them. Initially, they should classify incidents according to their origin as safety or/and security incidents. However, first responders did not follow those procedures generating tensions between responders and individuals in charge. Principally, they did not agree the procedure because they understood the situation in one way and applied a procedure trying to match it with the incident. In addition, they were usually not shared information with the individual in charge once he/she arrived about the procedure. This situation provoked tensions between them when the individual in charge did not approve the procedure and information sharing was triggered to change it. For instance a member of the firemen in concerts explained that

> once we (*safety responders*) arrived (*to the incident*) and saw that they (*safety supporters*) were doing a job (*performing a procedure on nursing*) which was not right, but I (*captain of safety responders*) wanted to get their attention to complain them. They refused the complaint and affirmed that they were doing the correct procedure. I noticed this to their leader (*Firemen,e48,24Feb2011,safety responder,tactical*)

The tensions were generated by the disagreement in the procedures for managing the incidents and by not following accorded channels of communication between individuals and their organisations. The changes in rules of interaction and unrecognising hierarchical levels were examples as sources of tensions between individuals. Although, information sharing was employed to add information in situational awareness, it was not used effectively. The change of procedures was a complicate task that was alleviated by the proper use of information sharing.

5.1.5 Discussion of Findings on Situational Directive

This discussion draws upon on the literature review presented in chapter 2. It begins by presenting the goal of information sharing, described as:

> to provide information to others, either proactively or upon request, such that the information has an impact on another person's (or persons') image of the world, i.e., it changes the person's image of the world, and creates a shared, or mutually compatible working, understanding of the world (Berger and Luckmann, 1967) cited on Sonnenwald (2006, p.1).

In addition, information sharing and information practice are used interchangeably and both have implied habitual behaviour (Wilson, 2009). Findings confirmed that motivations for information sharing were strongly linked to leadership. Moreover, some characteristics of the directive sharing, type of information sharing proposed by Talja (2002), were discovered in this research. This implied the discovery of motivations for sharing information, what outcomes were expected by sharing information and what tasks were required to achieve those outcomes. This also involved the contextualisation of goals, purposes and tasks for sharing information which are described and discussed below.

In order to continue with the exposition, the discussion of the name and the conceptual framework used in both investigations are presented. Initially this motivation was named situational directive because information sharing was triggered by situational leadership foundations in context. Information sharing was directed to control and coordinate other individuals involved in

the management of potential or active incidents. As stated by Talja (2002) concerning directive sharing, this type of information sharing implied tasks of teachers in directing the process of knowledge acquisition of students in academic contexts. The information sharing process included the engagement of teachers and students in two-way processes. On the other hand, in this research was found that first responders and individuals in charge were similarly engaged in information sharing as a two-way process. This was directed to create situational awareness in individuals involved in context. In other words, those individuals serving as situational leaders, first responders and in charge exhibited the two-way process of information sharing for creating situational awareness in others, specifically those managing the incidents.

Additionally, the findings uncovered that the conceptual framework used in the research done by Talja (2002) and this study are dissimilar. The former developed a framework to describe information sharing practices in connection with the context of document retrieval in diverse academic communities (Talja, 2002). Consequently, some characteristics of directive sharing were uncovered in terms of leadership including its purpose, goals and principal tasks required by directive sharing. Contrarily, this research used activity theory as a conceptual framework, stated in section 3.2. This framework helped for uncovering the purpose, goals and principal tasks of the information sharing process. This frame also aided in gaining additional insights with reference to the goals for sharing information and to conditions for how information sharing was exhibited in context. For instance, this framework assisted in discovering three operations and nine actions, as stated in section 4.3.1.

5.1.5.1 Purpose and Goals

The study of Talja (2002) and this study revealed the same purpose and goals for sharing information. These were to control and coordinate effectively individuals under their responsibility. On the one hand, teachers controlled and coordinated the knowledge acquisition of students under their responsibility in the academic context. On the other hand, first responders or

individuals in charge controlled and coordinated the situational awareness of incident individuals under their responsibility in context. Here, these leaders focused their efforts to indicate the responsibilities of incident individuals within the organisational boundaries. However, the former research only evidenced positive outcomes. Contrarily, this study presented findings suggesting that responsibility was a challenge because it generated tensions between individuals involved in context. For example, not taking responsibility for being a situational leader led to a disorder in incident management. That was "*they (a team of safety supporters) did not take the control of the incident and the disorder began* (*Civil protection department,e7,26Oct2010,regulator,tactical*)". For this reason, it was suggested that more research would unearth to what extent individuals are disposed to share information and who could be engaged and with whom in routine operation and incident management at major events.

5.1.5.2 Modes of Information Sharing

Findings on how teachers and students and first responders and situational shared information are consistent. This suggested that a two-way process was required to control and coordinate individuals with responsibility (Talja, 2002). However, it was argued that within this process there would be differences in the way in which information sharing was exhibited. This was stated that within the academic context modes of information sharing were not presented; contrarily, this research partially focused on modes of information sharing. This involved that previous research was done in a static context, whereas this research was done in a time constrained, uncertain and complex context. Furthermore, both contexts exhibited different conditions in relation to frequency of information sharing. The relation between teachers and students is considered as a continuous interaction; contrarily, incident individuals interacted only occasionally.

Moreover, it was argued that modes in information sharing shaped this process. This was supported by the discovery of tensions in context. An example is the tension generated on the basis of modes for sharing information; this was when an individual commented that "*they (safety or*

security responders in charge) forgot that we (safety supporters) are volunteers (Voluntary group,e17,15Nov2010,operational)". This was not considered as a manner for sharing information (Hassan Ibrahim and Allen, 2012) because leaders were not considered the awareness of individuals. Leaders forgot that volunteers expanded the capacity of organisations (Dynes, 1994).

Furthermore, it was also argued that individuals in charge were not capable to mediate with other type of organisations (Rietjens et al., 2009) in consideration that "better leaders were better communicators" (Cooper, O'Carroll, Jenkin and Badger 2007, p.632). As a consequence, information was not effectively delivered despite the aim of information sharing implied the change of situational awareness on others (Wilson et al., 2007). Nonetheless, findings in this study uncovered that modes or manners for sharing information were dimension that could be considered and studied. What types of modes exist for sharing information and how these modes influence the process of information sharing are potential questions that could be researched in the same context treated in this thesis.

Overall, information sharing was uncovered in leadership foundations, foundations that see information sharing as an essential command skill (Crichton et al., 2005). This motivation was also in connection with a type of information sharing presented by Talja (2002). This was directive sharing implying a two-way process. This process aided in uncovering relationships between purpose, goal and techniques used for sharing information in the context treated in this research. These can be summarised by stating that information sharing should be institutionalised (Castellano and Plionis, 2006; Waugh and Streib, 2006); lack of information sharing may lead to disorder (Weick, 1993; Weick, 1996); "giving orders" may cause tensions (Castellano and Plionis, 2006); information sharing should lead to better situational understandings (Zboralski, 2009); respecting rules and norms of interaction may lead to tensions (Castellano and Plionis, 2006) and respecting organisational boundaries should bring better shared situational meanings (Bharosa et al., 2010). Consequently, evidence showed that purposes, goals and techniques used for being situational leaders or

individuals in charge are likely to motivate information sharing in routine operation and incident management at major events.

5.2 Surface Credibility

This motivation is associated with trust, but not with that trust created as a consequence of continuous interaction between individuals over time. This is on the basis of the credibility of organisations and meanings placed on their uniforms. This was observed by individuals who wore uniforms with diverse colour, textures and marks. These were in reference to the organisational role in context. In other words, people trusted the clothes that were associated with organisations and their goals and representatives. So, this motivation was generated by individuals who trusted in others “based on the simple inspection” (Tseng and Fogg, 1999, p.42) of their uniforms. Individuals swiftly trusted other individuals only for the fact of wearing uniforms; uniforms which were associated with the achievement of organisational goals in safety and security issues.

Findings under this motivation suggested that uniforms were important signs within organisations. Uniforms served to distinguish individuals in context. Furthermore, according to Šterman (2011), uniforms were considered as a sign utilised by organisations to “indicate membership of a group in a social environment” (p.9). This facilitated the social interactions between individuals. Additionally, individuals wearing uniforms showed their roles associated with their parental organisations in context and individuals were seen an authority in their field. In other words, the individuals used uniforms to differentiate themselves. For this reason, the findings uncovered a relatively unexplored motivation for sharing information considered a contribution in the area of information science.

5.2.1 Ask For Support

Interactions between individuals were considered challenging tasks and certain individuals proposed that uses of uniforms can decrease those challenges. Uniforms aided in triggering information sharing between

individuals in context. In other words, this source of motivation was a representation of availability of information providers and receivers in context. Besides, this was perceived as giving relevance to the fact that individuals were spread around venues and were wearing uniforms making it easy to detect them. Indeed, some individuals were doing patrols meanwhile others were co-located. Consequently, the interactions increased between individuals over time and they gave the opportunity to increase the number of individuals connected.

However, uniforms similarly served to separate individuals and their organisations. This was because individuals developed scales of credibility based on uniforms giving relevance to some above others, see section 4.2 for additional information related to participant organisations. For instance, security responders (*policemen*) and supporters (*guards*) preferred the voluntary groups (*safety supporters*) above firemen (*safety responders*). Consequently, this preference was uncovered in information sharing practices. Security responders and supporters preferred to share information with safety supporters above safety responders. A member of a voluntary group in concerts stated that

> they (*security responders and/or supporters*) were walking and we (*safety responders*) can easily detect them. This is because they used the t-shirt or something distinctive (*the uniform*). They called us if something happened or they did not find the Red Cross members (*safety supporters*)…during the incidents, they shared the location of the incident and how we can arrive fast. They preferred to share information to the Red Cross (*Voluntary group,e40, 08Feb2011,safety supporter,tactical*)

Uniforms were also given the opportunity to increase the number of potential information providers and receivers. Similarly, they exposed the reactive information sharing process required to understand what happened. Moreover, the process was utilised to solicit support for creating shared situational awareness and for exhibiting organisational preferences.

5.2.2 Giving Orders

Individuals were identified by their uniforms and it was expected that they achieved determined organisational goals creating credibility for them. For

this reason, some of them are proud of using uniforms reducing the challenges implied by taking their roles and by sharing information. This was observed when individuals shared information related to what was going in situations over time changing the situational awareness in others. For instance, the continuous interaction between individuals helped the process of information sharing and its modes were also used to change the course of incidents. For example, a member of the security company in concerts stated that in a major event, the earth

> began to tremble...A spectator said that the building would fall down and ran. He tried to go out, but I (*a security supporter*) shouted him: ...you need to stop there! Do not open the door! Do not open it, be calm! You are scaring people!...He turned and saw me (*for wearing the uniform*) and asked me why I was calm…we (*security supporters*) learned to be calm in stressful situations… we should be involved in these kinds of situations and learn how respond to them (*Security company,e3,23Oct2010,operational*)

Potential incidents implied complex tasks for reducing uncertainty to manage them. For this reason, individuals should exhibit mastery in using adequate actions and operations of information sharing and manners in which to employ them in context. For instance, "giving orders" was an action to transfer information to control individuals' actions, specifically to manage potential incidents involving the spectators. Nonetheless, the interaction generated tensions between the spectators and the security supporters. Tensions were reduced by the performance of proud individuals wearing uniforms generating credibility in context.

5.2.3 Controlling Information

Wearing uniform helped to identify individuals and their organisations. Individuals reactively employed information sharing in context sharing information with those individuals considered capable for managing incidents. In other words, skills and abilities included in uniforms helped to separate individuals delimiting their responsibilities for emphasising the organisational boundaries between organisations. Consequently, uniforms assisted in discovering those individuals with specialised skills and abilities required in context. For example, if there were casualties in incidents, safety

supporters should care of them. Nonetheless, some individuals were in the middle of the information flow within the risk system and they proactively responded approaching to the incidents. Individuals understood that their support was required and intended positively to manage incidents. The facilitation of this interaction was attributed to the use of uniform promoting information sharing. A member of firemen in concerts commented that

> when I (*a safety responder*) was in front of a police officer (*security responder*) and if I wore the uniform, any officer can tell me “come in” because there is a problem. Moreover, if we have collaborated with them, we (*safety responders*) can enter to any area. This is the way in how we fulfilled to work together and share information in incidents. Contrary, some organisers (*regulators*) and guards restricted the entrance of some areas consequently the response to an incident was slow. For example, sometimes if the policemen (*security responders*) tried to move a casualty, people (*spectators*) did not permit; contrary, if they (*spectators*) saw us (*safety responders or supporters*), they gave full access. Women, children and men may not permit that policemen moved casualties. Consequently, policemen waited until we entered to nurse despite they were notified of the incident. Or, sometimes we did not mention the incidents to policemen (*Firemen,e44,21Feb2011,safety responder,tactical*)

However, there were situations in which it was preferable to stop information sharing with/between certain individuals. For example, some individuals were sources of tensions with spectators and themselves. Incident management was a complex task that involved diverse individuals, but, in specific incidents, it was preferable to avoid the interaction between the security responders (policemen) and the spectators. As uniforms facilitated the discovery of individuals within the crowd, information sharing was employed to involve other organisations and security responders were avoided.

Contrarily, in other situations, certain individuals were excluded from interactions and information sharing. For example, this was seen when regulators impeded the entrance of safety responders to some areas within the venues conditioning their involvement only to incident management. This means that safety responders can be involved in incident management if regulators believed that they can manage the incident; otherwise, regulators excluded them. Information was not provided to them as individuals

expected. For this reason, safety responders recognised the relevance of uniform as signs for facilitating or inhibiting information sharing. A member of firemen in concerts stated that

> sometimes organisers (*regulators*) were afraid of us (*safety responders*) and refused the entrance to certain areas of venues despite we arrived early and were introduced to them. As a consequence, our response to incidents was slow. Information arrived delayed about the incident despite us were visible (*for wearing uniforms*)… We expected that for wearing uniforms they should facilitate our work and interactions with others (*responders and supporters*) (*Firemen,e48,23Feb2011,security responder,operational*)

Individuals expected to be involved in routine operation and incident management covering all areas of venues. Nonetheless, they were excluded from certain areas. A consequence was the ineffective information sharing delaying the information required to make informed decisions in context. These situations generated tensions between individuals because safety responders and supporters wanted to be in the centre of information flow; but, they were only conditioned to react to contingent incidents.

5.2.4 Noticing

It was found that interactions increased in relation to the connections generated by wearing uniforms. Individuals detected other individuals and trusted them. For this reason, when individuals were immersed in incident management, they shared information in relation to their roles exhibited by uniforms. Individuals usually supported tasks between them in a reciprocal form. However, in certain situations, tensions were produced for crossing organisational boundaries, but these were not completely evident. In these situations, actions and operations of information sharing were changed and used to understand what happened in incidents to delimit responsibilities.

However, this understanding implied recognition of possibilities for creating other tensions. Consequently, this recognition also provoked tensions and, in order to deal with them, individuals managed their sources. Being near of individuals categorised as potential source of tensions was

one way to manage them. For example, individuals can regularly choose to follow the accorded channels of communication for sharing information avoiding tensions with other individuals, or changed the actions and shared information with the potential source of tensions. In this line, a member of the security company in concerts affirmed that

> during incidents, we (*security supporters*) had to report to them (*regulators or leader of security supporters*) to receive support from policemen, or we can directly approach to them if they were visible (*for wearing uniforms*). Sometimes, we cannot directly notify to the policemen because, if something is wrong, we can be complained by our authority…However, we decided to directly notify to policemen in cases that we cannot solve the problems… after we should notify to our command area…the uniform helped on giving identity (*Security company,e14,01Nov2010,security supporter,operational*)

Following the scripts or not is a source of tensions between individuals in context. Following the scripts implied that individuals should notify the incidents to regulators to receive support from them but incident response could be delayed. Contrarily, if individuals directly notified and asked for support from visible individuals, incident response could be fast. Here, information sharing was employed to create shared situational awareness in others reducing the potential tensions between individuals and soliciting support from them.

5.2.5 Discussion of Findings on Surface Credibility

The source of credibility is trust in uniforms. In current research, as shown in chapter 2, it was found that trust has been investigated as a relevant factor on organisational settings and group work performance (Dirks and Ferrin, 2001; Dirks, 1999), as a motivation in information sharing to increase building response capacity (Pardo et al., 2006), as a mediator and an influence on information sharing on ties (Lin, 2007b) and as perceptions in the psychological contract between individuals and companies (Sharkie, 2005). Additionally, it was found that trust puts its basis in cognitive foundations and is visualised as social perception.

However, in order to create trust, it was also found that individuals should be in direct contact over large periods of time (Allen and Wilson,

2003; Chen et al., 2008b; Dirks and Ferrin, 2001; Dirks and Ferrin, 2002; Ellonen et al., 2008; Hertzum et al., 2002; Lin, 2007b). For this reason, trust is considered a social perception of credibility. Moreover, it was found that swift trust is a nested type of trust exhibited by individuals in temporary organisations (Meyerson et al., 1996; Robert et al., 2009; Hassan Ibrahim and Allen, 2012). These organisations were tied to achieve specific goals but once the goals were reached, these were untied. Usually this type of organisation should be organised under the rules and norms of "knotworking" (Engestrom, 2008). From there, it was argued that swift trust was employed to glue individuals for achieving goals in context. Consequently, additional research should be done in order to explore the following questions: how knotworking work before, during and after major events; how organisations are assembled in the risk system and in what conditions organisation are "tied" and "untied".

5.2.5.1 Social Awareness

A relevant element in tying organisations is swift trust as social perception. This was also found at inferior levels of trust developed over time or in the initial states of trust not requiring time to develop it (Tatham and Kovács, 2010; McKnight et al., 1998; Meyerson et al., 1996). For instance, a source in that initial state of trust was the creation of credibility by simple inspection (Tseng and Fogg, 1999), that was placed in uniforms. According to Loveday et al. (2007), uniforms are a relevant part in the social perception of individuals. Perceptions were constructions from a large range of social and cultural images of those individuals wearing uniforms. Consequently, these perceptions led to forming particular views of individuals in terms of professionalism achieving goals. In other words, uniforms were associated with positive or negative perceptions leading to swift trust in individuals. Using these statements as background, additional questions arose in reference to how the public and individuals involved in context perceive the individuals wearing uniforms; to what extent these individuals are perceived compared to those individuals without uniforms, and in what (positive or negative) direction are those perceptions.

In addition, few studies were focused on swift trust motivating information sharing within time constrained, uncertain and complex contexts (Hassan Ibrahim and Allen, 2012). They argued specifically that information sharing played an important role for rebuilding swiftly trust to manage incidents. They also proposed a counterintuitive connection between information sharing and trust for reinforcing the argument that exhibited the necessity of swift trust to reinstate trust required in incident management. For these reasons, it is argued that trust collocated in uniforms has a strong relationship for motivating information sharing in context.

5.2.5.2 Comparable Appearance

The uniform served to give similar appearance to those individuals who were engaged in common practices and to be distinguished them from heterogeneous groups of citizens (Pfanner, 2004; Ferrell III, 2003). That is individuals created unified meanings with the use of uniforms (Sonnenwald, 2006). For instance, if "*they (security responders and/or supporters) were walking...we (safety responders) can detect fast. This is because they used the t-shirt or something distinctive (the uniform) (Voluntary group,e40,08Feb2011,safety supporter,tactical)*". For instance, individuals were discovered based on the association attributed to the professionalism and trustworthiness placed on their uniforms (Loveday et al., 2007). Consequently, this can enhance information sharing between individuals, but additional research is proposed to study to what extent individuals are disposed to share information and to whom and what elements are implied in professionalism and trustworthiness including wearing uniforms in context.

5.2.5.3 Influencing Attitudes

The uniform may influence attitudes of individuals within social interactions in context and these may be negative or positive (Bell, 1982). As suggested by Loveday et al. (2007), the images are derived from social and cultural aspects that implied experiences and perceptions with individuals wearing uniforms. Relevant aspects on these resulted in positive attitudes facilitating social interactions so that *"we can directly approach to them if they were*

visible (for wearing uniforms) (Security company,e14,01Nov2010,security supporter, operational)". These attitudes can facilitate information sharing between individuals. Contrarily, if individuals had negative experiences and perceptions of those individuals wearing uniforms (Bell, 1982), information sharing can be limited or inhibited. One reason could be located in determined situations in which uniforms were also related to authoritarian behaviours (Bell, 1982). For instance, "*if the policemen (security responders) tried to move the casualty, people (spectators) did not permit; contrary, if they (spectators) saw us (safety responders or supporters), they gave full access (Firemen,e44,21Feb2011,safety responder,tactical)".* Consequently credibility on uniforms can help or not the perceptions of individuals in context. As commented before, the public knew what type of service was expected so that uniforms served to infer the type of organisation which can provide the service (Šterman, 2011). In other words, spectators believed that security responders cannot manage the incident, thus they expected that safety responders or supporters approached to the incident and managed it.

Nonetheless, according to organisational documentation and handbooks on training, security responders received training for managing contingent incidents in safety areas. For this reason, further research can be necessary to discover to what extent the public are informed about the goals of individuals and their organisations displayed in the events, and what kind of training individuals received for managing contingent incidents. This would lead to an understanding of individuals' goals to facilitate the interactions between them and the public. Additional information is presented in section 7.3 related to knotted situational awareness.

5.2.5.4 Delimiting Power and Authority

Researchers are studied the differences of power and authority placed in uniforms (Šterman, 2011; Bickman, 1974); the social perception of the uniforms of health care providers (Loveday et al., 2007), and the effects of uniform on employee performance (Nelson and Bowen, 2000) and student performance (Brunsma and Rockquemore, 1998). In addition, it was found that uniforms of safety individuals played an important part in public

perception (Loveday et al., 2007). Moreover, other individuals have legitimised the power conferred by wearing uniforms (Bickman, 1974). This is “you trust the authority” (Bickman, 1974, p.58), related to expected levels of performance. However, tensions were generated consequently of these expectancies about performance. For example, when “*we (safety responders) expected that for wearing uniforms they should facilitate our work and interactions with others (responders and supporters) (Firemen,e48,23Feb2011,security responder, operational)*” was interpreted that firemen can access all areas in venues and facilitate the interactions between individuals, facilitating information sharing.

Nonetheless, before and during incidents, for the fact of wearing uniforms, firemen were detected and kept outside from some areas. This delayed information in potential or contingent incidents. Consequently, situational awareness was primarily created in contingent incidents exhibiting reactive behaviours in incident management. This suggested that additional investigation should be focused on to discover what extent individuals are encouraged to facilitate the work of those individuals wearing uniforms; what characteristics should be implied in the interactions individuals wearing uniforms, and what are the consequences in terms of efficiency and effectiveness for delaying information to those individuals wearing uniforms.

5.2.5.5 Identification of Individuals

Uniforms enabled the identification of individuals and their area of expertise and facilitated information sharing in context. According to Loveday et al. (2007) and Shaw and Timmons (2010), uniforms influenced the individual image and the professional identity of individuals wearing uniforms and increased their pride. In other words, a type of professional identity is being placed by wearing uniform so that it influenced the performance of individuals. This provoked positive messages in other individuals who interacted with them (Shaw and Timmons, 2010). For instance, in a potential incident, an individual wearing uniform employed information sharing to prevent it by telling “*you need to stop there. Do not open the door. Do not*

open it, be calm. You are scaring people (Security company,e3,23Oct2010, operational)". In this case, the individual was confident in employing information sharing to prevent that incident and this confidence was perceived by the information receiver. This was the case in which the role of that individual created swift trust in context (Hertzum et al., 2002). Although, this caused tensions between individuals, the task of preventing casualties was achieved. In other words, the interaction was challenging but positive outcomes resulted. For this reason, the use of the operation "*giving orders*" should be mastered to facilitate information sharing; specifically when the receiver observed the provider "(*for wearing the uniform*) *and asked (Security company,e3,23Oct2010,operational)"* about the situation creating shared situational awareness. Nonetheless, some questions arose to understand to what extent individuals are proud of using uniforms; what effective mediators are employed to increase interactions between those individuals proud of wearing uniforms and to what are the differences in terms of information sharing engagement between individuals being proud of wearing uniforms and those not being proud.

In conclusion, uniforms are signs that organisations used to create unified meanings in context (Sonnenwald, 2006). These indicated membership in social arrangements (Šterman, 2011) which helped in changing behaviour of individuals, specifically motivating information sharing. This activity was reinforced using a counterargument that uniform influenced behaviours of individuals (Bell, 1982). This was done by creating surface credibility (Tseng and Fogg, 1999) and generating swift trust which motivated information sharing. That is, individuals shared information with other individuals wearing uniforms. Besides, uniforms helped to distinguish individuals (Pfanner, 2004) as information sources (Hertzum et al., 2002). From the evidence and this discussion, surface credibility in uniforms is considered a source of motivation for sharing information, so that this finding represents a contribution to the current literature in the area of information science. Therefore, surface credibility is likely to motivate information sharing during routine operation and incident management at major events.

5.3 Normative Altruism

The section presents a counterintuitive position on altruism as a motivation for information sharing. This motivation was discovered in the foundations of ethical altruism exhibited by leaders of safety responders and regulators and command and control areas employed to control and coordinate voluntary groups or altruistic organisations (i.e. safety supporters). These leaders comprehended the relevance of tasks done by altruistic organisations in context. However, they expected that altruistic organisations were responsible in terms of sharing proactively information. This was because altruistic organisations were focused on the well-being of the casualties but abandoned information sharing. Consequently, leaders started to share proactively information with those individuals to obtain at least minimal information of the incident. In other words, leaders counteracted generating tensions with altruistic individuals.

Findings suggest that altruistic organisations changed the course of information sharing process. That is, altruistic organisations were engaged in sharing information upon request and not proactively as was expected by leaders. Consequently, they cannot control and coordinate altruistic organisations. They expected that those organisations should be engaged in information sharing because “sharing at least some information is obligatory to become part of the community” (Parrish, 2010, p.189). Richardson and Asthana (2005) argued that information sharing is related to ethical issues influencing behaviours in those individuals who interact with the policy and legal issues. For this reason, these organisations should follow policies which stated that they would be controlled and coordinated by governments through their departments, in this case by firemen (safety responders), organisers of events (regulators) and command and control areas. Although, these individuals pursued the increase of wellbeing of others (Hars and Ou, 2002), they left information sharing. That is, altruism has social impact on individuals as result of real actions of others (Latane, 1981), but not as expected. In other words, altruistic individuals should be proactively engaged in information sharing to change the course of incident management in context.

5.3.1 Updating

There is a challenge to control and coordinate efforts of diverse organisations that converged in context. Each organisation arrived with their goals in mind contributing to an overarching goal. Interactions between individuals enclosed a variety of behaviours and socio-cultural factors manifested during those interactions. For example, individuals' behaviours from each organisation can be differentiated by the forms of how information sharing was employed and what individuals were included in it. For this reason, leaders expected that during incident management interactions can facilitate information sharing. However, the majority of safety supporters were focused on achieving their goals and left outside information sharing. Nursing and caring casualties were put priority and other conducts were forgotten or minimised as information sharing causing tensions with leaders. A member of a voluntary group in concerts said that

> there was a lot of friction because we (*safety supporters*) should inform to C2 (*command area*) that we were approaching to the incident…For example, they (*safety responders or supporters*) arrived and another team (*of safety supporters*) was there that nobody authorised…They (*C2*) suggest that teams (*safety supporters*) should ask if they can approach to the incident for being near to the incident and for security and safety reasons…If we report that we are near, we receive the instruction to approach, and should inform what happened…They (C2) may not move another team, if we were available…it was to avoid unnecessary movement of teams (*Voluntary group red cross,e41,09Feb2011,safety supporter,tactical*)

The lack of information sharing was the cause of these tensions because leaders expected information from altruistic individuals. Similarly, they stated that information sharing enclosed ethical issues because altruistic individuals received information, but not provided pertinent information that can aid for controlling and coordinating them. This permitted to create and maintain low levels of shared situational awareness in context.

5.3.2 Information Seeking

Challenges in terms of information sharing were uncovered concerning how to control and coordinate organisations with different goals. Sharing minimal

information from incidents was expected to understand what happened and what was going in context. For this reason, certain individuals were at the centre of the information flow to approach directly to the incident areas without notifying that positional change. This movement put at a disadvantage those organisations that control and coordinate them. Consequently, this lack of information sharing caused tensions between individuals. For instance, the safety supporters did usually not share pertinent information with leaders increasing uncertainty in context. For this reason, leaders were not capable to infer if those individuals required support. They knew that information contained security and safety information that should be included in the shared situational awareness created and maintained. In this line, a member of the Civil Protection Department in concerts commented that

> "fever of services" is doing medical provision without control but not saying what they (*safety supporters*) are doing in any place they were. If they were near to the incident and listened to C2 (*command and control area*) that there was an incident, they should report that they were near and ask if they can approach to the incident. Surely, they (*personnel from command and control areas*) will give the authorisation to approach...but, they should notify the course of their actions managing the incidents…We (*regulators*) had another available resource with them…but they (*safety supporters*) wanted to be recognised as heroes and did not report anything (*Civil protection department,e6,26Oct2010,regulator,tactical*)

Safety supporters were focused on ensuring the wellbeing of casualties, but they were not completely convinced on sharing information with leaders. Nonetheless, leaders wanted to coordinate and control those individuals for managing efficiently and effectively the incidents. For this reason, information was shared proactively so that leaders can create shared situational awareness in those individuals over time.

5.3.3 Controlling Information

Diverse organisations were tied in incident management to achieve a holistic goal, but certain organisations preferred to achieve their goals above that goal. For this reason, it was usual that the context in study served as arena

to prove encouragement for reaching individuals' goals. However, leaders utilised information sharing to emphasise the necessity to achieve the overarching goal. This implied to control and coordinate individuals and to remember the roles and responsibilities of organisations generating tensions between them. But sometimes, information sharing was not performed in the way expected by leaders, specifically when individuals were activated (give orders to manage the incident), directly or indirectly approaching to those incidents. However, there were incidents in which two organisations approached to them. In those incidents, only one organisation was activated and tensions emerged between both organisations. There, information sharing was left out and ineffective coordination was manifested because individuals forgot the goals. They were principally focused on managing the incident. For instance, a member of a voluntary group in concerts noted that

> two voluntary groups (*safety supporters*) arrived at the same time. One team cared from the waist up and the second, from the waist down. We (*safety supporters*) did not discuss about the casualty and which team should nurse and transport the casualty to a safe area. We wanted to care her but we did not trust each other. I (*a safety supporter*) recognise that we had problems with other agencies… we did not understand what really happened. A life was in our hands and we forgot our goal, "save lives"….This is happening now, but with lower intensity…For example, in the incidents, we chatted and agreed who should manage the incident and who should transport the casualties (*Voluntary group red cross,e43,11Feb2011,safety supporter,operational*)

Safety supporters left outside information sharing to counteract other safety supporters in context. These supporters gave priority to the well being of casualties, but they forgot the organisational goals at specific and holistic levels. This was seen when individuals controlled the information exhibiting distrust between them. In other words, they controlled information sharing for controlling the shared situational awareness of individuals managing the incidents.

5.3.4 Checking Information

Information sharing as stated in previous sections was demanded to control and coordinate individuals in context. For this reason, the leaders involved

all available individuals when a contingent incident was in course. They tried to avoid duplication of individuals and organisations managing incidents. A form to do it is locating individuals and their organisations in determined areas to respond properly. Here, leaders can include or not certain individuals to manage the incidents. Nonetheless, the majority of safety supporters were at the middle of the information flow so that leaders expected that those individuals shared minimal information about their availability. This was with the goal to activate the individuals near to the incidents. However, they approached without the pertinent authorisation exhibiting the lack of understanding for managing effectively and efficiently the incidents. In this line, a member of one voluntary group in concerts commented

> if one team of Red Cross (*safety supporters*) was dispatched, the C2 (*personnel from the command area*) should not dispatch another team of firemen (*safety responder*) to the same place. If we (*safety supporters*) coordinated efforts with them (*safety responders or other safety supporters*), we can manage more incidents and avoid duplicity in the services…we notified this to rescue groups (*safety supporters*) and they agreed this form of coordination. Every team should notify when they were available and C2 should authorise the approaching to incidents. Teams should also inform what is going on in the incidents… that is because teams would require support and should notify this to receive adequate assistance (*Voluntary group red cross,e42,1Feb2011,safety supporter, operational*)

Leaders expected that safety supporters shared information related to their availability once they arrived at the major events. In addition, leaders said that individuals should notify their situational assessments from the incidents once they arrived. This was with the object of checking what was going on. Consequently, other individuals can be activated to support by creating shared situational awareness with/between them.

5.3.5 Noticing

Leaders utilised information sharing to control and coordinate participant organisations. For this reason, they agreed to minimise the lack of information sharing with/between safety supporters (voluntary groups). They believed that if they can control and coordinate those individuals, they could

manage effectively and efficiently the incidents. Consequently, they used the authority and responsibility conferred in their roles to make demands in terms of information sharing. In this line a member of firemen in concerts claimed that

> the voluntary groups (*safety supporters*) that came to manage incidents have the obligation to help us (*safety responders*). This is a condition to belong the voluntary groups of the city. We gave the opportunity to work in incident management when this was required…they should help with sharing what is going on in incident management and being available when was demanded by us (*Firemen,e47,23Feb2011,safety responder,operational*)

Consequently, information sharing was converted as a normative behaviour in context. In other words, this means that information practices were converted as a desirable behaviour obligating safety supporters to share information. Leaders remembered to the safety responders the importance for sharing information and their responsibilities. However, this reminder generated tensions between them. For instance, information sharing was a priority by leaders so that they can create clear situational understandings of what happened and what was in course. This was uncovered when first responders shared information with those individuals in charge creating those understandings. An operational member of safety supporters in concerts commented at this respect

> if the policemen (*security responders*) arrived first to the incident area, they did not distinguish whether Red Cross or Haws or Tijuana Rescue group came (*all of them are safety supporters*). They gave a detailed report…Clearly, they (*security responders*) wanted that people (*safety supporters*) helped people (*spectators*) (*Voluntary group,e20,03Dec2010,safety supporter,operational*)

Recognising information sharing as normative behaviour, first responders shared situational understandings so that safety supporters managed the incidents nursing the casualties. However, first responders (security responders) were capable to differentiate safety supporters giving preference to some above others. They gave preference to safety supporters than safety responders and transferred information according to

the local policies. Information was clearly transferred respecting organisational boundaries and roles. Nonetheless, this practice included legal implications for passing responsibilities in context. Consequently, tensions were generated between individuals as a consequence of these implications.

5.3.6 Discussion of Findings on Normative Altruism

Altruism is related to motivations of individuals who pursued the increase of wellbeing of others (Hars and Ou, 2002). Findings confirmed that this motivation has social impact on the behaviour of other individuals as a result of real actions of other individuals (Latane, 1981); for instance, it changed the courses in incident management. An example is seen when individuals *"gave a detailed report…Clearly, they (security responders) wanted that people (safety supporters) helped people (spectators) (Voluntary group, e20,03Dec2010,safety supporter,operational)"*. In that case, security responders shared information in a proper form giving a detailed report of what happened to safety supporters; however, this clear disposition to share information can be seen as egoist behaviour. According to Batson and Shaw (1991), the disposition for sharing information can include additional motives. For instance, information sharing can be seen as an act of passing responsibilities to one another. Nonetheless, these types of acts can change how situations are defined (Dynes, 1994). Thus, additional investigation is suggested to answer the questions to what extent individuals of safety supporters seek the wellbeing of others leaving aside information sharing and how individuals were aware of the social impact of their activities included in information sharing.

5.3.6.1 Controlling Individuals

Information sharing was clearly exhibited in relation to regulations associated with incident management. Regulations stipulated that information should be proactively shared and individuals who arrived first to incidents should control the incident until the individuals in charge appeared. These first responders should provide pertinent information to individuals in

charge sharing their situational awareness, as stated in section 5.1. However, this research revealed that this behaviour was due by hiding reasons (Batson and Shaw, 1991). The principal idea is that information sharing was exhibited because individuals expected something from the intervention. In this case, safety supporters "*wanted to be recognised as heroes (Civil protection department,e6,26Oct2010,regulator,tactical)".* However, it is important to remark that the altruistic behaviour can be seen from the pro-social perspective. In this perspective, those individuals can serve as information sources (Latane and Darley, 1970). Nonetheless, it was found that those individuals preferred to manage the incidents but did not share information as noticed by leaders. Altruistic individuals preferred to be recognised as skilful individuals and "heroes". In this line, some questions arose: how many altruistic individuals exhibited characteristics of heroes, to what extent they were disposed to be information providers and to whom and what kind of information they were disposed to share.

Furthermore, it is important to remark that incident management was achieved; but as Latane and Darley (1970) argued, if information was not shared, the intervention could not help. This served to discover that the lack of information sharing contradicted the altruistic organisations because it was expected that in incident management the altruistic individuals should proactively share information when they arrived to the incidents. For example, dispatchers or members of the command areas solicited to those individuals *"inform(ed) to C2 (command area) that we were approaching to the incident (Voluntary group red cross,e41,09Feb2011,safety supporter,tactical)".* This was based on *"security and safety reasons (Voluntary group red cross,e41,09Feb2011,safety supporter,tactical)"*. This means that leaders usually cared to each other and information sharing was employed with this goal. In this line, the following questions should be investigated: to what extent safety supporters are disposed to provide information and in what conditions they are disposed.

5.3.6.2 The Necessity of Information Sharing

Considering information sharing as a relevant element in incident management, it was stated that if safety individuals provide information to leaders, this would be meant that *"they agreed with this form of coordination (Voluntary group red cross,e42,1Feb2011, safety supporter, operational)"* and being information provider was formalised as an agreement. This was with the consideration of positive outcomes from incident management (Garcia et al., 2006; Frantz and Mayer, 2009; Garcia et al., 2009). However, safety supporters were left out this agreement generating tensions between them. In this line, Batson et al. (2002) argued that altruism in a limited form is similar to egoism or another form by understanding the motivations of altruism. Individuals felt good to increase the common good; but on the other hand, they generated tensions in other instances (Batson et al., 2002). This was seen when *"two voluntary groups (safety supporters) arrived at the same time (Voluntary group red cross,e43,11Feb2011,safety supporter,operational)".* Both groups were egoistic when "*one team cared from the waist up and the second, from the waist down (Voluntary group red cross,e43,11Feb2011,safety supporter,operational)*" and forgetting the overarching goal. For these reasons, it was suggested to continue investigating in what terms the coordination is agreed, if there is evidence of those formalisations, how egoism are perceived by altruistic individuals, they are conscious of that egoism, what are the consequences of this egoism in context and to what extend individuals feel good when they increased the common good and to what extent the lack of information sharing affects incident management.

5.3.6.3 Directing Information Sharing

Being information provider was required as crucial element in context to create shared situational awareness. This role was in connection with the organisational boundaries implied in problematic situations (Fischer et al., 2011) and this can impede or enhance information sharing. Nevertheless, altruistic individuals exhibited unexpected behaviours. These expressed the values of humanitarian concerns, putting in practice skills and knowledge

acquired in humanitarian academies to obtain personal benefits (Dovidio and Penner, 2001). As a result, these individuals did not give the expected importance to information sharing. Consequently, tensions were generated, for example when *"they (safety responders or supporters) arrived and another team (of safety supporters) was there that nobody authorised (Voluntary group red cross,e41,09Feb2011,safety supporter,tactical)".* That is, two teams approached the incidents, but one of the teams was not noticed by their leaders. This team did not follow accorded procedures and leaders should direct information sharing to control and coordinate that team. For this reason, additional research is proposed to investigate if individuals are aware of the organisational boundaries, to what extent are the unexpected forms of altruistic behaviours related to the lack of information sharing and in what conditions altruistic individuals leave out information sharing giving priority to incident management.

5.3.6.4 Policing Information Sharing

Being information provider was institutionalised because "sharing at least some information is obligatory to become part of the community" (Parrish 2010, p.189), community of safety supporters. These supporters should share information in incident management for remaining on the list of altruistic organisations of the city. In addition, they should share information because it implied ethical issues (Lin, 2007b; Richardson and Asthana, 2006). For these reasons, leaders tried to change the focus of how information sharing was seen by altruistic individuals. They located information sharing as a relevant activity of altruism, but from the perspective of the information provider (Batson et al., 2002; Brazelton and Gorry, 2003; Hew and Hara, 2007). This was argued by leaders when they affirmed that safety supporters *"have the obligation to help us (safety responders) (Firemen,e47,23Feb2011,safety responder,operational)",* sharing pertinent information from incident management. However, this help was triggered because they were immersed in problematic situations (Levine et al., 2005). In other words, safety supporters demonstrated that they can control the incidents by themselves. For this reason, information sharing was left out. Nonetheless, at the tactical level, this generated tensions and as a

counteraction, leaders institutionalised information sharing to control and coordinate them. They also mentioned that they only wanted to manage effectively and efficiently the incidents and for this reason, those individuals should share information in order to solicit their support if it was necessary. Leaders preferred to have "*another available resource (Civil protection department,e6,26Oct2010,regulator,tactical)*" in case of incidents. In this line it is proposed to research in what conditions the rules of being information provider could be utilised, to what extent and what organisations could follow those rules.

To put if briefly, altruistic individuals and their actions were found as the principal source of tensions in context. This was because leaders expected information sharing from those individuals. Altruistic individuals also showed their preference for being information receiver in incident management and not information providers. These types of actions and operations of information sharing were not associated with findings of other researchers (Batson et al., 2002; Brazelton and Gorry, 2003; Hew and Hara, 2007). They found that altruism served as a motivation to share proactively information and not to be passive receivers, as found in this research. For this reason, it is important to note that altruistic individuals definitely changed the course of incidents, but this implied tensions with other individuals involved. In short, normative altruism is likely to trigger information sharing but as a counteraction for controlling and coordinating safety supporters in context.

5.4 Summary of Information Sharing

The motivations for sharing information were discovered in diverse sources and emphasise the relevance of situational leadership, the use of uniforms and being ethical in activities, actions and operations in context. These were named situational directive, surface credibility and normative altruism. Situational directive was related to taking the role of situational leader in incidents. In the current literature, this was located as a type of information sharing named directive sharing (Talja, 2002). Its principal characteristic is

the enhancement in a two-way process of information sharing (Talja, 2002), that served to uncover tensions, disturbances and contradictions generated by interactions between individuals involved in those incidents. Furthermore, it was uncovered that information sharing was institutionalised (Castellano and Plionis, 2006; Waugh and Streib, 2006) by individuals leading to better situational understandings (Zboralski, 2009) in context.

Surface credibility was in relation to swift trust associated with the simple inspection of external appearance of individuals (Tseng and Fogg, 1999). The trigger of this motivation was uncovered by wearing uniforms in context. As a sign, uniforms demonstrated their validity in exhibiting the role (Bickman, 1974; Šterman, 2011) and a sign that shared general meaning in context (Sonnenwald, 2006). Furthermore, uniforms changed the social perception of those individuals wearing them (Loveday et al., 2007) facilitating their tasks, included information sharing, in basis of their attitudes among the public (Bell, 1982). Moreover, uniforms legitimated the tasks of those individuals who wore them (Bickman, 1974) changing the course of incidents by employing information sharing.

Normative altruism was linked to counteracting actions and operations of altruistic organisations generating tensions between their personnel and leaders. This was because it was expected that minimal information would be shared in order to form a community (Parrish, 2010), community which managed the incidents. However, altruistic individuals or safety supporters focused on managing the incidents instead of sharing information from the incident. Therefore, information sharing was institutionalised for creating and maintaining situational awareness in context. Furthermore, these individuals were not noticing that other issues in concern with social interactions should be considered. Those issues were located in ethical issues (Richardson and Asthana, 2006; Lin, 2007b) and can trigger information sharing.

CHAPTER 6
TOOLS

This chapter presents findings concerning the tools employed to mediate and control information sharing in routine operation and incident management at major events. The findings were uncovered from the scrutiny using activity theory of the actions and operations of the activities of information sharing and shared situational awareness, as stated in sections 4.3.1 and 4.3.2 respectively. This chapter also discusses the research question *what tools mediate and control information sharing*? The discussion draws upon the current literature and establishes a position in relation to those findings. In particular, this chapter shows that there is a strong relationship between the study findings and the current literature. In addition, it was discovered that tools were effectively employed to mediate information sharing. This mediation was used to exclude actors in the light of creating and maintaining shared situational understandings. Furthermore, findings suggested that each tool served to uncover the complexity of information sharing. This is revealed by giving or taking responsibilities and by setting clear organisational boundaries. Moreover, findings uncovered the preferences of using determined tools above others. In addition, abstract and material tools (Vygotsky, 1978a; Leont'ev, 1978) were utilised interchangeably and their uses were in strong connection with the created shared situational awareness in context.

This chapter presents situational awareness as an abstract tool utilised by individuals to be aware of what was going around them in context. It continues with reporting codes as another abstract tool used by individuals to convert situational information into symbols mediating and controlling the information sharing. Thereafter, radio as a material tool is depicted as a transceiver device employed to mediate and control information sharing between mobile and co-located individuals. The chapter then closes with a summary.

6.1 Situational Awareness

Situational awareness is an abstract tool that individuals employed in incident management in context. According to Endsley (1995), in order to obtain situational awareness, individuals should perceive environmental elements, comprehend their meaning in context, project their status and predict what external variables can affect the status of environmental elements. The result is a mental model that helps on understanding what is going on at a determined time and space. Furthermore, this mental model is required to achieve organisational goals (Cuevas and Bolstad, 2010), particularly in safety and security areas. Consequently, these mental models are used to mediate and control the information practices of individuals involved, specifically information sharing. Moreover, this tool was used in conjunction with other abstract and material tools. For instance, situational awareness helped on understand the incidents so that this permitted to the individuals made informed decisions. For example, explaining the policies concerned with the uses of bottles as projectiles, noted in section 4.3.2.1. However, this tool was only focused on individual awareness, but it put in place foundations in shared situational awareness presented and discussed in next chapter. This was because shared situational awareness was created between/with individuals from same or diverse organisations (Endsley and Jones, 2001), via information sharing.

Findings suggest that individuals pay attention to the environmental elements as risks and/or unusual shapes within crowds that can impact on their tasks. In other words, individuals were aware of those elements that can lead to potential incidents. Once they understood their meanings, they notified using information sharing what was going on in context. However, it was found that a lack or partial situational awareness led to control and limited information sharing. This was because there was an assumption that Individuals did not require all information to perform their roles and to achieve organisational goals (Höglund et al., 2010). For instance, the concept of tunnel vision emphasised the necessity of creating a complete mental model in incident management. This concept also helped to explain the strong connection between situational awareness and information sharing serving as a switch between them.

6.1.1 Evaluating Situations

Situational awareness helped to create confidence between individuals when abnormal situations were discovered and when situational awareness was shared. Individuals made informed decisions leading the performance of tasks in incident management. Similarly, information sharing was employed to separate individuals and delineate tasks for each of them involving or not individuals in incident management, as commented in chapter 5. In other words, the awareness of those individuals was an element of individual situational awareness serving to separate individuals who should manage the incidents from those that could be called on to support them. This was a consequence of the evaluation of the elements included in that situational awareness. Moreover, this allowed the separation of those individuals with complete situational understanding from those individuals with partial or lack of situational awareness. Nonetheless, tensions resulted from those states of situational awareness because these states permitted to make informed decisions that led tasks in incident management. That situational awareness helped to understand what was going on to subsequently trigger information sharing. A member of the firemen in concerts commented in this line:

> once the incident is discovered, we (*security responders*) approached to this area and assessed the situation. We should know if there was an incident, or they (*spectators*) were only try to confuse us in order to gain attention of uniformed people (*policemen*) and left uncovered other areas. Some (*police*) officers approached to this area and the rest was expecting what was going on via radio to act after if it is required (*Firemen,e46,22Feb2011,safety responder,operational*)

Situational awareness facilitated the informed decision making process. For example, individual comprehended that if they cannot manage the incidents, other individuals can support them. In addition, that information permitted to pass from a state of being confused (an uncertain state) to being aware about what was going on (a certain state). Furthermore, situational awareness helped on understanding what is happening around individuals. Individuals understanding how others achieved their roles and organisational goals taking their responsibilities and authority. In addition, they recognised the skills and abilities of themselves and other individuals around them. This also permitted to be aware of the

lack of abilities and knowledge of other individuals involved. However, this permitted to uncover those individuals who were using lack or partial situational awareness that was shared. This created narrowed or incomplete shared situational awareness in others. For instance a member of the Civil Protection Department in concerts commented that

> the tunnel vision is related to the capacity of the individuals (*safety and security responders and supporters*) to open the vision and evaluate the scene. When someone arrived to the scene, first it is required to evaluate the scene and second, report what happened. It is important that individuals...should see the intrinsic risks that can be in the surroundings, but without stopping. In a fast way, they should evaluate the scene and corroborate that there were no risks. After, they should approach to the safe and secure area. For example, if they arrived to an incident and there is an electricity pole fell, they should observe that there is not another implicit risk for being near to the pole. The fast evaluation of the situation helped on approaching to the incident in a safe way. In another situation, if individuals received a report that there is an incident in course, they approached to this area and could nurse the first casualty they saw; but they should consider that could be other casualties. Individuals could not solicit additional support to nurse others because they were only focused on the first casualty they observed. In addition, safety is relevant to individuals and their actions during the response which could be seen as selfish behaviour. This was because individuals (*safety and security responders*) arrived to the scene, but they did not want to nurse casualties. That was because there can be a risk and their lives can be in danger. The evaluation served to assess the risks included in the problematic area and what type of resources could be required to manage that incident. After individuals should solicit the resources avoiding the movement of unnecessary units (*personnel and equipment*) (*Civil protection department,e7,26Oct2010,regulator, tactical*)

The lack or partial situational awareness can trigger information sharing, but information provided was not sufficient to create and maintain shared situational awareness. This can be attributed to the deficiency of skills and abilities or capacity of individuals to evaluate the problematic situations. This was supposed that there was a strong relationship between capacity for creating individual situational awareness on evaluating incidents and sharing information for creating and maintaining shared situational awareness between individuals involved in incident management.

6.1.2 Locating Unusual Shapes and Behaviours

Situational awareness included responsibilities and organisational boundaries for achieving organisational goals. This was inferred because individuals continuously scanned the environment to discover unusual elements so that they can understand them in context. In certain situations, they cannot comprehend them thus information sharing was employed to solicit additional information from them and from other individuals near of the areas where those elements. If these individuals discovered an incident, they can solicit support from other individuals with the skills and abilities to manage them. However, tensions were generated because individuals crossed organisational boundaries and/or delimited responsibilities on creating that shared situational awareness. Here, individuals should firstly be sure by creating individual situational awareness in order to create shared situational awareness. A member of firemen in concerts stated that if

> in an event there was detected an unusual form, it could catch our (*safety and security responders*) attention. For example, if there was a circle within the crowd, it could gain the attention from the command area. This area was located in a strategic area within the venue and was used to observe this kind of unusual crowd movement. We visualised them and then agreed to approach to manage it. The incident management depends on the types of incidents: if there was a fight, the police should manage it; contrary, if there is a casualty, firemen should cope with it (*Firemen,e49,24Feb2011,security responder,tactical*)

Situational awareness helped for limiting responsibilities and visualising organisational boundaries by classifying the incidents as security, safety or both. This allowed employing information sharing to solicit support by creating shared situational awareness in competent individuals. For instance, in mixed incidents, the security organisations should provide security to safety individuals or vice versa. The evaluation of incidents helped in this way. Although, in certain incidents, leaders were not capable to create shared situational awareness, they used information sharing to control and coordinate individuals located near to the incidents. In this line, a member of the Commercial Police in concerts said

> if I (*a security responder*) observed something unusual in the middle of the crowd, because it was notorious, I should call to the nearest

> policeman on that area. For example, when a spectator was disturbing others, I called to the policeman (*from another division*) located near to that area and gave instructions to approach and manage the incident…we stayed in contact until the incident was managed…In that case, the spectator was invited to abandon the event (*Commercial police,e51,28Feb2011,security responder,tactical*)

In this incident, situational awareness was partially created and enabled the use of information sharing to dictate tasks required to control and manage it. Transferring situational awareness helped in managing the incident accurately and was utilised to involve individuals. This was by asking for support and giving orders as well as by involving individuals near to the incidents. In addition, this aided on giving commands to the spectator who provoked the incident.

6.1.3 Understanding Roles and States of Situations

Situational awareness was a mental model formed to understand what was going on in a determined situation and time (Millward, 2008). This involved the discovery of environmental elements and subsequently obtains meanings in context and served to facilitate information sharing. In addition, situational awareness permitted to the individuals anticipated future states of situations and proactively to prevent incidents. Nonetheless, certain individuals were not able to anticipate those states despite it was supposed that they created and maintained situational awareness. However, leaders uncovered that lack of situational awareness so that they used information sharing to help them in creating and maintaining shared situational awareness. For instance the coordinator of security in baseball matches in city 2 affirmed

> I (*a leader of regulators*) like to see baseball, but I came to work. Guards (*security supporters*) did not pay attention to spectators; nevertheless, we agreed that certain areas were monitored by them. They permitted that beer sellers left bottles to spectators during baseball matches. After I noticed them, they were angry with me. The important task was to be safe; but guards did not know what may happen if bottles are used as projectiles, they can cause damage (*Security coordinator,e21,18Dec2010,regulator,tactical*)

Situational awareness can generate tensions when shared situational awareness was created in others. This is because it implicated the roles and crossing organisational boundaries. For instance, individuals did not comprehend completely the situations but leaders helped in this task so that they provoked tensions between them. Particularly, if the leader showed the environmental elements that can damage the spectators. This was with the goal of preventing incidents.

6.1.4 Recognising Policies, Skills and Abilities

Situational awareness implied recognition of environmental elements and comprehension of their meaning in context by the individuals involved. This was also connected with the individuals' role and the recognition of individuals' skills and abilities exhibiting confidence by understanding the expectancies of others and themselves in incident management. For instance, they expected to be immersed in continuous interactions with others and to be sensitive of the responsibilities and authority of them. This permitted to be aware of their complementary skills and abilities in incident management. Nevertheless, crossing organisational boundaries was as challenging task. Here, information sharing was employed cautiously to facilitate those interactions and was proactively employed to build shared situational awareness in others recognising their roles and organisational boundaries. For instance the security coordinator in baseball matches in city 2 stated that

> during events, we (*security supporters*) were in good terms with policemen (*security responders*). Sometimes, we wanted to show that we could support them in incident management. In addition, we did not want to spend the relationship with them on requesting unnecessarily support, only when it was required. We understood that if there was a minor incident, we should not inform to the police. In certain situations, we can manage the incidents without their support. Contrarily, if certain spectators resulted injured from fights, we should inform this to the police because they should arrest to the fighters (for example). This is because we cannot arrest people (*Security coordinator,e21,18Dec2010,regulator,tactical*)

Situational awareness was shared when individuals projected their situational understandings so that they were aware of their limitations performing their roles. Consequently, they solicited support by creating shared situational awareness in others as noted before. For example, the safety supporters cannot arrest people, contrarily the police can. Individuals knew this rule that was included in shared situational awareness.

6.1.5 Expectancy of Performances

Situational awareness enabled the evaluation of performance of individuals managing incidents. A common practice was that individuals assisted each other in case of requiring support in safety or security issues, for example nursing casualties or controlling crowd. However, in certain incidents, they did not create shared situational awareness while they were immersed in the same situations. For instance, certain individuals were focused on understanding the incident meanwhile others, on understanding the surroundings of the incident. In other words, individuals were alert of what was doing others to support them and others were alert of the risks included incident management. This was observed when certain individuals were located behind individuals managing the incidents so that tensions were generated by that expectancy. Information sharing was crucial for soliciting support. For example, a member of a voluntary group in concerts commented that

> when an incident happened, we (*safety supporters*) were located behind of firemen and policemen (*safety and security responders*). We were expecting that they (*security responders*) asked for support. Sometimes, we may aid firemen with their tasks, if they asked for support. Here, the communication was given between organisational leaders. For example, in a fire, if they left the areas to rest, we gave oxygen and open more space to them. This was because they dressed heavy suits and this task was boring (*Voluntary group,e19, 15Nov2010,safety supporter,operational*)

The expectancy for supporting individuals can be a challenging task so that this can lead to tensions between individuals. This was because information sharing was only employed when individuals were aware that additional support was necessary. Here, situational awareness was focused

on recognising the lack of abilities, skills or resources in order to use information sharing to amend that lack creating shared situational awareness in context.

6.1.6 Discussion of Findings of Situational Awareness

Findings suggest that environmental information was employed to create situational meanings from the context. This served to project their future states in which external variables were considered. Moreover, findings suggest that individuals shared information when they obtained meanings from situations. If they were able to obtain meaning of situations (Flach, 1995), they may project future states of those elements, so they were likely to share information with other individuals (Endsley and Jones, 1997).

Furthermore, the findings suggest similarities with discoveries in other investigations in collaboration (Sonnenwald et al., 2004), in the military (Costello et al., 2006; Cuevas and Bolstad, 2010; Höglund et al., 2010; Endsley and Jones, 2001), in aviation (Milham et al., 2000), and in team performance (Millward, 2008). For example, Sonnenwald et al. (2004) argued that situational awareness included elements from the context, socio-emotional aspects and characteristics of tasks and processes performed. In this line, the findings uncovered similar sources in which emotional aspects were not considered for ethical reasons, as stated in section 3.6. Furthermore, Costello et al. (2006), Cuevas and Bolstad (2010), Endsley and Jones (2001), Höglund et al. (2010), Milham et al. (2000) and Millward (2008) argued that situational awareness provided the elements for creating shared situational awareness in others via communication. This investigation found the same elements and via considering that in this thesis communication was seen as information sharing (as a two-way process). Moreover, the findings confirmed that situational awareness mediated and controlled information sharing using abstract and material tools as means to achieve that shared situational awareness, see next sections for additional information.

6.1.6.1 Meanings of Environmental Elements

The elements included in situational awareness captured the meanings created from environmental elements that continuously were updated (Sarter and Woods, 1991). This permitted to project the states of the situations and predict what factors may affect the situations (Endsley, 1995). In this line, individuals suggested two elements required in context. These elements included the state of the situation in terms of what is and what should be (Hancock and Diaz, 2002). One was in relation to what was happening in a determined place and time. The other was in reference to what is the best state of the routine operation in major events (no incidents or fast return to this state). Both implied the discovery of complexities in situations which were included in the situational awareness created (Rauterberg, 1995).

Consequently, individuals located those environmental elements that mismatch the expected state of the situations. This was seen in the continuous interaction and immersion in the environment (Gibson, 1986; Gibson, 1983) shaping their activities, actions and operations in context. This also allowed the adaptation of individuals to the environment (Smith and Hanckock, 1995). For instance, when individuals understood that "*beer sellers left bottles to the spectators during the baseball matches (Security coordinator,e21,18Dec2010,regulator,tactical)*", they were immersed in the environment and their tasks were shaped by it. Furthermore, this situational awareness uncovered the role of the individuals involved and mediated information sharing. This was seen when the individual noticed that "*they (bottles) can cause damage (Security coordinator,e21,18Dec2010,regulator, tactical)*" to a security supporter. This information also suggested future states of the situations because "*bottles are used as projectiles (Security coordinator,e21,18Dec2010,regulator,tactical)*". According to these findings, it was suggested additional research on investigating what other elements are included in the understanding of those situations, what meanings are suggested by those elements and how those elements are connected with future states in context.

6.1.6.2 Discovery of Risks in the Environment

The discovery of risks from the environment was considered relevant in context. Individuals pointed out the requirements to open the vision at the moment of evaluating the situations so that they can broadly understand the situations and their risks. For instance, certain individuals should "*open the vision and evaluate the scene (Civil protection department,e7, 26Oct2010,regulator, tactical)*" in order to "*report what happened (Civil protection department,e7,26Oct2010,regulator, tactical)*". These individuals should focus their attention to certain environmental elements and others should be discarded (Harrald and Jefferson, 2007). This phenomenon has been named attentional tunnelling (Harrald & Jefferson, 2007, p. 6)" or "*tunnel vision (Civil protection department,e7,26Oct2010, regulator,tactical)*".

However, this phenomenon generated tensions between individuals for being certain of what was going on in the situations. In this line, individuals suggested that they were expected to manage incidents fast, but "*safety is relevant to individuals (Civil protection department,e7,26Oct2010,regulator, tactical)*"; thus, they preferred to be sure of what is going on in incident management. That was because individuals "*should see the intrinsic risks that can be in the surroundings, but without stopping (Civil protection department,e7,26Oct2010,regulator, tactical)*". Individuals should open the vision and be sure what was going on in incidents and in its surroundings. For instance, when individuals evaluated the situations, they wanted to "*know if there was an incident, or they (spectators) were only try to confuse us in order to gain attention of uniformed people (policemen) and left uncovered other areas (Firemen,e46,22Feb2011,safety responder, operational)*". Furthermore, the "*evaluation of the scene helped to intervene in a safe way (Civil protection department,e7,26Oct2010,regulator, tactical)*".

Nonetheless, this type of performance "*could be seen as selfish behaviour. This was because individuals (safety and security responders) arrived to the scene, but they did not want to nurse casualties (Civil protection department,e7,26Oct2010,regulator, tactical)*". In other words, individuals demanded that the evaluation "*served to assess the risks included in the problematic area and what type of resources would be required to manage that incident (Civil protection department,e7,26Oct2010,*

regulator, tactical)". Triggering information sharing. Hence, it would be important to study how risks are located in situations, what risks are relevant to safety and security areas, to what extent individuals are connected with those risks, are trained to discover risks in situations, how risks and future states of situations are united and what type of training effectively improve the skills and abilities to avoid attentional tunnelling.

6.1.6.3 Stimulation from Environmental Elements

The next element of interest was the reception of the stimulation from the environmental elements which subsequently were transformed and processed (Hancock and Diaz, 2002). For instance, when individuals saw that "*there was a circle within the crowd (Firemen,e49,24Feb2011, security responder,tactical)*", individuals suggested that this was an "*unusual crowd movement (Firemen,e49,24Feb2011,security responder,tactical)*" that should be managed. Being sure of what was going on triggered information sharing involving those individuals who can manage the incidents and notifying those who can control and coordinated the incidents. This was seen when "*the incident management depends on the types of incidents (Firemen,e49, 24Feb2011,security responder,tactical)*". Another example was when certain individuals "*observed something unusual in the middle of the crowd, because it is notorious (Commercial police,e51,28Feb2011,security responder,tactical)*", they subsequently notified to those individuals located near to that unusual movement.

Nonetheless, individuals should know the localisation of the individuals (Roth and Multer, 2005). Here, their positions were updated continuously verbally or being visible for using uniform. Tensions arose in context "*until the incident has been managed (Commercial police,e51,28Feb2011, security responder,tactical)*". This was because in certain incidents, spectators "*could be invited to abandon the event (Commercial police,e51,28Feb2011, security responder,tactical)*" for being involved in incidents and information sharing was employed with this goal. Some questions arose related to what crowd movements are considered unusual and why, and what information is considered to locate individuals in context.

6.1.6.4 Awareness of Individuals

This element was in relation to know other individuals in context and specifically, to be aware of the identity of those individuals (Glaser and Strauss, 1964), the perceptions of their competence (Treurniet et al., 2012) and the definition of their role. Here, the role was confirmed by wearing uniform. For example, security supporters were aware of security responders and these confirming their roles so that in certain incidents, they did not want to "*spend the relationship (Security coordinator,e21,18Dec2010,regulator,tactical)*" in minor incidents that they can manage without the support of security responders. In those cases, the supporters weighted the support that could be given by responders so that it would be solicited "*only when it was required (Security coordinator,e21, 18Dec2010,regulator,tactical)*".

Furthermore, individuals also expected that other individuals performed their roles; otherwise, additional individuals would be required to assist them when they failed or required support in context. For this reason, those individuals were "*located behind of the firemen and policemen (safety and security responders) (Voluntary group,e19,15Nov2010,safety supporter, operational)*" to back them. Similarly, when individuals solicited support by providing "*oxygen and open(ning-added-) more space (Voluntary group,e19,15Nov2010,safety supporter,operational)*". Moreover, additional research was suggested to answer the questions what skills and abilities are expected to perform individuals, what roles are principally required, how individuals comprehend that support is required and how it is expected, and to what extent individuals are located near to individuals managing incidents.

Overall, the findings suggest that individuals employed situational awareness to mediate and control information sharing towards creating shared situational awareness in context. Individuals obtained information from context including tasks, processes and other individuals (Sonnenwald et al., 2004). This helped to obtain meanings for being immersed in it (Flach, 1995; Gibson, 1983; Gibson, 1986), which also allowed their adaptation to the environment (Smith and Hanckock, 1995). Subsequently, this information was utilised to project future states of the situations (Endsley, 1995) in which other individuals were included providing information to them

(Costello et al., 2006; Milham et al., 2000; Cuevas and Bolstad, 2010; Millward, 2008). This was seen when individuals discovered risks and received stimulation from the environment (Hancock and Diaz, 2002) and served to identify other individuals (Glaser and Strauss, 1964) and their competences (Treurniet et al., 2012). For these reasons, the evidence exhibited that situational awareness is likely to mediate and control information sharing for creating and maintaining shared situational awareness in context.

6.2 Codes

Codes are the representation of the usual words or phrases used in context in other representations which usually took the forms of combinations of numbers and letters. As presented in section 4.2.1.1, the risk system included codes utilised by participant organisations in context. These codes are categorised as safety (A-codes) and security (10-codes) codes. Each of them implied situational awareness. Furthermore, codes exhibited potential characteristics of incidents to categorise them for responding appropriately (Sporer et al., 2007; Michael and Sporer, 2005). Moreover, codes were considered as representations of organisational traditions and uses of a proper language in situations (Ellis, 1992). However, an excessive number of codes can result in over classification of incidents and influence negatively their management (Sporer et al., 2007).

Findings suggest that codes were used to limit responsibilities and exhibit organisational boundaries. During the events, different codes were found to exhibit a proper language that organisations used for sharing information with/between their members. They also exposed residues of the organisational goals and roles in context. Furthermore, they were utilised to mediate and control interactions between individuals separating those who can use the codes and those who cannot use them. In other words, codes enabled/inhibited information sharing. In general, those codes can be created and planned to facilitate information sharing only between individuals from the same organisations.

6.2.1 Multiple Codes

Codes were planned to expose necessities of information about problematic situations which individuals can manage in their routine work. They were focused on safety and security issues. Organisations developed a great number of codes to match possible situations that can involve individuals. Each code described general characteristics of incidents and demonstrated specialised knowledge of the problematic situations. Similarly, they exposed a number of possible procedures for managing those situations. However, the great numbers of codes required excessive specialisation that led to contradictions in their use. For example, certain organisations allowed the use of their codes to other organisations; but tensions arose in their use. A member of firemen in concerts stated that

> firemen (*safety responders*) and police (*security responders*) were using same codes. Sometimes, we failed using the codes of Red Cross (*safety supporters*) or vice versa. That is, we failed using their codes because codes are longer and are combinations of letters and numbers…It is normal that police (*security responders*) and firemen (*safety responders*) understand to each other and Red Cross also understood what we were saying. However, when they (*safety supporters*) used their codes with us (*safety responders*), we did not understand…We required translators to be communicated that are located in command areas (*Firemen,e44,21Feb2011,safety responders,tactical*)

For this reason, uses of codes limited the number of individuals in the information sharing process. It was elucidated that if individuals can understand situations and started information sharing using codes, few individuals can complete the process of information sharing. This limitation was in relation to the numbers of codes employed to mean similar situations or pieces of situations. In order to avoid it, translators were collocated in the command and control areas. For example, if an incident was discovered, it subsequently was coded and transmitted. Nonetheless, this can take diverse forms in relation to the organisation which transmitted that code. For instance, in the following table is presented the types of code utilised by each participant organisation to codify an incident denominated “fire”.

Table 6-1 Codification of the incident "fire" by participant organisations

Organisation or agency	Code
Regulators	“Fire” (used natural language)
Security responders (Police)	12-09
Safety responders (Firemen)	12-09
Security supporters (Guards)	X-5
Safety supporters (Red Cross)	2A
Safety supporters (Rescue and voluntary groups)	12-09 or “fire”

Using information the provided in the table 6-1, it was concluded that one organisation used natural language in the information sharing process. Contrarily, other organisations employed codes, or in the case of voluntary groups, they have employed the 10-codes and natural language. Natural language is “the language that has evolved naturally as a means of communication among people” (Collins, 2003). Three different codes were uncovered, as noted in section 4.2.1.1. One type of code was utilised by security and safety responders and safety supporters, including voluntary groups. Another type was utilised by safety supporters represented by Red Cross. The last kind was exploited by security supporters. Thus, multiple codes led to tensions between individuals for employing them, but tensions were minimised by employing translators in the command and control areas.

6.2.2 The Number of Codes

Three different codes were employed by participant organisations and their personnel. The codes are combinations of letters and numbers representing different situations that implied specialised skills and abilities to manage them. They also exhibited a great specialisation on procedures for managing those situations. Nonetheless, this great number produced tensions and contradictions in their use. Certain individuals noted that, as a consequence of that great number, they cannot memorise them. An operational member of the commercial police in concerts said that

> there are many codes...we (*safety and security responders*) only employ the common ones because many of them are repeated....we conversed using the same codes; sometimes, we said one code and others did not know it. We did not understand what others were saying... training is important to learn codes... (*Commercial police, e52,02Mar2011,security responder,operational*)

The number of codes by itself represented a challenge for individuals. This was uncovered when the list of codes of participant organisations were reviewed. Consequently, memorising this great number of codes and their use were a challenge in context. For instance, the following table presents the number of codes used by organisations.

Table 6-2 The number of codes by participant organisations

Organisation or agency	Number of Codes
Regulators	Natural language
Safety responders	229
Security responders	229 (same as safety responders)
Safety supporters (Red Cross, own codes)	208
Security supporters	124
Safety supporters	229 (same as responders)

As stated in the last quotation: "*training is important to learn codes (e39)*", it should be a way to deal with this great number of codes and to allow their learning. That training was delayed so that individuals were involved in the context without receiving the adequate training on their use. They suggest that the rapid inclusion in context can facilitate the learning of those codes consequently for interacting with other individuals and being in the middle of the information flow. For example a member of the security company commented that

> during an incident, codes were employed to communicate. Initially, I (*a security supporter*) was afraid to use them. I did not want to make mistakes for using codes and saying something wrong. Supervisors said me that if I use the codes in the (*routine*) communication, it should be the only form to learn them…but I have not learnt all codes. I know the most usual…Other guards had not learnt all codes also. To learn codes, I used the strategy on putting attention to those codes that I did not know to after look for their meaning in the list of codes (*Security company,e3,23Oct2010,security supporter,operational*)

Memorising the number of codes was a challenging task that individuals should overcome. In addition, being in the middle of the information flow was another demanding task because individuals in determined situations could be faced with unknown meanings of the codes utilised producing tensions on them. Learning how and when use the codes gave advantages for facilitating the information sharing process between individuals notwithstanding they came from different organisations.

In addition, the large number of codes suggested a great specialisation required for understanding situations. Memorising the codes in relation with the situations was a demanding task and their learning was facilitated by training or being in the information flow in routine operation. Both tasks were enriched by receiving feedback from other individuals and leaders. However, codes included situational meanings and assistance to decision making process in incident management. For instance a member of the security company in concerts affirmed that

> I (*a security responder*) noticed to the supervisor that we (*security supporters*) were in X3 (*code that means an active incident*). We had a problem in the entrance of the venue. There is a guard who is located there. He had problems with people (*spectators*). I wanted that Mr P. (*leader of guards*) understood that he was transmitting this; but at this moment, Mr P. did not understand. He ordered me to return to my position. An organiser (*regulator*) asked me if the information was passed to the supervisor. Finally, she went there and interrupted him to pay attention to the incident (*Security company,e4,24Oct2010, security supporter,operational*)

However, memorising the codes and being in the middle of information flow were not a guarantee that individuals have effectively made decisions and performed accordingly to the incident for creating shared situational awareness. This was because having a clear understanding of the code and their meaning in practical terms is not sufficient to react accordingly to the instruction received. A member of the security company in concerts stated that

> I (*a security supporter*) was arriving (*to the command area*) when I heard the code (*by radio*) and understood what was happening: “an incident was in course”. After, they (*other leaders*) gave me the instruction to go there. We (*security supporters*) wanted to know if the guards were injured or not. In addition, we needed to inform to our clients (*regulators*) and the police (*security responders*) what happened giving details of the incident (*Security company,e11, 30Oct2010,tactical*)

Thus, knowing the codes and their meanings can facilitate information sharing between individuals. Similarly, they can facilitate interactions between individuals when they knew the codes of others. In addition, codes enclosed responsibilities and organisational boundaries that generate

tensions when those boundaries were crossed. This was enabled for being in the middle of information flow and for having translators to understand what was going on in diverse places over time, as stated in section 6.3.

6.2.3 Misinformation

Codes acted as situational representation through combinations of letters and numbers. These combinations matched situational particularities and individuals assumed that codes facilitated social interaction between them for simplifying the tasks that were under responsibility and for respecting organisational boundaries. For instance a member of the security company in concerts said that

> guards (*security supporters*) should learn the codes... when an incident is in course, they should know how to solicit support from C2 (*command area*)…Radio and codes are powerful tools... It was expected fast response once guards understood the situations and reported this to C2...they should know the meaning of codes to give a fast response and change course of the incidents (*Security company, e13,31Oct2010,security supporter, tactical)*

Nevertheless, evidence showed that codes were not always correctly employed or understood by individuals. It was supposed that their use can facilitate social interactions between individuals from the same organisations. However, it was discovered that use of codes was not clearly normalised at intra-organisational level. In addition, the majority of individuals learnt the codes without receiving formal training so that their use suggests wrong ways of learning. This led to misinformation that subsequently generated tensions and contradictions between individuals in the information sharing process. For instance, a member of the commercial police in concerts stated that

> certain policemen (*security responders*) pointed out that in other municipalities (*local governmental areas*) and states (*of the country*), codes are more complicated than ours. This was not true because I have the experience that codes told something, but the meaning was different in their use. Codes are employed in other ways during the incidents. I do not know why we have learnt them in this way causing confusion (*security responders*) (*Security department,e38,25Jan2011, security supporter,operational*)

Codes mediated information sharing, but it was suggested that codes can lead to misinformation. Misinformation is defined as “how close the information is to the true state of the environment (Koops, 2004; p. 103)”. This is in relation to the extent to which codes informed what was going on in situations. So, it was suggested that individuals learnt the codes in the wrong form. Then, this can provoke a mismatch between codes and their situational meaning, or that mismatch changed over time accumulating inaccurate information from the situations.

6.2.4 Discussion on Findings of Codes

Findings suggest that codes acted as forms of language that participant organisations utilised in their routine operation to facilitate the interactions between their personnel, but they generated tensions and contradictions. The sources were the number of codes employed by the organisations at major events, the difficulties to learn them and the mismatch between codes and information that they should describe. For instance, these tensions uncovered the ineffectiveness of codes in context leading to ineffective information sharing process for creating shared situational awareness.

6.2.4.1 Colective Languages

Due to the number of codes employed in major events, it was suggested that these were common languages (Ellis, 1992), languages utilised by individuals and participant organisation for sharing information. However, findings suggest that there was a lack of common language and it was seen as a source of problems between individuals and their organisations (Manoj and Baker, 2007). They argued that this lack of common language can lead to problems in information sharing. Principally, if individuals “*failed using the codes of Red Cross (safety supporters) or vice versa (Firemen,e44, 21Feb2011,safety responders, tactical)*”. The neccessity of having a comon language in context was not achieved because “*we required translators to be communicated (Firemen,e44,21Feb2011,safety responders,tactical)*”, specifically between individuals from diverse participant organisations.

Contrarily, it was confirmed that when individuals used a common language, information sharing was improved. For instance, "*it is normal that police (security responders) and firemen (safety responders) understand to each other (Firemen,e44,21Feb2011, safety responders,tactical)*" because they employed identical codes, as stated in section 4.2.1.1. Moreover, the use of multiple codes can lead to the misunderstanding between individuals and and their organisations (Ley et al., 2012). They pointed out that terminological differences can lead to miscommunication issues. It was stated "*when they (safety supporters) used their codes with us (safety responders), we did not understand (Firemen,e44,21Feb2011, safety responders,tactical)*". This suggested that additional research can be done in answering to what extent these multiple codes lead to misunderstanding between individuals, what are the principal characteristics of the misunderstandings and how individuals can correct the misunderstandings.

6.2.4.2 Overspecialisation

In reference to the number of codes employed by organisations, findings suggest that there was an overspecialisation in the codes, that was seen in number of the codes and their description signaling diverse situations. This led to inefective use of resources (Michael and Sporer, 2005; Sporer et al., 2007). They pointed out that specificity can result in giving excessive treatment and use of resources in incidents. It means that overspecialisation can lead to involving excesively some individuals and their organisations but excluding others and saturating the means included in codes. Individuals suggested that they "*only employ the common ones (Commercial police,e52,02Mar2011,security responder, operational)*". This was because there were a huge quantity but "*many of them are repeated (Commercial police,e52,02Mar2011,security responder, operational)*". Thus, indviduals also commented that during initial periods in their roles, they did "*not want to make mistakes on using codes (Commercial police,e52, 02Mar2011,security responder,operational)*" because individuals were aware that they were "*saying something wrong (Commercial police,e52, 02Mar2011,security responder,operational)*". In other words, individuals knew that the number of codes were unneccesary and can lead to mistakes or bad use of resources

in context. It was suggested that additional research can be done to answer what implications are linked to the use of common codes, to what extent individuals and participant organisations can use common codes and what motivations are implied in the use of common codes in context.

In relation to learning the codes, findings suggest that diverse techniques employed in training were tried to fit neccessities of individuals in order to faciltate the learning of codes. Peate and Mullins (2008) argued that when there was used a “one-size fits all” approach some challenges were created. In this case, codes should be learnt by actors, but they “*have not learnt all codes (Security company,e3,23Oct2010,security supporter, operational)*”. They affirmed that they “*know the most usual (Security company,e3,23Oct2010,security supporter,operational)*”. Although, certain individuals stated that they learnt all codes that “*when I heard the code (by radio) and understood what was happening: an incident was in course (Security company,e11,30Oct2010,tactical)*”; contrarily, other individuals were lost by the number of codes despite that they received training and used them continously. It was suggested that when individuals “*noticed to the supervisor that we (security supporters) were in X3 (code that means an active incident) (Security company,e4,24Oct2010,security supporter, operational)*”. As pointed out by Arnborg et al. (2000), precision of information is that any individual can utilise same information and be aware of its meaning. In this case, the information sharing process was completely achieved when individuals were aware of codes and their significance. Consequently, individuals “*did not understand (Security company,e4, 24Oct2010,security supporter,operational)*” the information provided because they were not aware of this information. This led to misunderstandings (Ley et al., 2012; Shattuck and Woods, 2000). In addition, it was suggested to address the questions what codes are usual and why, can individuals be trained using another approach, what type of information leads to better understandings of situations, can individuals and organisations improve codes in order to facilitate their instruction and how their instruction can be enriched by individuals and their organisations.

6.2.4.3 Misinformation

In relation to the mismatch between codes and their significance, findings suggest that this mismatch can lead to misunderstandings (Shattuck and Woods, 2000; Ley et al., 2012), misinformation (Manoj and Baker, 2007; Neubig et al., 2011) or incongruity in situations (Rauterberg, 1995). As it was commented before, some cases of misundestandings was found but in this part only misinformation is treated. Misinformation is defined as "how close the information is to the true state of the environment (Koops, 2004; p. 103)". It was stated when individuals "*have the experience that codes told something; but in their use, the meaning was different (Security department,e38,25Jan2011,security supporter, operational)*". It led that codes "*are employed in other ways during the incidents (Security department,e38,25Jan2011,security supporter, operational)*". This resulted in "*confusion between us (security responders) (Security department,e38,25Jan2011,security supporter,operational)*". Nonetheless, despite of this mismatch, individuals "*expected fast response (Security company,e13,31Oct2010,security supporter, tactical)*" as suggested by (Neubig et al., 2011). They argued that information on situations should be processed to provide useful and precise information in context. In addition, the quality of information is another element that should be included (Arnborg et al., 2000). If individuals were not notified with precise and high quality information, this can lead to them being excluded in the information sharing process, when they have not understood the implications or been aware of meanings. For instance, it was seen when an individual has commented that "*we (security supporters) were in X3 (code that means an active incident) (Security company,e4,24Oct2010,security supporter, operational)*". Consequently, some questions arose in concern with to what extent codes could be replaced by natural language, in what situations the use of natural language could be allowed the increase of precision and quality of information, how individuals perceive precision and quality of information and how the mismatch can be corrected to improve the precision and quality of information.

To sum up, codes were employed to mediate and control information sharing in context. They were inferred as a common language (Ellis, 1992),

but its lack was a source of problems between individuals and organisations (Manoj and Baker, 2007). In this case, findings suggest that use of multiple codes led to misundestandings between individuals and their organisations (Ley et al., 2012). Moreover, findings suggest that specificity in codes led to over use the resources (Michael and Sporer, 2005; Sporer et al., 2007), this generated tensions between individuals and their organisations. Futhermore, discoveries suggest that when individuals did not learn the codes, their usage can lead to misunderstandings (Ley et al., 2012; Shattuck and Woods, 2000). In addition, results suggest that the mismatch between codes and their significances may lead to misunderstandings (Ley et al., 2012; Shattuck and Woods, 2000) and misinformation (Manoj and Baker, 2007; Neubig et al., 2011). To put it briefly, presented evidence exhibited that codes are likely to mediate and control information sharing for creating and maintaining shared situational awareness in context.

6.3 Radio

Radio as a material tool is a communication technology employed to facilitate and mediate information sharing between mobile and co-located individuals in context. This type of technology was capable to transmit oral (or speech), emotional and audible information in collaborative work. In addition, this tool was preferred above other tools because it facilitated synchronously information sharing at unscheduled and unpredictable times between individuals who were collocated and distributed, permitting back-and-forth interactivity (Bolstad and Endsley, 2005; Bolstad and Endsley, 2003). This was possible from having frequency spectrum capabilities as technological characteristics (Timmons, 2007), which were demanded for interacting those individuals involved in context. Furthermore, this tool enabled via information sharing the creation and maintenance of shared situational awareness at intra- and inter-organisational levels.

Findings suggest that radio was categorised as a multifaceted tool. It was utilised by individuals to cross organisational boundaries using the frequency spectrums of radios. In those situations, radio was employed to

use those spectrums and to be in the middle of information flow. Moreover, radio has to be reliable for permitting its use in diverse areas of venues and locations of cities. This was uncovered as a challenge implied in its use, specifically in different closed areas of venues and zones of cities. Finally, tools allowed the identification of users in the information sharing process. In fact, this identification represented additional information for creating and maintaining shared situational awareness. These served to uncover the relevance of radio in mediating and limiting information sharing in context.

6.3.1 Multiple Frequencies Spectrums

Multiple participant organisations converged in the events, each of them with goals to achieve. These organisations were categorised as regulators, safety and security responders and supporters. To control the event, regulators used radio for sharing information with leaders of safety and security responders. Respectively, responders shared a radio frequency with certain safety supporters. In addition, certain divisions of security responders employed their frequencies. In addition, a safety supporter (Red Cross) and security supporters (security company) utilised their frequency. Thus, seven frequencies were utilised by participant organisations, as stated by a member of the Commercial Police in concerts

> during the events, there was an internal frequency which was only used by us (*regulators and leaders of safety and security responders*). In addition, other organisations (*safety and security responders and supporters*) had their own frequency. The leaders of firemen and police used another frequency to be communicated with other members of their organisations. The frequency included the voluntary groups (*safety supporters*). Red Cross used its own frequency. The guards also employed their own frequency. (*Commercial police,e51,28Feb2011,security responder,tactical*)

Radio was also utlised to delimit responsibilities and state organisational boundaries. Moreover, it was been confirmed that frequencies created nested organisations within the risk system. These organisations tied and untied individuals and their organisations on demanding from incidents sot that radio permitted “knotworking” activities in incident management. In addition, it simplified information sharing between those

“knots” formed. Subsequently, it was employed to limit information to those individuals situated outside of those kots. In this line, individuals suggested that one goal of those knots was to limit responsibilities. In this line a member of commercial police in concerts said that

> each division of the Police (*security responders*) has its own frequency. This is another way that we (*security responders*) can separate our responsibilities. Contrarily, there would be a problem, if we mixed all divisions of police in the same frequency. Sometimes, other divisions participated in the events using their radios and personnel but sharing same frequency (*Commercial police,e50,26Feb2011,safety responder, tactical*)

Although, radio frequencies helped in dealing with roles and organisational boundaries, information sharing facilitated the interactions between individuals; but at the same time, tensions and contradictions arose for limiting information between them, as presented in subsequent sections.

6.3.2 Interoperability

Radio frequencies aided with limiting responsibilities on individuals as stated in the nested organisations or knots formed. Individuals suggested that they wanted to be heroes so that when organisations were tied, tensions and contradictions were generated. The policies suggest that the organisation formed in major events should take a linear form. Here, all organisations converge for managing the incidents. However, one individual should lead that organisation and take the control of the event, as stated by one member of the firemen in concerts

> we (*safety responders*) tried to use the radio as unique channel of communication (*use the frequency spectrum of safety and security responders as unique frequency in major events*). For example, if Red Cross or another voluntary group brought its C2 (*command area*), this was not important if the frequency of firemen is the exclusive active frequency. This generated a lot of tensions with those agencies, because they wanted to use their frequencies…They forgot the importance of the Incident Command (*the command and control area*). One individual should control and coordinate the participant organisations (*Firemen,e49,24Feb2011,safety responder,tactical*)

Displaying an organisation with a unique radio frequency enabled individuals to be in the middle of information flow. That is radio should have a technological capability to permit this inclusiveness permitting the move from one frequency spectrum to another or others. This capability is named interoperability and is defined as the technological capacity to swap between frequency spectrums (Miller et al., 2005; Timmons, 2007). Moreover, this capability allowed the convergence of organisations for achieving the goal of the risk system. Consequently, diverse individuals and their organisations were added to the risk system and its command and control area, as member of the commercial police in concerts commented

> in the events, the commercial division of the police (*security responders*) was in charge of the security. Other divisions participated, but they were under its responsibility. When these policemen arrived to the events, they should change the channel (*frequency spectrum of their radios*) to the frequency of the events (*frequency of commercial division and firemen*)...they knew what frequency was. This was to be in the same channel (*frequency spectrum*) and we can work together using the same frequency (*Commercial police,e51,28Feb2011,security responder,tactical*)

Individuals were required to form a unified organisation even though they came from diverse organisations. In these situations, radio helped in forming that organisations named the risk system. However, tensions and contradictions were also generated by certain safety supporters. They preferred to display their own command and control to be independent from the risk system. To do this, they utilised radio to gather information from other organisations and to produce their own information. Interoperability facilitated this task for putting this organisation in the middle of the information flow. In this line, a member of the Red Cross in concerts said

> during the events, we (*safety supporters*) listened to our paramedics (*safety supporters*) and the police (*security responders*) frequency… We received information from all available sources. Our radios were capable to scan 10 different frequencies in context (*Voluntary group red cross,e40,08Feb2011,safety supporter,tactical*)

Interoperability as radio capability gave the opportunity to collocate individuals in the middle of the information flow within the risk system. This was done even though different organisations used diverse frequencies

spectrums. Nonetheless, radio also contributed by separating organisations as suggested by security supporters utilising their frequency spectrum.

6.3.3 Person Tracking

Radios served to share oral information and to share audible information that subsequently helped with identifying individuals involved in the information sharing process. This capability of radios enabled the identification of the user at a determined time (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005). It also aided to uncover what is going on with actors without giving this information explicitly. For example a member of the security company in concerts commented that

> in an incident, nobody had been noticed that a guard (*security supporter*) was asking for support creating noise (*the actor was using the Morse code*). After three reports (*every hour, guards should report their situational assessments to C2- command area-*), they (*personnel from C2*) understood what happened with him. His supervisor went to his position and found him injured…He was using the radio frequently creating noise for asking for support from C2…Another situation happened when young guards were playing with the frequency creating noise (*continuous interruptions in the radio frequency spectrum*). As a consequence of these problematic situations, supervisors and managers decided to buy a radio tracker to visualise who was using the frequency over time. Each radio has a number that helps to identify the user within the venue. This also helped to detected who was playing and being noticed what was going on in every area (*Security company,e3,23Oct2010,security supporter, operational*)

Individuals created noises for trying to gain the attention of the C2 to receive adequate support and for producing noise as a game interfering the routine operation. Thus, findings suggest that radio can help in identification of individuals or users involved in context. Hence, the lack of this technical characteristic can generate tensions and contradictions in context.

6.3.4 Reliability

A primary characteristic of radio is mobility. This is in relation to the capacity of being geographically independent (Makimoto and Manners, 1997). However, technical limitations included in mobility were uncovered when in

certain situations radios failed. This was elucidated and confirmed when individuals utilised complementary hardware. For instance, a member of the Red Cross revealed that

> we had radios, but we did not bring headsets. As a consequence of the volume of the music, we (*safety supporters*) did not hear well. Sometimes, we brought the headsets, but we cannot hear everything. We did not clearly listen to C2 (*command area*) or everything is modified. In certain situations, we arrived to a place where paramedics (*safety supporters*) were located and brought wrong things which were not asked for those paramedics. This was because several paramedics were positioned in corners near to the loudspeakers (*Voluntary group red cross,e40,08Feb2011,safety supporter,tactical*)

While radios gave the chance of being in the middle of information flow and faciltated information sharing, radios failed when information was not correctly transferred. That is, information was distorted when individuals intended to share information to each other. This technical problem is categorised under the term reliability. Reliability “is a network’s ability to perform a designated set of functions under certain conditions for specified operational times” (Snow, Varshney and Malloy, 2000, p.49). Thus, is unreliability led to innefectively information sharing. In addition, the use of radios uncovered other characteristics of this technical problem in relation to the areas where venues are located. For example a member of the firemen in concerts stated that

> events were carried out in diverse venues of the city. This depended on the type of event and its capacity. Although, certain venues are situated in the centre of the city, radios did not function well. In this area, frequencies are saturated. This is normal that all organisations (*security and safety responders and supporters*) used the frequency at the same time...In these cases, the radio failed and we used mobiles as substitutes (*Firemen,e49,24Feb2011,safety responder, tactical*)

Radio mediated and controlled information sharing; but technical characteristics as reliability should be considered. This can aid by reducing the limitations in using radio in location where the conditions are challenging. The lack of reliability can generate tensions and contradictions in its use.

6.3.5 Discussion on Findings of Radio

Radio was identified as a material tool used to mediate and control information sharing between individuals and their organisations. Findings suggest that it was the principal material tool used in context, it was because it facilitated the synchronously information sharing between those individuals collocated or distributed in context permitting back-and-forth interactivity at unscheduled and unpredictable times (Bolstad and Endsley, 2005; Bolstad and Endsley, 2003). In addition, it permitted to form knots within the risk system deployed in major events. These organisations were tied and untied in relation to incident management. Moreover, discoveries suggest that having multiple frequency spectrums produced tensions and contradictions. Interoperability as radio capability allowed the use of those multiple frequency spectrums for reducing them. Furthermore, findings suggest that reliability and person tracking are capabilities that radio should have.

6.3.5.1 Diverse Frequency Spectrums

Multiple frequency spectrums in the risk system were discovered leading to tensions and contradictions in context. Each frequency was utilised by at least one organisation. According to the Estados-Unidos-Mexicanos (2012), it is suggested that in incident management an effective organisation should take a military form in which its direction and control is centred on the incident command and control for coordinating and controlling the rest of the participant organisations and their personnel. However, two types of incident commands were found in relation to information sharing. One facilitated information sharing and the other, restricted it (Dekker, 2002; Houghton et al., 2006). They proposed diverse network architectures of incident command where the principal characteristic implied the allowing or not of information sharing. It was found that the source of tensions and contradictions was that incident command without information sharing. This was because participant organisations utilised frequencies that have not allowed information sharing. It was seen when "*an internal frequency which was only used by us (regulators and leaders of safety and security responders). In addition, other organisations (safety and security responders*

and supporters) had their own frequency (Commercial police,e51, 28Feb2011,security responder,tactical)". This has "*generated a lot of tensions with those agencies, they wanted to use their frequencies (Firemen, e49,24Feb2011,safety responder,tactical)*". The mismatch of frequencies originated the failure by using radios in certain situations (Paul et al., 2008a).

Moreover, if an incident command was installed with information sharing, "*the frequency of firemen is the exclusive active frequency (Firemen,e49,24Feb2011,safety responder,tactical)*". This type of command and control area allowed that "*one actor should control and coordinate the organisations managing the incidents (Firemen,e49,24Feb2011,safety responder,tactical)*". Furthermore, it was because "*we (safety responders) tried to use the radio as unique channel of communication (use the frequency spectrum of safety and security responders as unique frequency in major events) (Firemen,e49,24Feb2011,safety responder,tactical)*". Therefore, it is suggested to investigate what is the best form of the incident command and control area that allows information sharing, to what extent organisations are disposed to be involved in that incident command and control area, how information should be shared in order to tie and untie individuals and their organisations without producing tensions and contradictions and how information sharing practices could be effectively and efficiently improved in the incident command and control area.

6.3.5.2 Interoperability

Nonetheless, here in this type of incident command in which information sharing was allowed, interoperability played an important role. This is in relation to the technological capability of radio to switch between diverse frequency spectrums (Timmons and Hutchins, 2006; Timmons, 2007; Miller et al., 2005). Timmons (2006) argued that interoperability is one step in technological capabilities of radio to facilitate communication (information sharing) between individuals. It was seen when individuals "*arrived to the events, they should change the channel (frequency spectrum of their radios) to the frequency of the events (frequency of commercial division and firemen) (Commercial police,e51,28Feb2011,security responder,tactical)*".

Moreover, this capability tolerated that safety supporters "*listened to our paramedics (safety supporters) and the police (security responders) frequency (Voluntary group red cross,e40,08Feb2011,safety supporter,tactical)*". In addition, interoperability facilitated flexibility in connectivity (Miller et al., 2005) because individuals "*received information from all available sources (Voluntary group red cross,e40,08Feb2011,safety supporter,tactical)*" when they were connected with those frequency spectrums and similarly individuals and their organisations were in "*the same channel (frequency spectrum) (Commercial police,e51,28Feb2011, security responder,tactical)*". Thus, it is proposed to investigate to what extent interoperability allows information sharing, to what extent cognitive radio technology can allow information sharing, are individuals and their organisations capable to use radio cognitive technologies and are they noticed of the advantages on using cognitive radio technology. However, cognitive radio also faces several technical and regulatory challenges before it will be accepted in the public safety sphere (Baldini et al., 2012).

6.3.5.3 Person Tracking

Another capability of radio is person tracking. That is the capability to identify the user of this technology (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005). They argued that this capability permits to identify individuals and to discover the reliability of the information source. It was stated when individuals can "*visualise who was using the frequency over time (Security company,e3,23Oct2010, security supporter,operational)*". Findings suggest that this capability permitted to identify the source of "noise". However, this noise enabled the discovery of one individual who "*was asking for support (Security company,e3,23Oct2010,security supporter,operational)*". Moreover, radio with this capability allowed the location of those actors who were "*playing with the frequency…(continuous interruptions in the radio frequency spectrum) (Security company,e3,23Oct2010,security supporter,operational)*". In both cases, tensions were generated by noises. Nonetheless, individuals in the command and control area were not capable to decipher the meaning of the information included in the "noise" that was recurrent. In the second case,

radio allowed the location of individuals who were playing with the frequency. For this, additional investigation is recommended to understand how this capability enables the information sharing process, what elements are considered in that process, to what extent this capability is added to radio, and how individuals create and maintain shared situational awareness with basis on this capability.

6.3.5.4 Reliability

Another factor in consideration was reliability. This was in relation to the abilities of radio to perform determined functions in certain conditions of the routine activities (Snow et al., 2000). These researchers argued that mobile technology should be reliable in terms of permitting mobility to users but at the same time to perform under conditions stated in mobility. For instance, radios permitted users to arrive "*to a place where paramedics (safety supporters) were located (Voluntary group red cross,e40,08Feb2011,safety supporter,tactical)*" to give support. However, in "*certain venues…radios did not function well (Firemen,e49,24Feb2011, safety responder,tactical)*" stopping or interfering information sharing. It was inferred that some venues offered challenges to radios performing well. Another example is when individuals "*cannot hear everything (Voluntary group red cross,e40,08Feb2011,safety supporter,tactical)*" in information sharing. They "*did not clearly listen to C2 (command area), or everything is modified (Voluntary group red cross,e40,08Feb2011,safety supporter,tactical)*". This led to tensions between individuals because they have "*brought wrong things which were not solicited by those paramedics (Voluntary group red cross,e40,08Feb2011,safety supporter,tactical)*". Consequently, it is suggested that additional research on investigating how individuals perceive reliability and in what terms, to what extent reliability affects information sharing and in what conditions, and how actors remedies interruptions in information sharing.

In conclusion, radio as a material tool mediated and controlled information sharing in context. Radio enabled synchronously information sharing between collocated or/and distributed individuals at unscheduled

and unpredictable times permitting back-and-forth interactivity (Bolstad and Endsley, 2005; Bolstad and Endsley, 2003). Findings suggest that radio permitted interoperability enabling the changes between frequency spectrums (Timmons and Hutchins, 2006; Timmons, 2007; Miller et al., 2005); was reliable under conditions of user mobility (Snow et al., 2000), and was identifiable to be aware of what actors were utilising radio (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005). To put it briefly, evidence showed that the radio is likely to facilitate and regulate information sharing for creating and maintaining shared situational awareness in context.

6.4 Summary of Tools

Tools mediating and controlling information sharing were presented. Findings suggest that individuals in context utilised abstract and material tools. Furthermore, it was uncovered that “with good communications and supporting technologies, cases in which different pictures exist of the same situation will be revealed so that the team can take steps to gather information or work to resolve differences” (Endsley and Jones, 2000, p.48). In addition, these tools enabled the understanding of the information practices of individuals and their organisations (Pilerot and Limberg, 2011). Moreover, those tools shaped activities of individuals and activities similarly shaped the use of those tools in the routine activities. Additionally, the use of tools “impose rules and constrains as well as affordances” (Pilerot and Limberg, 2010, p.330), which mediate or control activity (Allen et al, 2011).

Situational awareness as an abstract tool was employed to mediate and control information sharing for creating shared situational awareness in others. Individuals obtained information from context and its elements (Sonnenwald et al., 2004). This information provided meanings (Flach, 1995; Gibson, 1983; Gibson, 1986), that consequently facilitated the adaptation of individuals to the context (Smith and Hanckock, 1995) providing a basis to project future states of the situations (Endsley, 1995), which subsequently served to included other individuals utilising information sharing (Costello et al., 2006; Milham et al., 2000; Cuevas and Bolstad, 2010; Millward, 2008).

The evidence provided foundations to argue that situational awareness is likely to mediate and control information sharing for creating and maintaining shared situational awareness in context.

Codes as an abstract tool were employed to mediate and control information sharing in context. Codes were described as a common language (Ellis, 1992), but non-existence of a common language can lead to difficulties between individuals and their organisations (Manoj and Baker, 2007). Findings suggest that use of multiple codes led to misundestandings (Ley et al., 2012) and to over-use the resources (Michael and Sporer, 2005; Sporer et al., 2007) leading to additional challenges. In addition, if individuals did not learn those codes, this can lead to misunderstandings (Ley et al., 2012; Shattuck and Woods, 2000) for mismatching the codes and their significances leading to misunderstandings (Ley et al., 2012; Shattuck and Woods, 2000) and misinformation (Manoj and Baker, 2007; Neubig et al., 2011). The evidence provided a basis to suggest that codes are likely to mediate and control information sharing for creating and maintaining shared situational awareness in context.

Radio as a material tool mediated and controlled information sharing in context. It enabled information sharing in real time between located or/and remote actors at unscheduled and random times permitting back-and-forth interactivity (Bolstad and Endsley, 2005; Bolstad and Endsley, 2003). Discoveries indicated that radio should be interoperable (Timmons and Hutchins, 2006; Timmons, 2007; Miller et al., 2005); be reliable (Snow et al., 2000), and be identifiable for tracking users (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005). Evidence presented suggests that the radio is likely to mediate and control information sharing for creating and maintaining shared situational awareness in context.

CHAPTER 7
SITUATIONAL AWARENESS MODES

The chapter presents findings in reference to shared situational awareness created and maintained in routine operation and incident management at major events. The findings resulted from the analysis using activity theory of the actions and operations of the shared situational awareness activity as noted in section 4.3.2. This chapter also discusses the research question *how does information sharing influence situational awareness?* The discussion draws upon the current literature related to situational awareness and presents a position in relation to the study findings. The findings suggest that incident individuals require creating and maintaining diverse situational awareness with allusion to their roles. Being or taking responsibility and respecting organisational boundaries gave the point of reference to those entailed in situational awareness. Furthermore, the focussing on certain environmental elements and using particular tools are other points of reference implicitly or explicitly included in that awareness. The initial point in those modes was individual situational awareness as an abstract tool uncovered within ecological (Gibson, 1983; Gibson, 1986; Flach, 1995) and information processing theoretical approaches (Endsley, 1995). Therefore, it is argued that situational awareness modes were crucial outcomes of information sharing in uncovering the proactive and reactive information practice of individuals.

This chapter begins with presenting intra-organisational situational awareness that exhibits compelled awareness by incident individuals using similar tools within their organisations and discarding individuals from external organisations. This is followed by inter-organisational situational awareness which reveals recognition of other skills and abilities required for managing incidents so that organisational boundaries were crossed. Therefore, it describes knotted situational awareness which ties incident individuals forming knots for managing incidents. Those incident individuals

used similar and dissimilar tools involving spectators in certain situations. The chapter terminates by summarising the main themes.

7.1 Intra-organisational Situational Awareness

Intra-organisational situational awareness is the result of information sharing between incident individuals from the same organisations for creating and maintaining a compatible image of the world in context. For instance, the images included the roles of incident individuals who were sharing information with members of the same organisations and impacting on their situational awareness. Moreover, individuals utilised similar tools (situational awareness and codes –abstract-, and radio -material-) in that creation. This was another characteristic of the modes of shared situational awareness.

Findings suggest that incident individuals created shared situational awareness utilising tools used by their organisations. This was stated when they shared information to evaluate incidents. These individuals employed codes and radio for mediating information sharing to create that shared situational awareness that served to evaluate the problematic situations. Moreover, individuals located them and notified to other individuals that incidents were in their area of responsibility. This facilitated the process of information sharing for maintaining that shared situational awareness until the incident was managed. In addition, individuals created and maintained that shared awareness by corroborating the incident status. This also served to anticipate the future states of those incidents so that they can foresee the necessity of additional resources to manage those incidents.

7.1.1 Evaluating Incidents

Individuals employed information sharing for creating and maintain a shared situational awareness in incident management and the tools played a relevant position. For example, tactical individuals solicited information from the incident to operational individuals deployed in the incidents. These encapsulated the situational information in codes to present that evaluation of the incident and used radio to share them. In this particular incident

individuals used the 10 codes and a frequency spectrum of radio designated to be used by them. Subsequently, the tactical individuals decoded information recognising the codes and their meaning, as stated in sections 4.2.1 and 6.2. A member of the safety responders in concerts stated that

> during incidents, I (*tactical safety responders –firemen-*) should solicit information from the problematic situations. When …I asked them (*to operational safety responders*) about their 10-5 (*it means: what are the actual work conditions?*). If they answered me that was completely 10-5, I understood that they were fine. However, if they answered that were 10-8 (*revising actual work conditions*), I knew that they were in trouble. ...I knew people and distinguished when they were skilful on their jobs. In occasions, they said that were in 10-5, but the tone of their voice told me another thing. I distrust and approached to the problematic area to corroborate if they were not in danger (*Firemen,e44,21Feb2011,safety responder,tactical*)

Tactical safety responders made decisions once they received an evaluation of the incidents from operational individuals. Nonetheless, the evaluation included situational information and its implications denoting emotional states, not touched on this research for ethical reasons. Another element was the recognition of skills and abilities of those individuals denoting capacity for managing incidents. Consequently, this led to make informed decisions by approaching or not to the area where the incident was in course. This can generate tensions for distrust to each other.

7.1.2 Locating and Noticing Incidents

According to the risk system, a certain number of individuals were located in venues and others patrolled so that they can continuously create situational awareness. For example, it was also observed that single or paired security individuals were located in specific areas or doing patrols. These individuals proactively shared their situational information for creating common pictures about what was going on in context. Thus, a shared situational awareness was created and maintained during the routine operation. However, when security individuals discovered unusual behaviours within the crowd, they tried or created compatible pictures for other individuals so that they can

manage the incidents. In this line a member of the security responders in concerts commented

> I (*tactical member of security responders –commercial police-*) preferred to be alone (*in major events)*. If I discovered abnormal behaviours within the crowd and, as I knew where others (*tactical and operational members*) were located, it was usually that they were near to this problematic area, so I called (*using radio*) them and said that they had a problem (*which was required to manage*). Sometimes they (*operational members*) did not answer me, thus I had to approach this area. Once I stayed there and found those officers (*operational members*) in the area, we stayed in touch until the incident was managed (*Commercial police,e50,26Feb2011,security responder, tactical*)

` Here, the tactical individuals tried to share information with those individuals located near to the problematic situations. The goal was to notify the incident, but the radio failed so that they can approach and look for the individuals who would manage the incident. Once they were notified of the situation, it was expected that they maintained a shared situational awareness until the incident was managed. Tensions can be generated by using unreliable tools.

7.1.3 Updating Outcomes of Incidents

Individuals created and maintained shared situational awareness during routine operation and incident management; however, it was usual that tactical members solicited additional situational information from operational members. Specifically, they solicited their situational evaluations so that they can discover future states of the situations. These states served to uncover additional resources required for managing the problematic situation. In this respect, an operational member of firemen in concerts commented that

> some captains of firemen (*tactical members*) liked to receive support from other firemen located in the incident. They should ask others about projected status of the situation; or if we (*operational members*) would require (*additional*) resources to manage the incidents. These questions generate disturbances in our tasks. Tactical members gave only orders so that we (*operational members*) also expected orders; but they solicited our opinions (*Firemen,e48,24Feb2011,safety responder,operational*)

However, the action of asking for additional information generated tensions between individuals. It was expected that tactical members gave orders and operational personnel received so that these can manage the incident. For instance, as each member created their individual situational awareness, operational personnel preferred to use that situational awareness created and shared by tactical members. Consequently, creation and maintenance of shared situational awareness between the majorities of members was a challenge for involving responsibility and authority. In addition, the shared situational awareness comprised the abilities and skills required to manage the incidents. It also implied the capacity for projecting future states of incidents. For this, it was important to share situational awareness with the command areas of their organisations because they can infer the necessities of support. For example, an operational member of the Civil Protection Department in concerts stated that

> when they (*members of voluntary groups*) were involved in incidents and discovered that they were capable for solving the incidents…; however, they should think in the subsequent stages of the incidents. These stages should be notified to C2 (*command area*). They should notify that they were capable to manage incidents and those subsequent stages of the situations…These helped to understand what was in course. Those individuals should also think on those stages to offer support. …Nonetheless, they did not say anything (*Civil protection department,e9,28Oct2010,regulator,operational*)

As certain individuals were incapable to provide those future states, the command areas were not supporting them. Individuals believed that they can manage the incidents with the resources deployed. Here, the achievement of roles was a priority. For example, the operational members were focused on managing the incident, while tactical members were creating and maintaining continuously shared situational awareness to anticipate future states of situations. This implied that tactical members should support the operational members by creating and maintaining shared situational awareness with personnel from the command areas. Specifically, they were focused on offering security and safety to operational members in incident management meanwhile those were managing the incidents. A member of firemen in concerts said

> the captain (*tactical member of firemen*) in charge had to be immersed in incident management. The motorist (*driver of the fire fighter*) should be free to communicate with C2 (command area) what happened and to ask for additional support if captain considered important. The motorist should also be alert about what was happening…During incidents, both actors were obtaining data from the incidents, projecting the situations while others were immersed in their management. They should be aware of potential factors which may affect us (*operational members of firemen*) (*Firemen,e47, 23Feb2011,safety responder,operational*)

The roles of those individual were clarified in context exhibiting diverse states of shared situational awareness in the same organisations. It was included in requirements for information by each individual at operational and tactical levels and by the command areas. Specifically, the requirements involve security and safety issues in context. Contrarily, in other situations, certain individuals exhibited a lack of information sharing and consequently a lack of shared situational awareness. In a manner of detail, certain tactical members were focused on incident management because they believed that they can manage the incidents, but the incidents can be more demanding than the resources deployed. Thus, when they asked for support from the command areas, they shared incomplete situational awareness not achieving shared situational awareness and the resources provided were incomplete. A member of firemen in concerts revealed that

> some captains (*tactical members of firemen*) are open-minded, but there are few. Contrarily, there are others who are closed-minded. They did not say anything during the incidents. Here, there was another problem when they notified to C2 that they were capable to manage the incidents, but additional resources were not sent to backup them. Later, incidents were bigger and exceeded the capacity installed (*for managing the incident*) (*Firemen,e45,21Feb2011, safety responder,tactical*)

Nevertheless, the absence of the ability to project future states of incidents generated tensions between the tactical individuals and the command areas. This was stated as not backing the individuals managing the incidents. The reason was not sharing pertinent information so that individuals from the C2 created incomplete shared situational awareness.

Specifically, tactical members were not asked for those additional resources to the C2.

7.2 Inter-organisational Situational Awareness.

This type of shared situational awareness was created and maintained between individuals from diverse organisations deployed in context. It also facilitated the control and coordination of those individuals in context. The individuals employed information sharing for creating compatible images of the world, performing their roles for achieving organisational goals. Similar and dissimilar tools were employed by them and organisational boundaries were crossed when individuals shared situational awareness between them.

Findings suggest that individuals acquired situational information facilitated by other individuals from other participant organisations creating shared situational awareness. This was done by confirming their relationships between them and their organisations. Moreover, individuals created shared images by evaluating the incidents and by recognising the future states of those incidents; here, information sharing was crucial. Furthermore, information provided created shared situational awareness uncovering individuals immersed in incident management. These individuals were considered skilful so that other individuals can infer the future states of the incidents expecting favourable results in incident management. In addition, the creation of shared situational awareness including the evaluation of actions in incident management is a challenge. Here, the interactions were put as a priority for facilitating that creation.

7.2.1 Facilitating Information Seeking in Incidents

There were incidents in which diverse organisations converged to manage them. Individuals suggested that they were required to share information for creating and maintaining shared situational awareness from incidents. This was facilitated if the individuals knew each other; otherwise, the information can be provided by command areas delaying that creation. It is important to remark that individuals were relevant elements in that shared situational

awareness. For instance, a member of the Red Cross in concerts suggested that

> when we (*Red Cross*) arrived to the incidents, I (*a tactical member*) like to chat with some firemen and rescue members (*safety responders and supporters*) about the situation. If I have good relationships with these members, it would be easy to be aware what happened...Otherwise, I could wait until information comes from C2 or elsewhere (*Voluntary group red Cross,e41,09Feb2011,safety supporter,tactical*)

Nonetheless, the process of gathering information for creating that shared situational awareness was conditioned by the existing relationships between individuals deployed in the incidents. This similarly suggested that information was informally gathered in face-to-face interactions and using natural language in those interactions. Thus, it facilitated the creation of shared images requiring less time; contrarily, individuals can spend additional time if information is provided by the command areas.

7.2.2 Evaluating Incidents

Multiple organisations were notified that an incident was in course so that they approached to this area. There, individuals created their individual situational awareness required for choosing an effective procedure to manage the incident. Nonetheless, it was important that individuals created shared situational awareness for agreeing the procedure, otherwise they can spend time on this creation so that they can forget their goal of managing the incidents. In this line a member of firemen in concerts commented that

> during a concert there was an unconscious person in the field. Two teams of rescue groups *(members of two voluntary groups)* approached to this area and tried to nurse her. They firstly conversed and agreed what organisation (*or group*) should care of her. They did not comprehend that she required oxygen. We *(firemen)* arrived and agreed to extract her to a safe area…They did not understand that something could happen if this person continued without care (*Firemen,e4,21Feb2011,safety responder,tactical*)

It was suggested that individuals lost their individual situational awareness for being located near to the casualty and impeding her as she

took oxygen. Thus, it was required to arrive at another type of organisation to take the control of the incident. These individuals notified the oxygen requirements of the casualty and provided convenient care. On the security side, two elements were relevant for creating shared situational awareness with Police officers. It was usual that they told others that they used guns and can arrest people. Thus, individuals considered these elements when they managed the incidents. For instance, a member of the Commercial Police in concerts stated that

> we (*operational and tactical members of security responders*) supported the guards (*operational and tactical members of security supporters*) when they asked for support. Specifically, in those situations which guards cannot restrain the public. We entered with precaution because we use guns and some spectators may take them away…These situations generated tensions with spectators and other agencies (*or participant organisations*)…Sometimes we cannot get into the ambulances of altruist organisations because we used guns what it was noticed by those organisations (*Commercial police,e50,26Feb2011,safety responder,tactical*)

Despite Police officers remarking that they supported the guards (security supporters), the tasks were done in consideration of using guns that can be taken by the public. Thus, this provided additional challenges for creating shared situational awareness with those who asked for their support.

7.2.3 Uncovering Skilful Individuals in Incidents

It was usual that individuals exhibited the relationships resulting from past interactions within the emergency management in cities. These interactions and relationships exhibited the knowledge, skills and abilities that individuals had which were recognised in context. These consequently facilitated the creation of shared situational awareness between them. A member of firemen in concerts said at this respect

> if I listened to Red Cross (*a voluntary group*) that they will manage the incident and specifically those paramedics I knew, I would be calm for this. These paramedics are skilled people; however, sometimes they were not labouring. Red Cross had a lot of voluntaries, but we do not know how voluntaries nurse. In addition, if I see how other voluntaries

> (*safety supporters*) laboured, I could infer that there is a lack of skills and abilities to nurse...That happened to me the last time that we laboured together. They changed the procedure to nurse (*Firemen,e45,21Feb2011,safety responder,tactical*)

The recognition of skills and abilities of other individuals managing incidents can give confidence because certain individuals can project the futures states of incidents focusing on those expected results. However, this recognition can lead to tensions between individuals, uncovering the lack of skills and abilities by following procedures in incident management. This served to discover inclusively the differences on creating individual situational awareness for not matching the procedures with the incidents. This means that individuals can create individual shared situational awareness, but this cannot help in choosing appropriate procedures for managing the incident.

7.2.4 Evaluating Procedures in Incidents

It was common that individuals followed certain procedures in incident management. These procedures were previously agreed between individuals so that when they were managing an incident they tried to match the incident with a procedure. Nonetheless, the procedures were in general terms so that in practice they were commonly changed. Here, the initial stage is the creation of individual situational awareness providing the pertinent information on that matching. Subsequently, this served to create the shared situational awareness with other individuals. In this line a member of firemen in concerts stated that

> when we decided to do things, we always were thinking on doing the correct ones...in incident management we should check if injured people did not present internal problems... A general procedure point out that patients should be immobilised prior to be moved...but, for example, they (*members of the Red Cross*) came down patients from vehicles, when one of them had a broken leg...these kinds of actions provoked conflicts with them. In occasions, if firemen understood what happened, we (*all individuals managing the incident*) should agree to follow the procedure learned to nurse. We do not want to cause more damage to the casualties (*Firemen,e45,21Feb2011, safety responder,tactical*)

While those individuals created a shared situational awareness, they agreed the procedure for managing the incident so that they can minimise the damage of casualties. Thus, individuals created shared situational awareness with others to manage effectively and efficiently these incidents.

7.3 Knotted Situational Awareness

This mode of shared situational awareness was the result of information sharing utilised for involving individuals and their organisations and the public. This type awareness included the intra- and inter-organisational situational awareness which subsequently involved the public being an active participant in the incidents. Furthermore, it was created to achieve organisational goals and the aims of major events. Here, the organisational boundaries were crossed for being responsible and individuals used principally their individual situational awareness for creating shared situational awareness in others.

Findings suggest that individuals utilised dissimilar tools and actions of information sharing that commonly were not employed in the past shared situational awareness. For instance, the creation of shared understandings in incidents was employed to highlight policies that can constrain future states of major events. In these incidents, it was usual that individuals involved the public notifying those policies. Moreover, individuals for creating shared situational awareness along the venues, they proactively gathered situational awareness utilising all available abstract and material tools in context. This included the tools employed by them and from other organisations. Moreover, individuals created shared situational awareness with individuals from the same and other organisations and the public including criteria for managing the incidents. The criteria were principally utilised to emphasise diversity of that awareness in context. In addition, shared situational awareness was created to uncover other individual awareness which served to discover diverse course of actions in incident management. The majority of that situational awareness contained the

recognition of future states of incidents which were utilised to create shared situational awareness in other individuals.

7.3.1 Noticing Policies in Incidents

Individuals created shared situational awareness required to manage incidents involving individuals from same and other organisations and the public. This was with the aim for managing effectively the incidents. In those situations, the individuals created their situational awareness that contained characteristics of the incidents and their related policies. Thus, in order to manage the incident, they shared these with individuals involved in the incident. Regularly, the regulators and supporters shared these with the public. For instance a member of the security department in baseball matches in city 3 suggested that

> during a fight between baseball players in field, some spectators jumped the fence and entered the field. The guards (*operational and tactical members of security supporters*) also entered to protect the baseball players. I (*operational member of security supporters*) dialogued with guards and agreed to form a human fence between spectators and baseball players. We notified to spectators that the fight was only between them (*baseball players*). I also added that we would be involved in administrative problems, if they (*spectators*) hit a player. After the police (*security responders*) arrived to support us (*Security department,e29,02Jan2011,security supporter,operational*)

Although the situation was complex, individuals from the security company shared their situational awareness with the public so the public changed their behaviour. This was also shared with the Police who supported them during this incident. A matter of detail, if there was a fight between players, these were only penalised by the umpires deployed in the fields and if other individuals were involved and hurt baseball players, the local baseball team will be economically penalised and the venue will be banned for subsequent matches. For this reason, the Police were initially excluded to avoid tensions with the public, as commented in section 5.2.3.

Furthermore, there were incidents in which the policies were shared with the public to control them; however, individuals managing them did not

control them. Hence, individuals asked for support from other organisations once the incidents were confirmed. This means that individuals managed the incidents by phases so that they were adding individuals and their organisations over time. Here, shared situational awareness was similarly created with them. For instance a member of Public Relations Department in concerts stated that

> in an event organised by the local government. Many organisations came together. We (*members of regulators*) divided the tasks with/between different teams of regulators and other organisations. The event passed without incidents during five hours. However, in the last hour of the event, two spectators started on yelling to one another. They fought and the disorder began. The guards (*members of the security company*) were not capable to control the fight. Some regulators were involved, but we finally called to the police. They arrested the spectators and controlled the event. One spectator resulted injured, so we solicited the emergency services. Red Cross (*a voluntary group*) arrived and nursed the casualty (*Public relations department,e2,21Oct2010,regulator,operational*)

Here, shared situational awareness was created over time once individuals were uncovering the necessities of skills and abilities in incident management. In those situations, individuals exhibited their roles passing responsibility to other individuals using dissimilar tools and their situational awareness as the principal abstract tool.

7.3.2 Using Diverse Information Sources in Incidents

The individuals were collocated within and outside of venues and others were doing patrols around the venues. All of them created and maintained situational awareness which subsequently was shared in face-to-face interactions or mediated by technology. Here the principal tools were natural language, codes and radio. Although, there were diverse codes and radio frequency spectrums, as stated in chapters 7, certain individuals were capable to create shared situational awareness with individuals from the same and other organisations. They proactively used those tools, as commented by one member of the Public Relations Department in concerts,

> in the events, I liked to be near of other actors (*safety and security responders*). I felt protected by them and liked to listen to police

> (*using their frequency*) to know when they were arresting people…I knew that we were using another frequency…,but I wanted to know what was happening at any time (*Public relations department,e10,28Oct2010,regulator,tactical*)

Creating shared situational awareness was a challenging task because the individuals crossed the organisational boundaries to gather information with this goal. Although, there were clear boundaries, they used their authority to collocate near of them individuals from other organisations so that they can receive fast support in incidents or gather information from other individuals collocated in other areas of venues. For this reason, it was usual that tactical members of organisations learnt the proper languages utilised by other organisations. This provided advantages for creating indirectly shared situational awareness in context.

7.3.3 Noticing Criteria in Incidents

It was usual that in incident management, the individuals signalled the policies for reacting to those incidents. As polices can be interpreted differently in context, the shared situational awareness helped in creating diverse situational awareness. This was because certain individuals considered contextual elements in their situational awareness providing complete images of the incidents. Moreover, they projected the states of the situations in those assessments. Both elements were introduced in the shared situational awareness offering additional information. This aided in the decision making process, but generated tensions between those individuals. For example, a member of the Police in concerts noted that

> in the events, there were minor incidents that we needed to solve fast. For example, if one spectator was nervous or drunk, we can move him/her to another area. However, if the situation was worst for disturbing other spectators, we would ask for him/her to leave from the event. They (*spectators*) refused this notice, but we put more pressure to be out of the event (*Police,e25,28Dec2010, security responder,operational*)

Creating and maintaining shared situational awareness in others was a challenging task, specifically, if the public were included. Moreover,

another tension emerged when individuals added additional elements to that shared situational awareness. For instance, it was usual that individuals mixed the goals of events, the policies and regulations of major events and the social norms in that shared situational understanding. These elements similarly added information to that awareness. Consequently, tensions were generated between those individuals. For example, a member of the Police security responders in concerts noted that

> there is much discretion with citizens. We did not want to be involved in problems with families during the events. For example, there was a family: a mother, a father and their son. The father invited an alcoholic beverage to his son, who was a minor. The son drank with the consent of his father. However, the Regulations Department (*regulators*) said that this situation was prohibited. They (*members of this department*) solicited to us that we should arrest to his father because he was corrupting a minor. We should present the father to the authority…We decided to invite to the family to be out from the event and the problem was finished. We understood that they tried to enjoy the event. In addition their behaviours were according to social norms. They only drank some beers. Nonetheless, the mentioned department started a conflict with us about this situation. They claimed that this family member was breaking the law. After, we received a lot of claim trades about this situation. Unfortunately for them, we agreed the need to increase our criteria in these kinds of situations. In other words to be flexible with them…but only we knew this criteria…Other departments were excluded from the meetings in which we agreed these criteria (*Commercial police,e50, 26Feb2011,security responder,tactical*)

Here, the shared situational awareness was not completely achieved generating tensions between the individuals. These were originated because individuals converged from two organisations with similar organisational goals. The goal of the Regulations Department is to regulate the sale, use and consumption of alcohol in the public places as major events. Contrarily, the goal of the Police is to prevent incidents. Consequently, these individuals can agree a procedure to manage the incident so that the Police officers decided to expulse the public. In further situations, individuals confirmed the projection of future states of incidents and reasons why they come to the event. These elements were included in the shared situational awareness facilitating the incident management. A member of the Police in concerts mentioned in this line that

> in a concert in a big venue, we (*operational and tactical members of security responders*) received a call from the regulator situated in one entrance. He was asking for support because there was a fight outside of the venue. In fact, there were two spectators pushed and insulted to one another. If they (*spectators*) came to enjoy the concert, the idea should be to obtain an agreement between them. We explained this and they were agreed to come back to the concert and enjoy it. The fight was finished and they returned to the venue. Contrary, if a casualty resulted from this fight, we should arrest both and after they would be presented to the authority in order to determine responsibilities. In last case, we do not consider reconciliation between them. We also commented this to them (*Commercial police,e51,28Feb2011,security responder,tactical*)

In these situations, the individuals added other elements to the shared situational awareness which permitted to manage the incident. However, these can generate tensions even though the incidents were managed effectively and efficiently by preventing casualties.

7.3.4 Noticing Courses of Action in Incidents

In certain incidents, individuals created and maintained shared situational awareness with individuals from the command areas notifying that an incident was in course in their area of responsibility. This served to solicit support from other individuals with the skills and abilities required for managing that incident. Once, these arrived, the individuals gave details of the incident creating shared situational awareness in others. This was facilitated in face-to-face interactions helping the decision making process, as commented by one member of security department in baseball matches in city 3

> a spectator threw a rocket. I approached to the guy who used yellow vest *(a member of regulators)* to borrowed the radio and asked for support from my superior (*manager of the stadium*). When they *(manager of stadium and other members of regulators)* arrived, we chatted to know what could happen with this spectator. We made the decision to invite the spectator to be out from the baseball match... That was bothering to borrow the radio each time it was required. Most guys *(members of other organisations)* did not want to lend radios and I did not like to borrow them either (*Security department,e24, 27Dec2010,security supporter,tactical*)

The act of asking for a radio generated tensions between individuals because the security department do not have this material tool so that the creation of a shared situational awareness was delayed. Moreover, two meetings were required to produce that shared understanding delaying consequently the response to that incident.

7.4 The Situational Awareness Modes in Incident Management (SAMIM) Model

Overall, the research findings suggest that individuals were required to create and maintain shared situational awareness at assorted levels and involving diverse individuals and their organisations and sporadically the public over time. These modes of situational awareness resulted from the motivations for sharing information and the use of abstract and material tools in information sharing in the routine operation and incident management at major events. For instance, the motivations were uncovered in the role of individuals, as stated in chapter 5. The situational directive set their motives as the responsibility for being the situational directive in incident management. For this reason, individuals in that role gave orders to control other individuals, provided overviews of the situations passing responsibility on that overview, controlled information to receive additional support, and offered other views to change the course of the actions taken in incident management. Surface credibility laid their motives in the skills and abilities of individuals in incident management. Thereby, individuals as responders and supporters passed their responsibility on to others for discovering the lack of skills and abilities to manage incidents, gave orders to control other individuals, controlled information to control individuals, changed the information flow and the response to the incident. Normative altruism set their motives in the control of altruistic individuals. In that way, individuals as leaders solicited from altruistic individuals their position, sought information from the incidents, controlled information between them, evaluated the incidents, noticed the rules of being voluntary and supported the responsibility by sharing it.

Moreover, the abstract and material tools were discovered in the mediation and control of information sharing in context, as presented in chapter 7. Situational awareness as the principal abstract tool provided understandings or images from incidents. By this means, individuals identified and evaluated the incidents asking for support from other individuals; located unusual shapes and behaviours within the crowd giving orders to other individuals; understood behaviours and states of incidents controlling those individuals who manage them; recognised skills and abilities of individuals for coordinating them, and projected future states of behaviours controlling and coordinating those individuals who supported them in incident management. Codes as an abstract tool facilitated the use of specialised languages. They also serve to categorise the incidents as safety and security and the individuals required to manage them; to engender overspecialisation in the uses of them, and to produce misinformation between individuals for accumulating improper practices. Radio as a material tool assisted with the formation of nested organisations in the risk system deployed in context. Thus, radio utilised multiple frequency spectrums in relation to those nested organisations so that they required interoperable characteristics to move between those spectrums enhancing similarly information sharing between individuals from those organisations. In addition, radio facilitated the tracking of users and uncovered its unreliability in certain areas within venues and areas of cities where venues were located.

Furthermore, the modes of shared situational awareness were the result of diverse interactions between individuals performing their roles and using abstract and material tools in context, as stated in sections 7.1, 7.2 and 7.3. Intra-organisational situational awareness was created and maintained between members of the same organisations and using similar tools in information sharing. In this line, individuals were focusing on the performance of other individuals from the same organisations; the evaluation of incidents; the location and notification of incidents, and the upgrade of outcomes of incidents. Inter-organisational situational awareness resulted from the creation and maintenance of shared situational awareness between individuals from the same and other organisations, utilising similar and

dissimilar tools. Thereby, individuals facilitated the information seeking between them; the evaluation of incidents; the discovery of skills and abilities of other individuals, and the evaluation of the procedures in incident management. Knotted situational awareness was the creation and maintenance of that shared situational awareness utilised by individuals managing incidents and usually involving individuals from the same and other organisations and the public. Thus, individuals achieved their roles and used similar and dissimilar tools for noticing policies and regulations related to major events and incident management; for using diverse sources of information; for noticing criteria in relation to contextualising those policies and regulations related to major events and incident management, and for noticing courses of action in incident management.

These findings served to propose the Situational Awareness Modes in Incident Management (SAMIM) Model. This model is developed for continuing the development of the “interwoven situational awareness”, term coined by Sonnenwald and Pierce (2000), discussed in section 2.3.3.4. Moreover, this also exhibits the necessities of incident responders for creating and maintaining diverse shared situational awareness demanded in context, as shown in figure 7-1. This was because incident management was characterised for being in a time constrained, uncertain and complex environment and for tying and untying individuals from same and other organisations and occasionally the public. Individuals also used similar and dissimilar tools to facilitate information sharing employed on that creation.

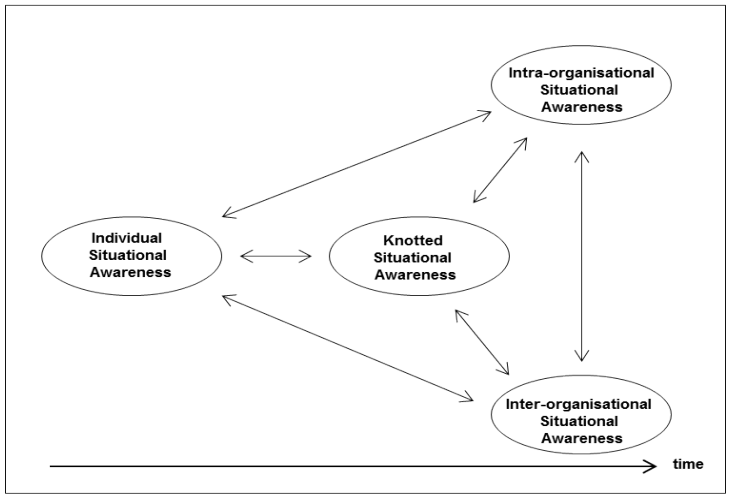

Figure 7-1 The Situational Awareness Modes in Incident Management (SAMIM) Model

This model integrates essential findings mentioned above. It started with recognising that individual situational awareness was created and maintained by each individual who participated in the major events. Certain individuals were collocated and others were doing patrols along the events over time. Their positions and movement helped for creating and maintaining their situational understanding. These were focused principally on appreciating their roles and tools which can be used to share information within the risk system. Being aware of their role, the role of others and what abstract and material tools can be utilised for sharing information were included in the initial stage of that understanding positioning individuals at the centre of their surrounding environment. Thus, they started on discovering the environmental elements included in their responsibility area. This helped on evaluating the incidents for putting attention by corroborating if there was an incident or not and by discovering risks in the incident and what skills and abilities were required to manage incidents. It also served to locate those unusual shapes and behaviours within the crowd permitting to solicit support from those individuals near to those areas in which these shapes and behaviours were. Both evaluation and location of environmental elements were related with the stages of perception of environmental elements and comprehension of their meaning in terms of context (Endsley, 1995). Furthermore, it aided in evaluating the performance of individuals and the states of incidents. This was done in recognition of the policies and regulations related to major events and emergency management in the routine operation of cities. In addition, it provided an image of the recognition of the skills and abilities of other individuals performing their role in incident management. This assisted with the evaluation of the performance of those individuals. Here, the evaluation of performance of those individuals and situations and with the recognition of policies and regulations were associated with the stages of the comprehension of meaning of environmental elements and the projection of futures states of the situation in the situational awareness demanded in context (Endsley, 1995).

After, situational awareness triggered information sharing, providing foundations of shared situational awareness with and between individuals

from same or/and other organisations. As noted in chapter 5 and 6 relating to motivations for sharing information and abstract and material tools respectively, individuals shared information in relation with the information requirements of those individuals with the skills and abilities required to manage incidents and using associated tools with their role in context. They consequently created three modes of shared situational awareness with those individuals tied in context. For example, the safety individuals used one frequency and the “A codes” meanwhile the security individuals utilised another frequency and the “10 codes”. In case of the management of safety incidents, the safety individuals used their assigned frequency and the “A codes” as proper language. In addition, they shared individual situational awareness taking the form of information for creating shared situational awareness with other individuals from the same organisation. Similarly, if safety individuals were managing the incidents and discovered unsafe conditions in context, they can share their situational awareness with security individuals utilising the “A codes, 10 codes or the natural language” and the radio served to decode the radio frequency used by those individuals. It is important to remark that in the case of knotted situational awareness, individuals employed the last stage of situational awareness which is related to the prediction of those variables affecting the projection of the future states of situations. For this reason, individuals revealed the policies and regulations concerned to major events and emergency management and the other contextual elements under the name of criteria for managing incidents.

7.5 Discussion of Findings on Situational Awareness Modes

The research question *how information sharing influences situational awareness?* is discussed in this section. The findings suggest that individuals required two types of situational awareness in routine operation and incident management at major events. One of them was the picture formed individually from the situations where individuals were immersed. Individual situational awareness or situational awareness was treated in chapter 6 as an abstract tool and served to mediate and control information

sharing for creating and maintain shared situational awareness, the second tone. This awareness was created with/between individuals interacting in context and three types of shared awareness were discovered: intra-organisational, inter-organisational and knotted situational awareness, as stated in sections 7.1, 7.2 and 7.3 respectively.

These types may look similar to the types of situational awareness found by Sonnenwald and Pierce (2000). However, these researchers argued that individuals from command and control areas in the military created and maintained an interwoven situational awareness to facilitate the completion of their tasks. This interwoven awareness included individual, intra-group and inter-group situational awareness. In this line, they pointed out that individuals in command areas were located near to each other, used similar tools and performed roles to achieve organisational goals. For this reason, it is important to remark that the same researchers suggested that information sharing played an important role to create and maintain the intra-group and inter-group situational awareness, considered similarly as types of shared situational awareness. The intra-group situational awareness was that shared understanding between individuals located within the command areas and personnel deployed in other areas. The intra-group situational awareness was that shared understanding between individuals, groups and teams within command areas and the battlefield.

Nonetheless, findings of this research uncovered that interwoven and knotted situational awareness have differences in essence. The differences were principally in four aspects: the context of study; the roles on achieving organisational goals; the location of individuals and the uses of tools for sharing information. To emphasise their importance, these aspects served to frame the discussion presented below.

7.5.1 Context of Study

Both interwoven and knotted situational awareness facilitated the completion of tasks in the military context and in the routine operation and incident management at major events respectively. For instance, the military context was considered time constrained, uncertain and complex for the continuous

change of situations making it difficult to gather appropriate information to respond appropriately in minimal time (Sonnenwald and Pierce, 2000). On the other hand, the context treated in this thesis, its tasks fit unexpected routine and contingent problematic situations or incidents where new information was generated over time. This information was consequently shared under volatile requirements of information that changed over time. For these reasons, both contexts were considered similar.

However, the theoretical frameworks utilised to study both contexts correspondingly differed. Sonnenwald and Pierce (2000) proposed a framework to enhance situational awareness in collaborative environments in which technology played a relevant role for supporting the human information behaviour. That was principally focused on the interaction between information systems (material tools) and users (individuals) so that these facilitated the acquisition and dissemination of information in context. That research additionally considered aspects of training and organisational structures. Contrarily, this research utilised activity theory as a framework in which information sharing was considered as the activity that individuals performed for creating and maintaining shared situational awareness in context. This framework also provided additional elements in consideration of this collaborative context. For instance, these were the rules and norms of interaction between individuals, the community and division of labour contributing to the discovery of particularities in the shared situational awareness. In addition, these elements were included in the intra-organisational, inter-organisational and knotted situational awareness. Moreover, information sharing was considered as the principal activity directed for creating and maintaining those shared understandings. Here, abstract and material tools were considered in information sharing, as discussed in chapter 6, excluding training as an abstract tool. Moreover, situational awareness was included as an abstract tool in the information sharing activity system, presented in section 6.1. To sum up, this frame provided a holistic snapshot of how information sharing influences situational awareness in context, as depicted in sections 3.2 and 4.3.

7.5.2 Roles Achieving Organisational Goals

In reference to the roles achieving organisational goals, the research done by Sonnenwald and Pierce (2000) studied only one organisation and, in contrast, this research considered multiple organisations that were tied in context. For instance, Sonnenwald and Pierce (2000) studied diverse roles of individuals within the same organisation. In other words, the different roles of individuals in the command areas of the military were investigated and were categorised as tactical and operational personnel. Similarly, the roles were performed by individuals who accumulated experiences in real and simulated scenarios of the military. In addition, each individual enabled and required diverse types of shared situational awareness in relation to their roles and interactions with other individuals. These interactions generated diverse shared situational awareness denominated intragroup (same teams or groups), intergroup (across teams and groups) and interwoven (a dense net of shared situational awareness). In fact, interwoven situational awareness was considered as a tool facilitating the completion of tasks because those individuals gathered pertinent information so that this information was used to perform their roles focusing on that completion.

On the other hand, this research involved individuals from diverse organisations who were tied in context. Those organisations were categorised as regulators, safety and security responders and supporters in relation to their organisational goals. Each organisation made clear their goals overlapping across them, depicted in sections 4.1 and 4.2. Although, those individuals performed their organisational roles, they mentioned that they occasionally supported individuals from other organisations so that these experiences facilitated or interrupted their interactions with/between them. This also permitted that individuals knew each other and respected those abilities and skills required to achieve their organisational goals. Similarly, this facilitated the completion of tasks because individuals shared information between them. That information included what skills and abilities were required to manage the incidents, details of the incidents and location of those incidents. In addition, this research involved individuals representing diverse organisations and some of them performed two or three roles at the same time in other organisations. This research also comprised tactical and

operational personnel of safety and security organisations, stated in sections 4.1 and 4.2 . These personnel exhibited experience in major events and in emergency management of routine operation of cities providing additional richness to this research.

7.5.3 Location of Individuals

The research done by Sonnenwald and Pierce (2000) emphasised the location of individuals in the command areas and those individuals located in the battlefield as a crucial element for creating shared situational awareness. Their locations permitted to exhibit the formation of groups and teams within the command areas in which the groups were elements of the teams and certain teams were located in specific areas in the command areas. Moreover, this clarity on locations facilitated the face-to-face interactions between them (Sonnenwald and Pierce, 2000). For instance, that was seen when the researchers stated that individuals require individual, intragroup, intergroup and interwoven situational awareness in order to complete their tasks. These researchers pointed out that the intergroup situational awareness included two types. One of them was in reference to the intergroup situational awareness across teams; and the second one was in relation to intergroup situational awareness across groups.

Alternatively in this research, fixed locations and doing patrols were two types of positions considered. That was certain individuals were positioned in fixed areas in venues and others were patrolling the venues over time. These consequently facilitated the face-to-face interaction and in certain situations, these interactions between the individuals collocated and doing patrols were mediated by radios (material tools). As a result, diverse shared situational awareness was formed at intra-organisational, inter-organisational and knotted levels. This showed that individuals required interacting with other individuals from different organisations to perform their roles achieving the organisational goals. It is important to remark that knotted situational awareness was interestingly related to the formation of knots. A knot is a type of emergent organisation where authority and responsibility is diluted between the individuals converging in that

organisation (Engeström, 2008). The knot served to point out that individuals were tied for managing incidents, but once it was managed, those individuals were untied. Those knots included interactions between individuals from same organisations, other organisations and the public. For this reason, this type of shared situational awareness resulted as the most complex task in incident management because individuals should exhibit mastery for using abstract and material tools by performing their role, as presented in the next section.

7.5.4 Uses of Tools

The research done by Sonnenwald and Pierce (2000) included tools which mediated information behaviour towards situational awareness. In general, these tools were the proper language of the military, experience of individuals in diverse real and fictitious scenarios, training and division of labour, information systems and radio. These suggested that they helped in providing and disseminating diverse types of information demanded by individuals. Moreover, these researchers pointed out that information sharing was a proactive act of individuals in context, but when this act was not performed, negative outcomes should result as the increase in the number of casualties in the battlefields. In addition, they mentioned that tools served to facilitate and mediate information sharing between those individuals. For example, the use of same terminology facilitating the understanding of situations within the command areas and the battlefield. Another illustration was the uses of detailed information that was shared between the individuals in an n-way information flow enhanced by the use of radio. Here, it was assumed that radio was only employed with one frequency spectrum facilitating and controlling information sharing for creating shared situational awareness between individuals collocated in the command areas and those on the battlefield. Similarly, the concept of contested collaboration coined by Sonnenwald (1995) was another example to uncover that diverse tools were required to create and maintain shared situational awareness. In this line, Sonnenwald and Pierce (2000) argue that contested collaboration “may seriously degrade team performance” (p.475) by impeding information sharing in context.

On the other hand, in this research it is argued that contested collaboration does not only degrade performance but also was the source of tension and contradictions between individuals. As stated in previous chapters, the tensions and contradictions served as a basis for discovering the motivations for sharing information and the tools that mediated and controlled information sharing, as noted in chapters 5 and 6 respectively. For instance, tensions and contradictions found in the diverse interpretations of the rules and norms and in the division of labour helping for uncovering the motivations for sharing information. Furthermore, tensions and contradictions aided for discovering the preference of individuals to be involved in face-to-face interactions rather than mediated interactions. Consequently, this impacted on the formation of shared situational awareness in context.

Similarly, tensions and contradictions helped in discovering the preference for certain abstract and material tools utilised in context. These were individual situational awareness, specific terminology (codes) and radios, presented in chapter 6. These also facilitated and/or controlled information sharing for creating shared situational awareness between other individuals and occasionally the public. Situational awareness was considered as the principal abstract tool employed in the formation and recreation of shared situational awareness. This was primarily to understand what was going on around the individuals that led to information sharing for creating and maintaining in others shared understandings of what was going around them, as stated in section 6.1. Codes were another abstract tool employed by individuals in context. These were considered as proper language of individuals exhibiting their roles in achieving organisational goals. Similarly, codes were information exhibiting pieces of situational awareness encoded that led to informed decisions once individuals decoded those codes. Unfortunately, the process of encoding and decoding generated tensions and contradiction because individuals did not learn the codes leading to misinformation, as stated in section 6.2. Radio was a material tool used in the information sharing process. The number of frequencies, reliability and person tracking were the source of tensions and

contradictions which led to uninformed decisions in context, as stated in section 6.3.

7.5.5 The Relevance of Information Sharing

The findings suggested that information sharing as two-way process was relevant element in the formation of shared situational awareness (Millward, 2008). This emphasised the necessity of individuals for being involved in diverse types of awareness performing their roles (Endsley, 1994b). For instance, it was seen when "*some captains of firemen (safety responders) liked to receive support from other firemen around the incident (Firemen, e48,24Feb2011,safety responder,operational)*". Although, this generated some tensions between them, the goal was to enrich the understanding of the situations by creating shared understandings that can permit to know "*projected status of the situation (Firemen,e48,24Feb2011, safety responder,operational)*". This was stated at the intra-organisational level.

Nonetheless, at inter-organisational levels, individuals were able to discover individuals from other organisations in context. This provided a basis to uncover those individuals who were able to match the incidents and the procedures to manage them and who performed well those procedures. As argued by Sonnenwald and Pierce (2000), the perception of quality in completing tasks was an important element that can generate differences between individuals. That was seen when a casualty resulted from an incident and individuals in the area preferred to chat about which individuals should manage the incident, but "*they did not comprehend that she required oxygen (Firemen,e4,21Feb2011,safety responder,tactical)*". It caused tensions between those individuals who approached to the area where the incident was discovered, so that certain individuals preferred to "*extract her (the casualty) to a safe area (Firemen,e4,21Feb2011,safety responder, tactical)*" to nurse and left the chat focusing on performing.

In addition, the most complex shared situational awareness was knotted situational awareness because that involved multiple individuals from diverse organisations that were tied to manage the incident, but once the incident was managed the knot was dissolved. One of the characteristics

of this knotting was that interactions between individuals were managed without a stable centre (Engeström et al., 1999; Engestrom, 2008). For instance, that was seen when in a fight between baseball players, security supporters created a shared understanding with spectators who wanted to intervene in that fight that "*was only between them (baseball players)…we would be involved in administrative problems, if they (spectators) hit a player (Security department,e28,02Jan2011,security supporter,operational)*". This provoked a change in the behaviour of spectators and this was reaffirmed with the intervention of policeman supporting the tasks of guards.

7.6 Summary of Situational Awareness Modes

This chapter has presented and discussed the findings in relation to the shared situational awareness stated by individuals in incident management. Intra-organisational situational awareness was the shared understandings of the situations between individuals from same organisations. It was the situational awareness created and maintained between individuals from certain organisations which managed the incidents without crossing their organisational boundaries. The principal characteristics were that these individuals employed analogous tools and performed their roles within the boundaries stated in the risk system. In addition, within this awareness, information was concerned with locating incidents within the crowd to be assured that individuals can manage those incidents and check that effectively the unusual situations were incidents. Moreover, information can help in anticipating possible states of the incidents to perform preventive or reactive tasks. These were done by individuals who were controlled and coordinated by personnel from the command areas of their organisations.

Inter-organisational situational awareness was a type of awareness created and maintained between individuals converging from diverse organisations. It was suggested that it was created to avoid delayed information coming from the command areas. This situational awareness also included skills and abilities of individuals following accorded procedures on managing incidents. The creation of this situational awareness served to

revise procedures and to reject unskilled individuals managing incidents. Furthermore, this awareness enabled individuals to effectively manage incidents by proposing courses of action in relation with the incidents.

Knotted situational awareness captured the most complex of the shared situational awareness required by individuals managing incidents. Findings suggest that individuals located near to other individuals indirectly can create and maintain shared situational awareness. This was with the aim to understand what was going on in other areas which were not under their responsibility. Moreover, creating this shared awareness aided individuals to select adequate courses of action in incident management. Furthermore, originating this shared awareness between individuals allowed managing incidents without negative outcomes. Specifically, this shared awareness helped in knotting individuals with appropriate skills and knowledge for managing the incidents. Finally, individuals exhibited criteria when they created shared situational awareness with other individuals and the public. These criteria created tensions and contradictions between the knotted individuals but, similarly, they provided flexibility in incident management.

Overall, the Situational Awareness Modes in Incident Management (SAMIM) Model was proposed to summarise the complexity of the shared situational awareness required by individuals in the routine operation and incident management at major events. This awareness included diverse types of awareness which were similar in reference to capacity of individuals to be immersed in interactions with other individuals from the same or other organisations and the public. These interactions between individuals collocated or doing patrols were face-to-face or mediated by technology in which were stated roles and organisational boundaries.

CHAPTER 8
CONCLUSIONS AND FUTURE RESEARCH

This chapter reviews the work reported in this thesis by revisiting the research problem and research questions outlined in chapter 1 in light of the principal findings stated on chapters 5, 6 and 7. It starts by presenting the theoretical implications of the research. The principal findings are then summarised. This is followed by a summary of the principal implications in relation to policies and regulations, tools and training. Next it discusses the strengths and limitations of the research and outlines possible directions for future research. It finishes with the concluding remarks of the thesis.

8.1 Theoretical Implications

This thesis aimed to address certain theoretical gaps within the areas of study as noted in chapters 1 and 2. These were uncovered in the context of the routine operation and the management of routine and contingent incidents at major events, information sharing, situational awareness and tools used for information sharing. Activity theory was used to frame the study. The figure 8-1 presents the activity systems that form the entire process in routine operation and incident management at major events and those studied, as stated in chapter 4.

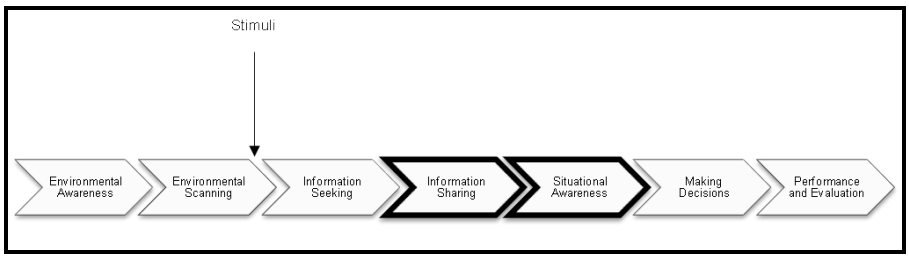

Figure 8-1 The activity systems covered in the research

Although the theoretical gaps noted in chapter 2 were filled, new gaps emerged in the activity systems not covered in this study that were related to

the motivations for sharing information, the abstract and material tools and the situational awareness modes. These gaps are discussed further in section 8.5 relating to future research.

Related to the theoretical implications, overall the study findings suggest that incident management at major events is likely to experience challenges similar to those identified in the extant literature (Rozakis, 2007; Contrast, 2012; Cooper, 2012; Sedgwick, 2010; Alexander, 2002; Altay and Green III, 2006; Dantas and Seville, 2006; Muhren et al., 2008; Paton et al., 1998) and if they are not managed properly using information sharing for creating and maintaining shared situational awareness, the results could be catastrophic (Rozakis, 2007). This was because the routine and contingent incidents included uncertainty and complexity that should be managed.

Concerning to information sharing, findings suggest that the approach suited well for studying information sharing in the context handled here. One asset was contemplating information sharing as a two-way process (Talja, 2002), helping to uncover the convenience of considering motivations for information sharing from cognitive and social perspectives (Hassan Ibrahim and Allen, 2012; Marcella and Baxter, 2006; Mishra et al., 2011b; Sonnenwald, 2006; Sonnenwald and Pierce, 2000). Their studies showed that both perspectives are not mutually exclusive so therefore that was necessary to consider both in context. Similarly, the approach provided the basis for confirming that information sharing is a crucial element in the creation and maintenance of shared situational awareness, named “type II” (Millward, 2008). This type of situational awareness is likely to be created and maintained by information sharing, as noted in chapter 7.

Relating to situational awareness, findings suggest that individuals demanded to create and maintain unique situational awareness from each incident, contrary to those argued by Endsley (1994b), who stated that situational awareness is only necessary as a general form of situations. In other words, she pointed out the necessity to measure situational awareness to infer if individuals can be capable to deal with tasks from a type of controlled situation. Although this study followed some theoretical implications and assumptions stated in diverse studies (Endsley, 1995;

Endsley, 1994b; Millward, 2008); the findings also suggest, in strong relation with the naturalistic context handled here, that “shared situational awareness type II” (Millward, 2008) is also informed under the approach of information behaviour. Moreover, this type of situational awareness is concerned with the “interwoven situational awareness” (Sonnenwald and Pierce, 2000). This is connected with the individuals exhibiting their roles and using tools for creating and maintaining shared situational awareness in context. Furthermore, the findings also highlighted that shared situational awareness was informed by information processing approaches (Endsley, 1995) and by ecological approaches (Gibson, 1983; Gibson, 1986; Flach, 1995). The findings suggest that individuals included in their situational awareness future states of situations and variables that may affect those future states (information processing approach) and meanings of environmental elements of major events (i.e. circles and movements within the crowd) (ecological approach).

Finally, with reference to the tools employed for sharing information, the findings suggest that material tools were discovered within communication and information behaviour approaches (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005; Sonnenwald, 2006; Sonnenwald et al., 2004; Sonnenwald et al., 2008) and the abstract tools were implied or superficially considered in those approaches (Constant et al., 1994; Hara and Kling, 2002; Talja, 2002). In relation to the material tools, it was highlighted that individuals used principally ICTs to mediate information sharing for creating and maintaining shared situational awareness (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005; Sonnenwald, 2006; Sonnenwald et al., 2004; Sonnenwald et al., 2008). However, it is argued that abstract tools were more connected with the creation and maintenance of that awareness than material tools. Situational awareness and codes were discovered as relevant abstract tools. They put the basis for creating clear the shared awareness via information sharing. For instance, codes were pieces of information including situational awareness for facilitating their sharing. Other material tools as video were not considered as a consequence of methodological limitations. This because CCTV was only

used in the command and control areas to which access was restricted. This limitation will be discussed in further detail in section 8.4.

8.2 Principal Contributions

This section presents a summary of the principal findings highlighted in chapters 5, 6 and 7.

8.2.1 Surface Credibility as Motivation for Information Sharing

In the current literature under cognitive and social paradigms, it was found that trust was a motivation for sharing information exhibited by individuals who were in direct contact over long periods of time (Allen and Wilson, 2003; Chen et al., 2008b; Dirks and Ferrin, 2001; Dirks and Ferrin, 2002; Ellonen et al., 2008; Hertzum et al., 2002; Lin, 2007b). However, “swift trust” emerged as a type of trust exhibited by individuals in organisations that needed to work closely with other individuals and organisations in short periods of time (Meyerson et al., 1996; Robert et al., 2009; Hassan Ibrahim and Allen, 2012) as those organisations managing incidents at major events, having characteristics of “knotworking” (Engestrom, 2008). In this type of trust, individuals were motivated to share information with those individuals who worked closely with them but were not or only partially been in direct contact before. Furthermore, individuals did not have time to develop trust as a consequence of the dynamics of those temporary organisations.

Thereby, the findings suggest that swift trust provided the basis to present surface credibility as a motivation for sharing information in context. It is argued that the uniforms worn by individuals provided the foundations to motivate them for sharing information in face-to-face interactions. Here swift trust was not a concern with trust between individuals, but it was with the association of uniforms with the role of individuals and their organisations in context. Consequently, this type of swift trust was named surface credibility to indicate that motivation. That is, individuals trusted other individuals motivating information sharing “based on the simple inspection” (Tseng and Fogg, 1999, p.29).

8.2.2 Normative Altruism as Motivation for Information Sharing

The current literature on cognitive and social paradigms suggest that information sharing was motivated by altruism to indicate that information provided can increase the welfare of a collective (Batson et al., 2002; Hew and Hara, 2007) and can contribute to the increase of knowledge of information receivers (Hars and Ou, 2002; Brazelton and Gorry, 2003). However, studies demonstrated that this type of information sharing was undertaken in static contexts. Moreover, they tried to change the conditions of others and this unilateral behaviour was considered as a one-way process because individuals proactively shared information.

Nonetheless, the findings in this research suggest that contrary to those expected by leaders of organisations, some altruistic individuals (safety supporters) were not proactively contributing with information or were minimally participating for creating and maintaining shared situational awareness in context. This caused tensions with those leaders who their roles were to control and coordinate them. Here, information sharing was seen as one of the instruments operated to create and maintain that shared awareness with/between organisations. As argued by Richardson and Asthana (2006) and Lin (2007b), individuals should share information based on ethical motivations contributing with that shared understanding. Consequently and in order to minimise the tensions and to control and coordinate those individuals, as noted in section 5.3, leaders suggested that those individuals should share information because “sharing at least some information is obligatory to become part of the community” (Parrish, 2010, p.189) of individuals involved in context.

8.2.3 Situational Awareness as an Abstract Tool

In the current literature, situational awareness is informed by information processing and ecological approaches and is a term employed to understand the gained situational knowledge at individual level (Endsley, 1994b; Endsley, 1995; Breton and Rousseau, 2003; McLaurin, 2006) or at collaborative levels (Millward, 2008; Desourdis and Contestabile, 2011; Salas et al., 1995; Roth et al., 2006; Riley et al., 2006). However, most of

research on collaborative levels has focused on forming “shared situational awareness type I” (Millward, 2008). This type was related to form informational overlaps between individuals involved in context and information sharing was not considered as a means to achieve those overlaps. This type of awareness is informed under cognitive approaches. Contrarily, “shared situational awareness type II” places information sharing as a principal element for creating and maintaining that shared situational awareness (Millward, 2008). It was assumed that this type of awareness is informed under cognitive and social approaches of information behaviour.

Thereby, findings suggest that situational awareness is an abstract tool that mediated and controlled information sharing for creating and mediating shared situational awareness demanded in context. This awareness also helped on balancing duality of information sharing under the cognitive and social perspectives of information behaviour. If incident responders were immersed in context and did not obtain a clear shared situational awareness, they would probably not be capable to utilise information sharing to allocate to others clear shared situational awareness (Millward, 2008; Endsley and Jones, 2001). This implied that situational awareness included perceptions of meanings from the environmental elements (Flach, 1995; Munslow, 2008; Bigley and Roberts, 2001; Gibson, 1983; Gibson, 1986). In addition, these perceptions were placed in immediate, intermediate and long terms (Endsley, 1988; Endsley, 1995) to make clear shared situational awareness over time. For instance, as stated in chapter 5, motivations for sharing information balancing responsibilities and authority in the roles of individuals and their organisations. This balance can be insinuated for facilitating or limiting the situational understandings in other individuals for involving or not those individuals, and for controlling and coordinating those individuals in context.

8.2.4 The Situational Awareness Modes in Incident Management (SAMIM) Model

It was found in the information behaviour approach that there were certain areas unexplored of information sharing, specifically in the area of situational

awareness (Talja and Hansen, 2006; Widen and Hansen, 2012) in incident management at major events. This research covered this gap and proposed the SAMIM model to exhibit the necessity for individuals to be aware of diverse situations in context. The findings suggest that if incident individuals were individually aware of diverse situations, next they probably shared via information sharing for creating and maintaining a shared situational awareness in context over time.

Furthermore, this model exhibited basic requirements of information in terms of situational awareness at individual and intra- and inter-organisational levels including regularly the public. It also exposed connections between the individuals on the basis of their motivations for sharing information and their roles, the rules and norms for directing behaviours, the use of abstract and material tools, and the consumption of time in context. Furthermore, it exhibited the relationship with “diverse types of awareness” (Endsley, 1994b) demanded in which information sharing was necessitated for creating and maintaining those shared awareness (Millward, 2008). Moreover, it exhibited the association with the term “interwoven situational awareness” Sonnenwald and Pierce (2000). This term is concerned with the information practices of individuals in time constrained, uncertain and complex environments, as the context handled in this thesis.

8.3 Practical implications

The practical implications are principally in three major areas and are implied by the motivations for information sharing, the abstract and material tools and the situational awareness modes, as noted in chapters 5, 6 and 7.

8.3.1 Policies and Regulations

Concerning to major events, it was found that there was a policy which only stated the necessity of an organisation focusing towards safety and security issues during major events. This policy also suggested forming a centralised organisation with a command and control area that should be let by governmental agencies. In addition, it was found that individuals employed

certain regulations and policies that are utilised in normal life of cities concerning to the context of emergency and disaster management. Those individuals translated these regulations and policies to the context of routine operation and incident management at major events. However, these policies caused tensions between individuals leading to ineffective and inefficient processes of information sharing and creation and maintenance of shared situational awareness. For instance, examples of these tensions were uncovered in the lack of clear rules about being situational leader and being ethical for sharing information in incident management, noted in sections 5.1 and 5.3 respectively.

Consequently and informed by findings presented in this thesis, it was suggested that policy should be generated for adequate protocols to manage the routine and contingent incidents at major events. These protocols should incorporate a command and control area which should be directed by organisers incorporating all participant organisations through their leaders and employing technology (abstract and material tools) to facilitate information sharing, as suggested by Houghton et al. (2006). The structure of this area should also incorporate flexible elements (Bigley and Roberts, 2001) to facilitate the interactions between individuals and their organisations for consequently sharing information between them. Furthermore, description and limitations of roles should be stated in protocols concerned with the types of routine and contingent incidents. However, similarly the description should state flexibility in those situations where specialised individuals (i.e. safety and security responders and supporters) will not be available, opening the opportunity to those individuals who will be present. For this, individuals should incorporate knowledge of both areas to be able for managing mixed incidents and to interacting with all individuals involved in context. So, a relevant element in this area was training that will be discussed in section 8.3.3. In addition, the protocols should incorporate the uses of abstract and material tools to facilitate and limit information sharing towards shared situational awareness. These will be discussed in section 8.3.2 and 8.3.3.

8.3.2 Tools

There is a lack of adequate tools that mediate and control information sharing towards situational awareness modes in the routine operation and incident management at major events. The findings suggest that if deficiencies in uses of tools are remedied, information sharing should be employed for efficiently and effectively creating and maintaining shared situational awareness. The initial state of it is a mental model (situational awareness) that is used to perceive the environmental elements and to comprehend their meanings for projecting what may happen in the near future in a similar situation so that external forces that can act upon them were considered (Endsley, 1995). Furthermore, they were in strong connection with tasks required to achieve organisational goals. Although, most mental models were created at the individual level, organisations should enhance individuals to develop “shared situational awareness type I” and “shared situational awareness type II” (Millward, 2008) under cognitive and social approaches. For this reason, individuals should understand policies, evaluate situations, detect risks in situations, locate unusual shapes and behaviours and recognise skills and abilities and expect performances of other incident actors for enabling information sharing. This should also be assisted with training, presented in section 8.3.3.

Codes as an abstract tool were the proper languages of participant organisations and were employed to control their personnel. They were brought by the normal life of cities, but generated tensions, contradictions and disturbances in context, as noted in section 6.2, leading to inefficient and ineffective creation and maintenance of shared situational awareness over time. Three types of codes were utilised, as noted in section 4.2.1.1, and they led to misinformation. Consequently, it is suggested that organisers should develop proper and specific codes to limit their use in context for facilitating the efficient and effective the creation and maintenance of shared situational awareness. In addition, they should incorporate the projective identification Boyle (2007) to inducing emotional states, which can similarly increase the information processing capacity (Shattuck and Woods, 2000). Similarly, they should facilitate situational awareness incorporating meanings of environmental elements to lead the decision making process.

Furthermore, radio is a material tool employed to mediate information sharing by separating or tying actors and organisations in context. However, the findings suggest that its use generated multiple tensions and contradictions, principally in relation to the frequency spectrum (Timmons, 2007) and identification of users and reliable (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005). Radios should incorporate the ability to change between the frequencies spectrums to incorporate or disconnect individuals and organisations, referred as interoperability and presented in section 6.3. Radios should also be identifiable and reliable. In this line, they should help with the identification of users at the moment of the information sharing in a back-and-forth-interactivity (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005) and permit the use of Morse code in situations where codes or natural language cannot be used towards shared situational awareness. Moreover, radios should improve reliability using cognitive radios to scan frequencies and to select and use the most convenient frequency (Quan et al., 2008; Cardenas-Juarez and Ghogho, 2011).

8.3.3 Training

It was found that certain individuals exhibited a lack of knowledge for creating and maintaining effectively and efficiently shared situational awareness. For this reason, individuals should have appropriate training to increase the knowledge of the policies and regulations of emergency and disaster management and the protocols developed by the organisers of major events. Specifically, the training should be focused on the recognition of responsibilities and authority and those emergent issues in context.

Furthermore, individuals should receive suitable training in the use of the tools utilised in context. This should be recognising environmental elements from context and creating meaning of them, specifically for creating efficiently and effectively situational awareness (Endsley and Jones, 2001). Moreover, the relationship between situational awareness and codes developed by organisations as proper language is an area of interest in which individuals should receive proper training for translating situational awareness on codes to make efficient and effective this process.

Furthermore, the use of radio as the means to disseminate information is another area in which individuals should receive training, emphasising the advantages and disadvantages for using radios to create and maintain shared situational awareness amongst physically collocated and remote individuals (Bolstad and Endsley, 2003; Bolstad and Endsley, 2005).

Moreover, individuals should receive training on the recognition of diverse attributes in incident management as minimal time to response, uncertainty and complexity and the learning of information management as one way to efficiently and effectively manage those attributes (McEntire, 2002; Paton and Flin, 1999; Paton et al., 1998; Jackson, 2006; Paton and Jackson, 2002). Similarly, establishing responsibilities for being in the information flow should be another area to receive training, specifically to minimise the lack of information sharing and to be aware when others share information, what information and to whom (Legrand, 2008).

Finally, it is suggested that exercises should be played to attune the training received in the mentioned areas in order to move from theory to practice. As argued by Crichton and Flin (2001), controlled exercises help individuals to deal with non-technical skills required in context. Nonetheless, the exercises should be focused on curing those disturbing aspects (Gorman et al., 2010) that can minimise the knowledge acquired in the exercise. Thereby, exercises should facilitate the creation and maintenance of situational awareness between individuals involved (Salas et al., 1995) promoting information sharing between them (Regester, 2008; Belopol, 2012; Kent-County-Council, 2014; Millward, 2008) to create efficiently and effectively that shared situational awareness demanded.

8.4 Strengths and Limitations

This study has some strengths and limitations discovered during this research which are discussed in the following sections.

8.4.1 Strengths

There are two main strengths in this thesis. One is in connection with the multi-voiced organisation displayed in the context handled here. This organisation included social and cultural meanings and values from organisational cultures (Talja et al., 1999) providing invaluable richness to this research. For instance, organisers controlled the routine operation of major events together with the safety and security agencies and supporters. This provided insights from the preventive and reactive cultures in safety and security issues. In addition, this research was done in a multi-voiced organisation providing a basis to uncover three motivations that triggered information sharing at intra- and inter-organisation levels. Furthermore, this study helped to discover what tools served to mediate and control information sharing, uncovering that situational awareness, codes and radio were relevant for creating and maintaining shared situational awareness at intra- and inter-organisational levels.

The second is in relation to the information gathered during the fieldwork. Three methods were employed to collect data, as presented in section 3.5. Over 100 hr were observed in 22 events in three cities, covering two concerts and 20 baseball matches that included the semi-finals and finals of the season. Moreover, 147 diverse documents were reviewed which included policies, protocols, organisational charts and photos. The pictures aided to reconstruct incidents and to discover individuals involved in the routine and contingent incidents. Furthermore, 55 interviews were undertaken involving 13 different organisations categorised as organisers, supporters and safety and security responders and supporters. The interviews included tactical and operational personnel from each participant organisation. Additional information is presented in annexes C to D.

8.4.2 Limitations

There are several limitations to this research. The fieldwork was realised in three cities that included concerts and baseball matches in only one country. This limited the study because it was inferred that data from other major events, cities and countries can reinforce, add or change the findings of this

research. Moreover, the roles of stress and operational circumstances were not considered in this research. Dealing with stress can be a challenging task because gathering and analysing data in these circumstances can generate bias but, at the same time, richness. Furthermore, the study did not consider how working conditions can affect the areas in study. For instance, the type of event is a crucial factor which can change the conditions in how events are operated. The following limitation is the inability to observe the routine operation of the command and control areas. It was inferred that it is crucial to observe the information practices of personnel from those areas because they employed continuously information sharing for creating and maintaining shared situational awareness over time so that they can control and coordinate geographically collocated and remote individuals displayed at major events. The last limitation is in concern with generalisation of results. Outcomes are analytical generalisable (Yin, 2009), but they are not statistical generalisable. It is because they were constrained by the nature of the sample, the participant organisations, the types of events, the cities and the countries. So, this limitation will be treated as future work in next section.

8.5 Directions of Future Research

As stated in discussions of chapters 5, 6 and 7 and in the theoretical implications, some questions arose that would serve to delineate the future work over the coming years. The main areas are stated below:

1. The activity systems and the context handled here serve to delineate additional research on the rest of the activity systems uncovered for gaining additional insights of them. For instance, it is suggested that research can follow the same order of the activity systems to obtain a holistic understanding of the context and the theoretical and practical implications contained.
2. Further investigation on motivations for sharing information can serve to put foundations on understanding to what extent each motivation was exhibited in each incident. In addition, they can serve to delineate future research in relation to what factors served to trigger them.

Moreover, the propositions developed in concern with them can assist to develop a controlled research under the quantitative approach.

3. The uses of tools can provide the basis to expand the knowledge on each tool uncovered. Situational awareness was treated as an under-researched area that similarly can offer foundations to focus research from the information behaviour approach and to find additional relevant environmental elements in context. Codes were also another area in which their development and usage were considered an un-explored area that can be exploited from the same approach.
4. The Situational Awareness Modes in Incident Management (SAMIM) model can serve to frame future research to discover to what extent tools discovered have an impact in the shared situational awareness and how individuals utilised shared situational awareness to achieve organisational goals. Moreover, it can assist in knowing the impact for creating situational awareness in geographically collocated and remote individuals in context. Furthermore, it can aid to comprehend what was the impact of external forces in the creation and maintenance of shared situational awareness. In addition, it can be utilised to delineate the requirements of situational awareness demanded in context in relation to the role of individuals.
5. Further research can be useful to prove, contrast and increase the results of this study. For this reason, it is suggested that can be useful to replicate this research to generalise the results, as stated in section 8.4.2. Changes in its conditions can consider the increase in the sample, the inclusion of additional participant organisations and the expansion to other major events, cities and countries. In addition, accessing to the command and control areas is another relevant area in consideration.

8.6 Closing Comments

This research answered three research questions that were outlined in section 1.2. The questions investigated the motivations for sharing

information, the tools employed in the information sharing and the influences of information sharing to situational awareness in the context of the routine operation and incident management at major events, as noted in chapters 5, 6 and 7 respectively. Two motivations (surface credibility and normative altruism) for sharing information and one abstract tool (situational awareness) that mediated and controlled information sharing are argued as contributions to the current knowledge in the information behaviour area. In the same way, the SAMIM model is proposed to exhibit information necessities of individuals for being aware of diverse situations at major events and the necessity of individuals for being prepared to facilitate social interactions between them and the public in context.

Furthermore, this research has theoretical implications because diverse gaps of knowledge were uncovered in the current literature and covered in this research, as stated in sections 1.3 and 8.1. The context handled here, information sharing, situational awareness and abstract and material tools were the gaps covered. Similarly, this research pointed out practical implications in the motivations for sharing information, the shared situational awareness modes and the abstract and material tools employed. For instance, the elaboration and practice of proper policies, regulations and protocols for managing incidents at major events and the development and acquisition of adequate tools can facilitate information sharing and shared situational awareness. Moreover, training can be utilised to polish the learning of those policies, regulations and protocols and the use of those tools. In the same way, training could serve to attune the non-technical skills demanded in incident management (Crichton and Flin, 2001). These tasks can be done to improve efficiency and effectiveness of information sharing for creating and maintaining shared situational awareness in the routine operation and incident management at major events.

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Appendix A
Interview Guideline

University of Leeds
Interview Guideline
Name of the project: Information Sharing in Major Events

Name of the researcher: Guadalupe Hernandez Escobedo
Name of Supervisors: Dr. David K. Allen and Prof. Alan Pearman

Date:_____ Start and End Time:_____

Participant: _____

Explain the following points: Purpose, participation, benefits, confidentiality, contact.

Request permission to record: I would like to record our discussion today with a digital audio recorder. No one in your organisation will have access to these recordings. If you feel uncomfortable with digital audio recording, please let us know, so we can make notes instead.

1. History. This section is focused on general information of the participant: study level, years of experience and position(s) on past or/and current organisation(s).
2. Evolution. This part is to obtain deeply understanding of working experiences. Both sections would help to create empathy and to develop trust.
3. Current responsibilities. This point helps to know actual responsibilities within major events.
4. Networking. This unit assists to discover intra- and inter-organisational relationships.
5. Urgent situations. This sector is focused on how responders understand imperative situations creating a whole picture and the Critical Incident Technique is employed to achieve it. The requirement is all participants have participated on routine incident management within major event contexts. The following questions are asked (adapted from Chell, 2004):

   What happened during the incident? When it happened?
   Why did it happen?
   How did it happen?
   With whom did it happen?
   What did the parties concerned *feel*?
   What were the consequences?
   How did the responders cope?
   What tactics were used?

   In addition, some questions are asked following the conceptual framework and the elements of the activity system.

6. Growth. This point assists to obtain critical intellectual changes about routine incident management through asking about contemplated procedures and the use of tools during incident management.
7. Thanks for the interview

Appendix B
Ethical Review

Research Support
3 Cavendish Road
University of Leeds
Leeds LS2 9JT

Tel: 0113 343 4873
E-mail: j.m.blaikie@adm.leeds.ac.uk

UNIVERSITY OF LEEDS

Guadalupe Hernandez-Escobedo
LUBS
University of Leeds
Leeds, LS2 9JT

AREA Faculty Research Ethics Committee
University of Leeds

21 September 2011

Dear Guadalupe

Title of study: **Information Sharing in Major Events**
Ethics reference: **AREA 10-165**

The above research application has been retrospectively reviewed by the Chair of the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and the following documentation was considered:

Document	*Version*	*Date*
1 Ethical Review Form Guadalupe Hernandez-Escobedo response1.doc	2	05/08/11
2a Supporting Materials Guadalupe Hernandez-Escobedo.doc	1	14/06/11
2b Supporting Materials Guadalupe Hernandez-Escobedo.doc	1	14/06/11

This is a retrospective review and as such the committee has not had opportunity to amend the ethical dimension to the project if it had been necessary. Given this consideration, the Chair of the AREA Research Ethics Committee was satisfied that the necessary procedures had been put in place and are consistent with the University's guidelines on ethical conduct within research.

It is anticipated that the researchers involved will seek to provide the opportunity for ethical review in a timely manner in future and certainly before the research has commenced.

The committee wishes you success in your PhD studies.

Yours sincerely
JBlaikie

Jennifer Blaikie
Research Ethics Administrator, Research Support
On behalf of Dr Anthea Hucklesby
Chair, AREA Faculty Research Ethics Committee

CC: Student's supervisor(s)

Appendix C
Description of the Events

1. Concerts

Event	Characteristics	Description
Concert 1	City, venue and distribution	City 1 is situated at the north of Mexico, specifically in the frontier with the United States of America. The population is approximately of 1,300,000 inhabitants. The venue where the concert took place is located in the area near to the Ocean Pacific and this is utilised regularly to run bullfights. It has a capacity of 25,000 spectators. The distribution of the spectators was done in areas which were separated by corridors named safe areas. In these areas the safety and security responders and supporters were located. Unfortunately, these areas were lost as events passed. So, the movement of the personnel and equipment was difficult activity in case of incidents. It was usual that the security responders were doing patrols along those safe areas. Contrarily, the security supporters were located in specific areas as entrances, near to the stage and VIP areas. The safety responders and supporters were positioned in specific areas within the venues and in the mobile hospitals. The personnel of all organisations were generally observing the behaviours of the spectators. The concert was organised by the local government through the Public Relations Department. This department created a linear organisation which involved the public services, including the emergency services. In other words, they made use of the public resources to organise the concert and negotiated with the participant organisations their involvement through agreements.
	Entire duration of the event, including preparation and lifting facilities	12 hours, starting in the middle of the day and finishing at midnight
	Organisation formed	The organisers of the concerts formed a linear organisation in which the leaders of the Public Relations Department, Civil Protection Department, police and firemen were situated at strategic and tactical levels. Personnel included into this level of the organisation used radios and a specific radio frequency to be communicated between them. Most of the time, approximately 250 individuals formed this organisation. The Public Relations Department took control of their personnel, the internships and the security company or guards. They used the natural language to be communicated between them. In addition, as the Public Relations Department as organiser of the concert, they can solicit the support from the majority of the participant organisations in the concert, an exception is the security company which was hired for that purpose and they convinced to the internships to participate without paying a salary. The Police took control of four divisions of Police: preventive, commercial, touristic and tactical. The police officers used a radio frequency to be communicated between them. In the routine operations in city, those divisions used radio and a specific radio frequency, but they utilised radios with the capacity to be moved between frequencies. In addition, they utilised a command a control area. The firemen took control of their personnel and four voluntary groups, including the Red Cross. They used a frequency to be communicated and all agencies used radios utilising the same frequency of firemen. The firemen operated an independent command and control as well as the Red Cross. Additionally, the Red Cross placed a mobile hospital. The Civil Protection Department as independent organisation supported the activities of firemen and voluntary groups. They used radios with frequencies of Public Relations Department, police and firemen.
	Number and type of spectators	According to the Director of the Public Relations Department, the audience was 25,000 spectators and was made up by youth and adults.
	Date of the concert	25 September 2010

Concert 2	City, space and distribution	City 1 is situated at the north of Mexico, specifically in the frontier with the United States of America. The population is approximately of 1,300,000 inhabitants. The venue where the concert took place is located in the area near to the Ocean Pacific and this is utilised regularly to run bullfights. It has a capacity of 25,000 spectators. Specifically, this concert was done in the parking lot of this venue because the organisers wanted to increase the capacity of spectators. The distribution of the spectators was done in areas which were separated by corridors named safe areas. In these areas the safety and security responders and supporters were located. Unfortunately, these areas were lost as events passed. So, the movement of the personnel and equipment was difficult activity in case of incidents. It was usual that the security responders were doing patrols along those safe areas. Contrarily, the security supporters were located in specific areas as entrances, near to the stage and VIP areas. The safety responders and supporters were positioned in specific areas within the venues and in the mobile hospitals. The personnel of all organisations were generally observing the behaviours of the spectators. The concert was organised by the local government through the Public Relations Department. This department created a linear organisation which involved the public services, including the emergency services. In other words, they made use of the public resources to organise the concert and negotiated with the participant organisations their involvement through agreements.
	Entire duration of the event, including preparation and lifting facilities	12 hours, starting in the middle of the day and finishing at midnight
	Organisation formed	The organisers of the concerts formed a linear organisation in which the leaders of the Public Relations Department, Civil Protection Department, police and firemen were situated at strategic and tactical levels. Personnel included into this level of the organisation used radios and a specific radio frequency to be communicated between them. Most of the time, approximately 250 individuals formed this organisation. The Public Relations Department took control of their personnel, the internships and the security company or guards. They used the natural language to be communicated between them. In addition, as the Public Relations Department as organiser of the concert, they can solicit the support from the majority of the participant organisations in the concert, an exception is the security company which was hired for that purpose and they convinced to the internships to participate without paying a salary. The Police took control of four divisions of Police: preventive, commercial, touristic and tactical. The police officers used a radio frequency to be communicated between them. In the routine operations in city, those divisions used radio and a specific radio frequency, but they utilised radios with the capacity to be moved between frequencies. In addition, they utilised a command a control area. The firemen took control of their personnel and four voluntary groups, including the Red Cross. They used a frequency to be communicated and all agencies used radios utilising the same frequency of firemen. The firemen operated an independent command and control as well as the Red Cross. Additionally, the Red Cross placed a mobile hospital. The Civil Protection Department as independent organisation supported the activities of firemen and voluntary groups. They used radios with frequencies of Public Relations Department, police and firemen.
	Number and type of spectators	According to the Director of the Public Relations Department, the audience was 55,000 spectators and was made up by youth and adults.
	Date	16 October 2010

2. Baseball Matches

Event	Characteristics	Description
Baseball matches. City 2	City, space and distribution	City 2 is situated at the northwest of Mexico. The population is approximately of 260,000 inhabitants. The venue where the baseball matches is located in centre of the city. It has a capacity of 11,000 spectators. The distribution of the spectators is around the field where the match takes place. The security coordinator was positioned in one entrance of the stadium. The security supporters were located in specific areas and the same time, others were doing patrols. On the other hand, the security responders were positioned in the entrance of the stadiums to avoid being seen by the public. This was to reassure the public. The events were organised by a private company which owns the franchise of this baseball team. Consequently, in the organisation of events, this company incurs in cost of hiring personnel and external companies that support their activities. It is the owner of the franchise pays to the security company and to the police for their services performed. Additionally, organisers believed that in case of incidents with consequences in the safety side, they can solicit the services provided by the governmental agencies in short periods of time. In other words, they believed that safety services may be provided promptly if they are solicited. This was because the city is small and agencies are located near to the venue. Otherwise, if they solicit the services during the venue, this would be an extra cost that cannot afford at that time.
	Entire duration of the event, including preparation and lifting facilities	The events started around 4 PM and duration varied. Duration of matches is in relation with the type of match which would be a regular, semi-finals or finals match. The shorter duration matches are in regular season and the longer duration matches are in the semi-finals and finals.
	Organisation formed	The organisers formed a linear organisation in which the leaders of the security company or guards, Police and the security coordinator were situated at strategic and tactical levels. Most of the time, approximately 50 individuals formed this organisation. The security coordinator was located in a specific area and solicited that one guard and one police officer using radio were located near to him. This was because in case of requiring additional support, he can access to other guards and/or police officers through the guard and the police officer. The leader of the security company took control of their personnel or guards. They used radios to be communicated between them. The Police took control of the police officers displayed along the entrances of the stadium and used radios to be communicated.
	Number and type of spectators and dates of events	According to the security coordinator, the audience was: 25 Nov 2010 -6,000 spectators 14 Dec 2010 - 6,500 spectators 15 Dec 2010 - 6,500 spectators 16 Dec 2010 - 6,500 spectators 27 Dec 2010 - 9,500 spectators 4 Jan 2011 - 11,000 spectators 5 Jan 2011 - 11,000 spectators 6 Jan 2011 - 11,000 spectators The public was made up by children, youth and adults.
Baseball matches. City 3	City, space and distribution	City 3 is situated at the west of Mexico. The population is approximately of 130,000 inhabitants. The venue where the baseball matches is located in the north of the city. It has a capacity of 9,000 spectators. The distribution of the spectators is around the field where the match takes place. The stadium manager was doing patrols along the venue. The security supporters were located in specific areas and the same time, others were doing patrols. On the other hand, the civil protection unit were positioned in the entrance of the stadiums to avoid being seen by the public. This was to reassure the public. The events were organised by a private company which owns the franchise of this baseball team. Consequently, in the organisation of events, this company incurs in cost of hiring personnel and external companies that support their activities. It is the owner of the franchise pays to the security company and may incur in extra costs if they hire the services of the safety organisations. Additionally, organisers believed that in case of incidents with consequences in the safety and security sides, they can solicit the services provided by the governmental agencies in short periods of time. In other words, they believed that safety and security services may be provided promptly if they are solicited. This was because the city is small and agencies are located near to the venue. Similarly, in occasions the organisers permitted the entrance of the police officers that were doing their patrols outside of the venues to verify the current status of what happens inside of the venue. In other words, the police officers entered and did patrols inside of the venues to help on controlling the event. On the other hand, in the finals, the organisers solicited the services of the firemen

		and Red Cross, but in these cases, the organisers made an agreement with those organisations. The personnel of those organisations were located in areas of the field and were prepared to manage incidents. Nonetheless, the personnel were permitted to see the match and only they were activated to manage the incidents if they were notified by the organisers, guards or the civil protection unit. In other words, they were reactive actors and not preventive as other mentioned actors.
	Entire duration of the event, including preparation and lifting facilities	The events started around 4 PM and duration varied. Duration of matches is in relation with the type of match which would be a regular, semi-finals or finals match. The shorter duration matches are in regular season and the longer duration matches are in the semi-finals and finals.
	Organisation formed	The organisers formed a linear organisation in which the leaders of stadium, the security company and civil protection unit were situated at strategic and tactical levels. Most of the time, approximately 35 individuals formed this organisation. The stadium manager was doing patrols along the venue. He was using radio to be communicated with the human resources manager of the stadium and the guards. The leader of the security company took control of their personnel or guards. The major number of guards was settled in specific areas and the minor number was doing patrols. They used radios to be communicated between them. The civil protection unit took control of their personnel and were displayed along the entrances of the stadium. They used radios to be communicated between them and were using the radio frequency of the stadium.
	Number and type of spectators	According to the stadium manager, the audience was: 28 Nov 2010 - 5,000 spectators 21 Dec 2010 - 5,500 spectators 22 Dec 2010 - 5,500 spectators 23 Dec 2010 - 6,500 spectators 25 Dec 2010 - 8,500 spectators 26 Dec 2010 – 8,500 spectators 1 Jan 2011 - 9,000 spectators 2 Jan 2011 - 9,000 spectators 24 Jan 2011 - 9,000 spectators 25 Jan 2011 – 9,000 spectators 26 Jan 2011 – 9,000 spectators The public was made up by children, youth and adults.

Appendix D
Participant Organisations in the Research

1. Concerts

Event	*Organisation*	*Origen*	*Goals and Activities in the events*	*Role*
Concerts. City 1	Public Relations Department	Local Government	**Goal: Regulate and Support** Organise concerts and establish responsibilities amongst other organisations. During the concerts support other organisations. Under their responsibility is the security company.	Regulators
	Civil Protection Department	Local Government	**Goal: Support** Support the organisation of concerts and operation of concerts at tactical and operational level	Regulators
	Firemen	Local Government	**Goal: Emergency Responder** Focus on extinguishing fires and rescuing spectators from damage conditions, under their responsibility are voluntary groups and Red Cross.	Safety Responder
	Commercial Police	Local Government	**Goal: Emergency Responder** Concentrate on prevention of incidents and maintenance of public order. They can arrest individuals.	Security Responder
	A voluntary Group	Civilian	**Goal: Emergency Responder** Centre to help others using their expertise of pre-hospital emergency care.	Safety Supporter
	Red Cross	Civilian	**Goal: Emergency Responder** Centre to help others using their expertise of pre-hospital emergency care.	Safety Supporter
	Security Company	Private	**Goal: Support** Concentrate in prevention of incidents and maintenance of public order. They cannot arrest individuals.	Security Supporter

2. Baseball Matches

Event	*Organisation*	*Origen*	*Goals and Activities in the events*	*Role*
Baseball Matches. City 2	Organisers. Safety and Security Coordinator	Private	**Goal: Regulate and Support** Organise the games and establish responsibilities to other organisations. Under his responsibility is the security company.	Regulators
	Security Company	Private	**Goal: Support** Concentrate on prevention of incidents and maintenance of public order. They cannot arrest individuals.	Security Supporters
	Commercial Police	Local Government	**Goal: Emergency Responder** Concentrate on prevention of incidents and maintenance of public order. They can arrest individuals.	Security Responders
Baseball Matches. City 3	Organisers	Private	**Goal: Regulate and Support** Organise the games and establish responsibilities to other organisations. Under his responsibility is the security company.	Regulators
	Security Department	Private	**Goal: Support** Concentrate on prevention of incidents and maintenance of public order. They cannot arrest individuals.	Security Supporters
	Civil Protection Unit	Local Government/ Civilian	**Goal: Support and Emergency Responder** Support safety operations during games and centre to help others using their expertise of pre-hospital emergency care.	Regulators

NOTE: To facilitate the role of each participant organisations, the type of organisations, their origin, the goals and the activities done in the events served to be categorised as regulators, safety responders, safety supporters, security responders and security supporters. This also serves to differentiate their goals in the events in consideration of policy issues related to the major events. This refers to the legal responsibilities in incident management because there were legal responsibilities implied in the role of the participant organisation.

Appendix E
Data Collected in the Events

1. Concerts

Event	Type of data gathered	Description
Concert 1	Observation	Seven hours including two hours from preparation and one hour from lifting facilities. On incident was observed and it was an unconscious in the area near to the principal stage
	Interviews and incidents reported	34 written consent and 2 verbal consent 15 interviewees from tactical level and 21 from operational level 98 incidents were reported by interviewees
	Organisational documentation	54 documents The civil protection legislation of the city council, protocols of communication between governmental agencies, layouts of distribution of spectators and personnel from the diverse agencies and organisations, organisation manuals, procedures of managing incidents or emergencies, among other documents were gathered from the same organisations and from their websites. Pictures of the location of the personnel and the organisations within the venues, command and control locations and location of spectators in relation to the safe areas and personnel and their organisations were taken to capture the real location of personnel and other elements considered into the initial layout provided by the Public Relations Department. This layout provided the expected location of the personnel and the participant organisations.
	Number of participant organisations in the research	Seven different organisations from 10 participant organisations in concerts
Concert 2	Observation	Eight hours including two hours from preparation and one hour from lifting facilities. On incident was observed and it was an unconscious in the middle of the crowd.
	Interviews and incidents reported	Included in concert 1
	Organisational documentation	Included in concert 1
	Number of participant organisations in the research	Included in concert 1

2. Baseball Matches

Event	Type of data gathered	Description
Baseball matches. City 2	Observation in the matches	Match 1 (25 Nov 2010, regular match) =2 hr. Match 2 (14 Dec 2010, regular match) = 5 ½ hr.* Match 3 (15 Dec 2010, regular match) = 5 hr. * Match 4 (16 Dec 2010, regular match) = 4 5/6 hr. * Match 5 (27 Dec 2010, regular match) = 3 ½ hr. Match 6 (4 Jan 2011, league semi-finals) =6 ½ hr. * Match 7 (5 Jan 2011, league semi-finals) = 6 hr. * Match 8 (6 Jan 2011, league semi-finals) = 3 hr. *These observations included 30 minutes from preparation and 30 minutes from lifting facilities. According to the regulations of the league, the match should start at 6 PM. 17 incidents were observed
	Interviews	5 written consent 3 interviewees from tactical level and 2, from operational level 8 incidents were reported by interviewees

	Organisational documentation	44 documents including: The civil protection legislation of the city council, protocols of communication between organisations, layouts of distribution of spectators and personnel from the diverse agencies and organisations, organisation manuals, procedures of managing incidents or emergencies, among other documents were gathered from the same organisations and from their websites. Pictures of the location of the personnel and the organisations within the venues and location of spectators in relation to the safe areas and personnel and their organisations were taken to capture the real location of personnel and other elements considered into the initial layout provided by the organisers. This layout provided the expected location of the personnel and the participant organisations.
	Number of participant organisations	Three different organisations including the security coordinator of the stadium and one porter representing the organisers; the commercial police and the security company or guards.
Baseball matches. City 3	Observation in the matches	Match 1 (28 Nov 2010, regular match) = 3 hr. Match 2 (21 Dec 2010, regular match) = 4 ½ hr. * Match 3 (22 Dec 2010, regular match) = 2 ½ hr. Match 4 (23 Dec 2010, regular match) = 2 ½ hr. Match 5 (25 Dec 2010, regular match) = 5 hr. * Match 6 (26 Dec 2010, regular match) = 5 ½ hr. * Match 7 (1 Jan 2011, league semi-finals) = 6 ½ hr. * Match 8 (2 Jan 2011, league semi-finals) = 5 ½ hr. * Match 9 (24 Jan 2011, league finals) = 2 hr. Match 10 (25 Jan 2011, league finals) = 5 ½ hr. * Match 11 (26 Jan 2011, league finals) = 5 hr. * *These observations included 30 minutes from preparation and 30 minutes from lifting facilities. According to the regulations of the league, the match should start at 6 PM. 37 incidents were observed
	Interviews	7 written consent and 7 verbal consent 4 interviewees from tactical level and 10, from operational level 22 incidents were reported by interviewees
	Organisational documentation	49 documents including: The civil protection legislation of the city council, protocols of communication between governmental agencies, layouts of distribution of spectators and personnel from the diverse agencies and organisations, organisation manuals, procedures of managing incidents or emergencies, among others documents were gathered from the same organisations and from their websites. Pictures of the location of the personnel and the organisations within the venues, command and control locations and location of spectators in relation to the safe areas and personnel and their organisations were taken to capture the real location of personnel and other elements considered into the initial layout provided by the Public Relations Department. This layout provided the expected location of the personnel and the participant organisations.
	Number of participant organisations	Three different organisations including the stadium manager and the human resource manager representing the organisers; the guards representing the security of the stadium and the Civil Protection unit representing the local government

Appendix F
Codes of Interviews

1. Concerts

Code	*Number of interview*	*Event*	*City*	*Date*	*Organisation*	*Role in the events*	*Hierarchical level*
Public relations department,e1,21Oct2010,regulator,operational	1	Concerts	1	21 Oct 2010	Public Relations Department	Regulators	Operational
Public relations department,e2,21Oct2010,regulator,operational	2	Concerts	1	21 Oct 2010	Public Relations Department	Regulators	Operational
Security company,e3,23Oct2010,security supporter,operational	3	Concerts	1	23 Oct 2010	Security company	Security supporters	Operational
Security company,e4,24Oct2010,security supporter,operational	4	Concerts	1	24 Oct 2010	Security company	Security supporters	Operational
Public relations department,e5,25Oct2010,regulator,operational	5	Concerts	1	25 Oct 2010	Public Relations Department	Regulators	Operational
Civil protection department,e6,26Oct2010,regulator,tactical	6	Concerts	1	26 Oct 2010	Civil Protection Department	Regulators	Tactical
Civil protection department,e7,26Oct2010,regulator,tactical	7	Concerts	1	26 Oct 2010	Civil Protection Department	Regulators	Tactical
Civil protection department,e8,27Oct2010,regulator,operational	8	Concerts	1	27 Oct 2010	Civil Protection Department	Regulators	Operational
Civil protection department,e9,28Oct2010,regulator,operational	9	Concerts	1	28 Oct 2010	Civil Protection Department	Regulators	Operational
Security company,e10,28Oct2010,security supporter,tactical	10	Concerts	1	28 Oct 2010	Security company	Security supporters	Tactical
Public relations department,e10,28Oct2010,regulators,tactical	11	Concerts	1	29 Oct 2010	Public Relations Department	Regulators	Tactical
Security company,e12,30Oct2010,security supporter,tactical	12	Concerts	1	30 Oct 2010	Security company	Security supporters	Tactical
Security company,e13,31Oct2010,security supporter,tactical	13	Concerts	1	31 Oct 2010	Security company	Security supporters	Tactical
Security company,e14,01Nov2010,securitysupporter,operational	14	Concerts	1	01 Nov 2010	Security company	Security supporters	Operational
Securitycompany,e15,01Nov2010,security supporter,operational	15	Concerts	1	01 Nov 2010	Security company	Security supporters	Operational
Civil protection department,e16,05Nov2010,regulator,operational	16	Concerts	1	05 Nov 2010	Civil Protection Department	Regulators	Operational
Public relations department,e17,10Nov2010,regulator,tactical	17	Concerts	1	10 Nov 2010	Public Relations Department	Regulators	Tactical
Voluntary group,e18,15Nov2010,safety supporter,tactical	18	Concerts	1	15 Nov 2010	Voluntary group	Safety supporters	Tactical
Voluntary gropu,e19,15Nov2010,safety supporter,operational	19	Concerts	1	15 Nov 2010	Voluntary group	Safety supporters	Operational
Voluntary group,e20,03Dec2010,safety supporter,operational	20	Concerts	1	03 Dec 2010	Voluntary group	Safety supporters	Operational
Voluntary group red cross,e40,08Dec2010,safety supporter,tactical	40	Concerts	1	08 Feb 2011	Voluntary group. Red Cross	Safety supporters	Tactical
Voluntary group red cross,e41,09Feb2011,safety supporter,tactical	41	Concerts	1	09 Feb 2011	Voluntary group. Red Cross	Safety supporters	Tactical

Voluntary group red cross,e42,11Feb2011,safety supporter,operational	42	Concerts	1	11 Feb 2011	Voluntary group. Red Cross	Safety supporters	Operational
Voluntary group red cross,e43,11Feb2011,safety supporter,operational	43	Concerts	1	11 Feb 2011	Voluntary group. Red Cross	Safety supporters	Operational
Firemen,e44,21Feb2011,safety responder,tactical	44	Concerts	1	21 Feb 2011	Firemen	Safety responders	Tactical
Firemen,e45,21Feb2011,safety responder,tactical	45	Concerts	1	21 Feb 2011	Firemen	Safety responders	Tactical
Firemen,e46,22Feb2011,safety responder,operational	46	Concerts	1	22 Feb 2011	Firemen	Safety responders	Operational
Firemen,e47,23Feb2011,safety responde,operational	47	Concerts	1	23 Feb 2011	Firemen	Safety responders	Operational
Firemen,e48,24Feb2011,safety responder,operational	48	Concerts	1	23 Feb 2011	Firemen	Safety responders	Operational
Firemen,e49,24Feb2011,safety responder,tactical	49	Concerts	1	24 Feb 2011	Firemen	Safety responders	Tactical
Commercial police,e50,26Feb2011,security responder,tactical	50	Concerts	1	26 Feb 2011	Commercial Police	Security responders	Tactical
Commercial police,e51,28Feb2011,security responder,operational	51	Concerts	1	28 Feb 2011	Commercial Police	Security responders	Tactical
Commercial police,e52,02Mar2011,security responder,operational	52	Concerts	1	02 Mar 2011	Commercial Police	Security responders	Operational
Commercial police,e53,03Mar2011,security responder,operational	53	Concerts	1	03 Mar 2011	Commercial Police	Security responders	Operational
Commercial police,e54,03Mar2011,security responder,operational	54	Concerts	1	03 Mar 2011	Commercial Police	Security responders	Operational
Commercial police,e55,04Mar2011,security responder,operational	55	Concerts	1	04 Mar 2011	Police	Security responders	Operational

2. Baseball Matches

Code	*Number of interview*	*Event*	*City*	*Date*	*Organisation*	*Role in the events*	*Hierarchical level*
Security coordinator,e21,18Dec2010,regulator,tactical	21	Baseball matches	2	18 Dec 2010	Organisers, security coordinator	Regulators	Tactical
Stadium manager,e22,26Dec2010,regulator,tactical	22	Baseball matches	3	26 Dec 2010	Organisers, stadium manager	Regulators	Tactical
Human resources manager,e23,27Dec2010,regulator,tactical	23	Baseball matches	3	27 Dec 2010	Human resources manager, stadium 2	Regulators	Tactical
Security department,e24,27Dec2010,security supporter,tactical	24	Baseball matches	3	27 Dec 2010	Security department or guards	Security supporters	Tactical
Police,e25,28Dec2010,security responder,tactical	25	Baseball matches	2	28 Dec 2010	Police	Security responders	Tactical
Police,e26,28Dec2010,security responder,operational	26	Baseball matches	2	28 Dec 2010	Police	Security responders	Operational
Security department,e27,01Jan2011,security supporter,operational	27	Baseball matches	3	01 Jan 2011	Security department or guards	Security supporters	Operational
Security department,e28,02Jan2011,security supporter,operational	28	Baseball matches	3	02 Jan 2011	Security department or guards	Security supporters	Operational
Security department,e29,02Jan2011,security supporter,operational	29	Baseball matches	3	02 Jan 2011	Security department or guards	Security supporters	Operational
Civil protection unit,e30,03Jan2011,regulator and safety responder,tactical	30	Baseball matches	3	03 Jan 2011	Civil protection unit	Regulators and safety responder	Tactical
Civil protection unit,e31,03Jan2011,regulator and safety responder,operational	31	Baseball matches	3	03 Jan 2011	Civil protection unit	Regulators and safety responder	Operational
Civil protection unit,e32,04Jan2011,regulator and safety responder,operational	32	Baseball matches	3	04 Jan 2011	Civil protection unit	Regulators and safety responder	Operational

Security company,e33,05Jan2011,security supporter,tactical	33	Baseball matches	2	05 Jan 2011	Security company or guards	Security supporters	Tactical
Security company,e34,05Jan2011,security supporter,operational	34	Baseball matches	2	05 Jan 2011	Security company or guards	Security supporters	Operational
Security department,e35,24Jan2011,security supporter,operational	35	Baseball matches	3	24 Jan 2011	Security department or guards	Security supporters	Operational
Security department,e36,25Jan2011,security supporter,operational	36	Baseball matches	3	24 Jan 2011	Security department or guards	Security supporters	Operational
Security department,e37,24Jan2011,security supporter,operational	37	Baseball matches	3	24 Jan 2011	Security department or guards	Security supporters	Operational
Security department,e38,25Jan2011,security supporter,operational	38	Baseball matches	3	25 Jan 2011	Security department or guards	Security supporters	Operational
Security department,e39,25Jan2011,security supporter,operational	39	Baseball matches	3	25 Jan 2011	Security department or guards	Security supporters	Operational