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Learning through joint Emergency Preparedness -

A Case Study of a joint Industrial Safety and Emergency Preparedness System

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Stian Kristoffer Olsen
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Summary

The purpose of this study is to extend on scientific knowledge related to emergency preparedness, knowledge acquisition and learning within joint collaboration between industrial enterprises. There are limited researches that have been done when it comes to learning (singe and double lop learning) within safety science (Drupsteen and Guldenmund 2014). Further Ramli, Mokhtar & Aziz (2014) and Reiners (2010) have pointed out that there is little attention has been made when it comes to collaboration between different enterprises at for example industrial parks. Therefore this thesis looks at a join industrial preparedness system at an industrial park in Norway. Further this thesis looks at what kind of learning platforms that are established as a result of this collaboration. Therefore the following research question have been developed: *Research questions 1:* How is emergency preparedness established and organized through collaborative efforts among the enterprises in the industrial park? *Research question 2:* What kinds of learning platforms are established as the result of collaboration on emergency preparedness and how are they utilized for joint learning. *Research question 3:* Does the evaluations of the learning that have taken place within these platforms, facilitate single or double loop learning?

Learning in this study has been defines as the acquisition of knowledge (Stein 1997), while knowledge defined as "*a shared collection of principles, facts, skills, and rules*" (Stonehouse & Pemberton 1999: 132). This thesis has used a knowledge management model developed by Evans, Dalkir and Bidian (2014). This model have then been linked with the Plan, Do, Study, Act cycle to describe how the knowledge that is acquired can lead to singe or double loop learning within the ISEP- system. The main conclusion in this thesis is that the industrial park that has been studied has developed a cost - efficient industrial safety and emergency preparedness system. The collaboration has led to the establishment of learning platforms where individuals from the different enterprises met and shared knowledge. The platforms act as knowledge connection point where people from the different meet in groups to share knowledge that can contribute to learning (Inkpen 1998). The learning platforms took the form of risk analysis, visiting tours, education, training, and excises that all were evaluated. The evaluation of these learning platforms resulted in single or single and double loop learning.

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1 Chapter one: Introduction.

1.1 Background:

The industrial sector is accident-prone (Ulykker i Norge 2009). Industrial accidents can generate financial losses, decrease in human capital, damage to machinery and technology, and harm the enterprises reputations. Enterprises that operate in close proximity have an increased risk that failures or accidents will affect the safety and production of all the enterprises. There is also an increased chance of "domino effect" if the enterprises share processes or auxiliary systems that link them tightly together (Heikkilä et al. 2009). An environment, with several enterprises, with close proximity, creates an interconnection where the actions and happenings that take place affect the field of risk for all the enterprises at the site (Heikkilä et al. 2009) The consequences related to activities in these kinds of industries highlight the need to prevent accidents, or at least to reduce the consequences of their impact (Khan & Abbasi 1999). Therefore the geographical proximity often forces enterprises to take into account each other activities, and to collaborate to manage the shared operations, which also include safety management (Heikkilä et al. 2009 from Malmén et al. 2008).

Reiners (2010) recommends that enterprises should think about collaboration regarding safety management in high-risk processes industries. Ramli, Mokhtar & Aziz (2014) goes even further and say that such safety focus needs to be present in all industries that are in co-existence, regardless if they are low or high-risk or small or large-scale industries. Since there are risks related to industrial production, there is a need to have a systematic safety management that is capable of dealing with issues related to industrial operations (Ramli, Mokhtar & Aziz (2014). Reniers and Amyotte (2011) also say that more efforts need to be related to cross enterprise emergency[1] management, that is systematic and guided. In Norway enterprises that have operations that can affect or ham other enterprises are obliged to establish a common emergency management system (Forskrift om industrivern 2011 §11).

Collaborations make it possible for enterprises to gains competitive advantage and achieve organizational goals that would be more challenging to achieve alone (Vangen & Huxham

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[1] The author uses the definition disaster. According to Sutton and Tierney (2006) emergency peredness can also be regarded as a part of disaster loss reduction.

2006). When enterprises collaborate it creates economical benefits and the potential for synergies through shared networks, suppliers, markets, resources, distributors, resources and support systems (Tudor, Adam & Bates 2007). According to Hudson (1999) sharing of knowledge and production of learning can benefit all the enterprises that are partners within the network. This can in turn create new relations between the companies that are based on collaboration, trust and sharing for mutual benefits (ibid). This is one of the reasons why collaborations between organizations has gained increased importance and strategic emphasis (Fichtner, Frank, & Rentz 2004; Engestrom & Kerosuo 2007).

Even though such collaboration through networking can have positive effects when it comes to learning, there exists a lot of hindrance. E.g. many of the rules and principle that have been developed are often focus on single enterprises and not that enterprises should work in groups (Heikkilä et al. 2009). The reason for this is because many of the guidelines when it comes to safety and security management were developed when the industry sector was dominated by large bureaucratic companies (Heikkilä et al. 2009). Other studies (e.g. Fichtner, Frank, & Rentz, 2004; Roberts, 2004) show that barriers that take place within the different enterprises hinder developing long- term partnership between enterprises. This can be related to reluctance when it comes to sharing of information or uncertainty related to the benefit when it comes participating. Costs when it comes to participation are also a major hindrance. Lack of quality, continuity and when it comes to flows of information, resources can create bottlenecks. Such collaborations can also create loss of control over resources and related decisions (ibid).

Even if collaboration takes place it is not given that learning take place. Lagadec (1997) mentions that learning processes are barely tolerable within an organization, and they become even more problematic across organization. This is something that other researchers also mentioned. For instance Winkelen (2010) shows that individuals do manage to bring the implication of learning from the networks back to their organizations. And even if they do, quite often the organizations do not have the structure and processes to transfer and amplify the learning that the individual brought back to the organizations (ibid). The last then years research when it comes to organizational learning have shifted from single enterprises to inter- organizational networks (Engeström & Kerosuo 2007). Today the focus sis more

directed towards the importance of establishing alliances and collaborations between organizations.

1.2 Previous research:

Research when it comes to collaboration between industrial parks on safety and emergency preparedness is scares. Gibbs and Deutz (2007) mentioned that since there is a lack of examples when it comes to networking among enterprises, and that most of the enterprises are at a early stage when it comes to developing such networks, the linkages between the enterprises are more potential rather than real. Therefore many researchers have been focusing on potential connection and synergies that can take place between the enterprises instead of providing empirical data on actual connections (ibid). Reiners and Amyotte (2011) point out that the focus when it comes to safety and security measures are mostly currently concentrated on the single enterprise and there is little collaboration between different enterprises.

Quite often social scientists organize research around four phases regarding emergency preparedness: mitigation, preparedness, response and recovery (Sutton & Tierney 2006). According to the American National Research Council (NRC 2006), the core topics in this field of science are the hazard research on one side and disaster research on the other side. Hazard- research focuses on pre- disaster vulnerability analysis and on mitigation. Disaster research focuses on post disaster emergency response and recovery (ibid). Preparedness intersects with both of these two categories. Therefore preparedness is a link between the pre-impact and the post impact of disaster events (Sutton & Tierney 2006). Research on emergency preparedness is extensive (Lindell, Kathleen & Perry 2001: Perry & Lindell 2003; Sommer and Njå 2011; 2012; 2013; Fattah et al. 2012; Pilemam, Andersson and Mojir 2014).

Most of the research when it comes to emergency preparedness has mainly been based upon lessons learned from past major accidents or exercises (Karagiannis, Piatyszek & Flaus 2010). For instance Alexander 2005 and Perry and Lindell (2003) focused on research when it comes to the development of emergency plans. There are some studies that focus on risk analysis and the use if risk analysis as part of emergency planning, like Fabiano et al. (2005), and

Münzberg, Wiens and Schultmann (2014). Karagiannis, Piatyszek and Flaus (2010) have presented a model-based approach to the analysis of the robustness of industrial emergency plans. This model based approach function in that way that it is possible to identify dysfunctions with those plans that are analysed.

When it comes to training Alexander (2000) focuses on how to establish methods for learning in order to manage and prevent disasters. Banuls, Turoff and Hiltz (2012) have looked at collaborative scenario modelling in emergency management. Alexander (2005) focuses on the how it is possible to use scenario methodology to teach principles of emergency management. Berlin and Carlström (2015) have looked at collaborations when it comes to exercise. Their findings shows that exercises contribute to learning that can be useful in actual emergency work, which confirmed the results of Perry's (2004) 10-year-old study. Further this study shows that the ability to work with other organisations is strengthened by practising (ibid). Brændeland and Refsdal (2013) have studied at what factors that affect the risk level during emergency response. Their study-identified lack of acknowledgement of risk due to lack of knowledge is the factor that increases the risk for rescue personnel and civilians.

Carmeli and Schaubroeck (2008) have studied at organizational preparedness and the importance of learning from unwanted events. The study focused on the importance of both learning from failures and preparedness by examining the link between these domains. Their study shows that it is important for enterprises to employ and structure learning behaviours from failures in order to respond more effectively to a and unwanted event. Drupsteen and Guldenmund (2014) point out that the there is limited research when it comes to learning from incidents, which can be explained by the complexity of the field. Learning has been marginally described within safety literature, especially the learning to learn process that enables the organizations to improve consciously.

1.3 Research questions, purpose and limitations:

Based what is mentioned in the background and previously research it would be interesting to look at the collaboration between different enterprises, and see if the collaboration creates platforms for learning and sharing of knowledge, that can benefit all the enterprises. In order

to do this, this thesis has chosen on industrial park (henceforth IP) that has a coordinated Industrial safety and emergency preparedness system (henceforth ISEP- system) that *"ensures that qualified personnel in an enterprise are available for emergency response at short notice"* (NSO 2011: 5). An IP consists of different production enterprises that operate within the same zone, thus sharing the same infrastructure (Heikkilä et al. 2009 cited by Malmén et al. 2008), which is the case in this study. The enterprises consist of processes industry that processes raw materials and produce goods (Oxford Dictionary), mechanical workshop, regular offices, laboratories for testing of good and products etc. There are in total then enterprises in this case study that are a part of the joint ISEP- system.

Empirically the purpose of this study is to contribute to knowledge on emergency preparedness through collaboration and learning between industrial enterprises. This study want to see how what kind of learning platforms that is established as a result of this collaborations, and how these platforms utilized joint learning. Further this study want to see if the evaluations of the lessons learned that is gained through the different learning platforms, facilities single or double loop learning. Based on this the following research questions have been formulated:

Research questions 1: How is emergency preparedness established and organized through collaborative efforts among the enterprises in the industrial park?

Research question 2: What kinds of learning platforms are established as the result of collaboration on emergency preparedness and how are they utilized for joint learning.

Research question 3: Does the evaluations of the learning that have taken place within these platforms, facilitate single or double loop learning?

Given that the ISEP- system consist of several processes, it would not be possible to focus on the whole system in the scope of one thesis. Therefore this study has been limited to the

different formal learning platforms that take place within the PDSA cycle. The learning platforms in this study can be seen as connections point where the different enterprises meet to share and gain knowledge. Because of the limited time and resources, this study would not have the capacity to include all the enterprises that are covered by the ISEP - system, therefore two of the enterprises have been selected. The selection has been based on the enterprises involvement in planning, training and exercising.

1.4 The Structure of the Thesis:

This thesis consists of six chapters. Chapter one starts with the introduction of the theme and background for this thesis, before it looks at previously research that has been done in the field of emergency preparedness. Further it represents the research question, purpose and the limitations of this study. Chapter two consist of the analytical framework for this thesis, where theory related to safety management, emergency preparedness, learning and knowledge management are represented. Chapter three give an overview of the study's methodological approach. Chapter four represent the empirical findings of this study. Chapter five is the discussion chapter, where the empirical data are discussed up against the analytical framework. Chapter six addresses the main conclusions of this thesis, and the recommendations for further research.

2 Chapter two: Analytical Framework.

This chapter consist of six subchapters. The first subchapter present theory related to collaboration. The second subchapter describes the emergency preparedness process that takes place within the system, through the use of the Plan, Do, Study, Act cycle (henceforth PDSA cycle). The third subchapter represent theory related to learning platforms. The fourth subchapter represent theory related to the knowledge management. The fifth subchapter represent theory related to single and double loop learning. The sixth subchapter addresses the implication when it comes to the use of the analytical framework.

2.1 Collaboration:

Reiner, Dullaert and Visser (2010) suggested using the word collaborability when there are at least two firms that constantly collaborate in order to increase the sustainability of their activities and environment. Collaboration is a form inter-organizational relationship. This relationship does not rely on market forces or on hierarchal mechanisms for control (Lawrence Phillips & Hardy 1994, from Ouchi 1980). Instead it relies on negotiation that occurs through ongoing communicative processes (Lawrence Phillips & Hardy 1994). In comparison to hierarchies that "*are associated with a willingness on behalf of members to submit to both direction and monitoring by their superiors", collaboration involves the negotiation of roles and responsibilities in a context where no legitimate authority sufficient to manage the situation is recognized*" ((Lawrence Phillips & Hardy 1994: 482). An alliance is also a tool that can be used in collaboration. Alliances can be viewed as the creation of governance mechanisms that make it possible to pursue collaborative interest between two or several enterprises (Park & Ungson 2001). The alliances can vary from loose cooperative arrangement to formal relations through written agreements (Winkelen 2010). The purpose when it comes to joining alliances is to exploit current resources and areas of strength more efficiently or effectuality. Another reason could be to explore the possibility by learning from partners (Winkelen 2010, from Johnson and Scholes, 2002, Child 2003).

To have collaboration in the form of an alliance network requires that a partner have knowledge that can be useful for different enterprises (Inkpen 1998). The joint collaboration could be used by the enterprises to enhance their own operations and strategies. Alliances can also be used by the enterprises as a substitute for knowledge that it cannot manage to create on its own. In way the enterprises would remain depended on collaboration (Inkpen 1998). Through collaboration enterprises develop their collective knowledge through construction and modifying their inter- organizational environment and rules (Larsson et al 1998). Inter-organizational learning can be achieved by transferring knowledge from one enterprise to another, or by creating new knowledge through interaction between the enterprises. To be able to do that there is need for the enterprises to be transparent. If enterprises are not transparent, it would not be possible to disclose the existing knowledge and thereby it cannot be shared or used collectively to generate new knowledge (ibid). Inkpen (1998) points out that without active management of the learning processes and understanding the nature of the joint

collaboration, many of the opportunities will remain unexploited (ibid). This can happen because each organization tends to focus on its own tasks instead of focusing on the big picture (Berlin et al. 2008). Another thing is that a participant seems happy with doing things that are familiar with, but they can be passive when new unknown collaborations take place (ibid). In this case study the collaboration evolves around emergency preparedness.

2.2 Emergency preparedness as a continuous process:

Perry and Lindell (2003) define emergency preparedness as:

> "*The readiness of a political jurisdiction to react constructively to threats from the environment in a way that minimises the negative consequences of impact for the health and safety of individuals and the integrity and functioning of physical structures and systems.*" Perry and Lindell (2003:338)

According to Aven et al. (2004), preparedness is connected to the measures that are taken to prevent an unwanted event, and the measures that are taken to reduce the negative consequences of the unwanted event. This can be seen as a wider definition since it is also focused on the preventive side and not only on reducing the negative consequences like Perry and Lindell's (2003) definition. This study will be using Aven et al. (2004) definition when it comes to emergency preparedness.

Preparedness is a process where a community (in this case an industrial park) evaluates its ability to manage a range of environmental hazards. The process also involves identifying the human and material resources that are necessary to handle threats, and create organizational structure in order to arrange a coordinated response (Perry and Lindell 2003). Organizational preparedness includes developing emergency response plans, training employees and response personnel on what they should do in emergency situations, acquiring the needed equipment, supplies, materials and conducting exercises (Lindell, Kathleen & Perry 2001). This represents a continuous process. This is due to organizational structure and resources change over time. Skills deteriorate if they are not maintained through exercises. Therefore planning and training related to emergency preparedness have to be continuous in order to both establish and maintain emergency preparedness (Seid et al. 2007; Perry and Lindell 2003

from Daines, 1991; Buckle et al., 2000). To illustrate the emergency preparedness as a continuously process the PDSA Cycle has been applied in this study.

The PDSA cycle was originally developed as quality management tool for the manufacturing industry (Seid et al. 2007, from Demning 1982). Walter A. Shewhart (1931) was the first to introduce this framework (Shewhart 1931). It quickly became knows as the Plan, Do, Study, Act cycle (The Edwards Deming Institute 2015). The PDSA cycle was originally applied to predictable, stable and standardized processes, where the outcome is apparent (Seid et al. 2007). Emergency preparedness on the other hand differs from the manufacturing framework. All emergency situations are unique. For instance events that cause emergency situations can be rare, the environment is frequently changing, and output when it comes to emergency preparedness does not necessary seem immediately apparent.

There are many examples when it comes to the use of the PDSA cycle in emergency management. The PDSA cycle have been used to describe an incident control system, in another case it have it have been built into exercises in order to test the preparedness (Seid et al. (2007). Seid et al. (2006) and Curran and Bunyan (2012) have used the PDSA cycle as an analytical tool to increase the preparedness in order to reduce incident and impact. In this thesis the PDSA cycle is going to be used to describe the process of planning, organize, exercises and evaluation of a joint industrial safety and emergency preparedness system.
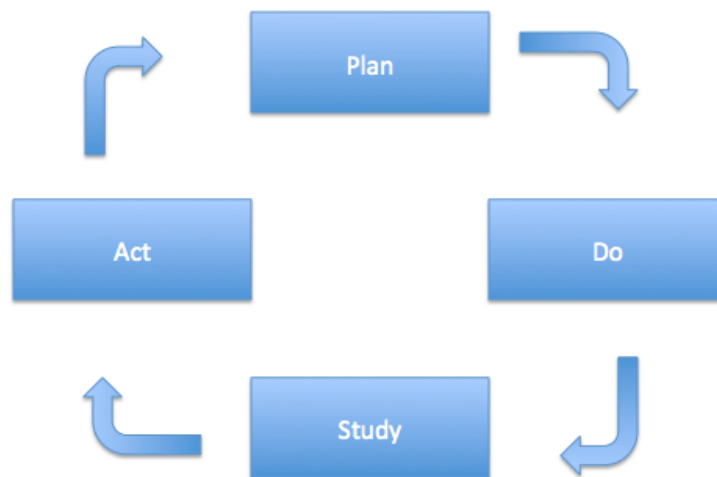
Figure 1: The Plan, Do, Study, and Act Cycle.

Source: The Edwards Deming Institute (2015).

Plan: The cycle starts with the planning phase that involves identifying goals that are necessary for putting a plan into action (The Edwards Deming Institute 2015) and where data is gathered (Maruta 2012, from Imai 1986). Planning is an essential part of preparedness (Perry & Lindell 2003). The planning phase can involve risk analysis. A known problem is that risk and vulnerability analysis often becomes writing exercises that end up in the archives, instead of being put into action (Aven et al. 2004). One way to but the risk analysis into action is to created scenarios (Alexander 2000). These scenarios can be based on past events or they can be hypothetical construction of future events (Alexander 2000, from Foster 1980). The basic building blocks when it comes to scenarios is describing what, when, where and whom the scenario affects. This makes it possible to establish causations for how the scenario can develop. In this way it is possible to define the role of the participants, what kind of goals they should try to achieve (Alexander 2000).

Do : The next is the Do phase, where the components that have been created in the planning phase are implemented (The Edwards Deming Institute 2015). This can be the number of emergency personnel, what kind of equipment that they need, training and courses. Alexander (2000) mentioned that in order to manage emergencies there need to be a combination of both classrooms learning and learning by experience (ibid). The scenarios can be used as means

that can be used to test the actor's ability to respond effectively on to problems in a practical way. The scenarios must be built in such a way that the actors think through the consequences when it comes to their decisions and actions (ibid). Organisations can expand their knowledge related to cause effect by observing similar organization (Mahler & Casanayou 2009, from March, Sproull, & Tamuz 1996). Another alternative is that they can create their own experience by building on scenarios based on actual incidents.

Study: The next phase is the study phase where the outcome is monitored to see if the plan was a success or if there is need for improvement (The Edwards Deming Institute 2015). In this study this is where the exercises and occasionally incidents take place. Exercises can be seen as the establishment of operational settings, where it is possible to study and examine operational details (Perry & Lindell 2003, from Ford & Schmidt 2000; Simpson 2001; Alexander 2003). Exercises themselves represent opportunities to test plans, protocols, equipment, personnel training, facilities and materials (Perry and Lindell 2003; Perry 2004). Testing of the plan can be seen as important because it brings together different organisations and allows individuals develop personal relationship with one another (Perry and Lindell 2003). It is important that exercises are not loosely coupled. If they are, they will fail to sufficiently integrate organizations at the accident scene (Berlin & Carlström 2015). An exercise is successful when the collaboration has an impact on actual practise. In order to create such expertises they can base themselves on scenarios (Alexander 2000). It is necessary to integrate organizations into to accident site on order to generate learning (ibid).

Act: The last phase is Act, where learning from all the phases all the phases integrated, so it would be possible to adjust the goals or methods that have been used in the process (The Edwards Deming Institute 2015; Maruta 2012, from Imai 1986; Walton 1986). Then all the phases are repeated all over again, in a never-ending cycle (ibid). Learning can be effective when workers come together to discuss and evaluate in groups that take place after the exercises in the form of forums (Moynihan 2009). Learning often takes the form of collaborative learning.

2.3   Collaborative learning:

Learning occurs when there is a mismatch between the outcome and the expectation to that outcome that leads to the identification of the mismatch and the correction of it (Argyris & Schön 1996). Learning can be seen as an integrated part of the acquisition of knowledge (Stonehouse & Pemberton 1999). Therefore in this study learning defined as the development of knowledge (Stein 1997). Further learning involves the action(s) when it comes to using the existing knowledge (Pervaiz, Lim & Loh 2002). There are multiple definitions on what knowledge is. As Hudson (1999: 61) puts it: "*knowledge is not an undifferentiated entity and it exists in a variety of forms*". In this study knowledge *has been* seen as a state of understanding, which help form and shape action(s). Knowledge and learning mutually reinforce each other. This happens through the act of learning, which provides the knowledge of understanding, which in turn feed further learning (Pervaiz, Lim & Loh 2002). Knowledge can for example take the form of "*a shared collection of principles, facts, skills, and rules*" (Stonehouse & Pemberton 1999: 132). Inter- organizational learning happens by changing the rules and procedures, just in the same ways as at the level of an individual organization (Larsson et al. 1998). Learning also depends on the ability to shift strategies depending on the actual situation and to be able to customize and adjust initiatives in collaborations with others in order to make a good output (Grote et al. 2009; Nemeth et al. 2011).

In order to transfer knowledge between different enterprises, there must be a connection between them (Inkpen 1998). This type of knowledge connection is established through the relationship between individuals and groups that come together from the different enterprises (ibid). This can be seen as network learning where a group of organisations learns as a group (Knight & Pye 2005). These networks create the potential for individuals to share their observation and experience (Inkpen 1998). This can be seen as a common platform where individuals test their beliefs and ideas through sharing knowledge that is then debated, discussed and questioned related to the exciting practises (Pemberton & Stonehouse 1999). This is consistent with what Argyris and Schön (1996) refer to as dialectical learning, which is a form of debate that reveals assumptions, biases, and facts and evaluates different alternatives. Moynihan (2005) uses the term "learning forums", which are dialogues that are especially focused on solutions seeking. In these forums the actors collectively examine information, consider it and decide how this will affect further actions (ibid). In these platforms both

performance data and more tacit experimental knowledge are used to produce an outcome through reviews that identifies, examine and suspend basic assumptions (Moynihan 2009).

2.4   Knowledge management cycle:

Learning between organizations is concerned with the creation and adaptation of knowledge (Larsson et al. 1998). This happens through a more formalized way of storing, sharing and coordination of knowledge through knowledge management (Pemberton & Stonehouse 1999). Knowledge management is both related to learning and the creation of new knowledge, it is also concerned with the management of the existing knowledge stocks, which also is an integrated part of the process (ibid). To illustrate how knowledge management can lead to learning and improvement this thesis used Evans, Dalkir and Bidian (2014) model for knowledge management (see figure 2).
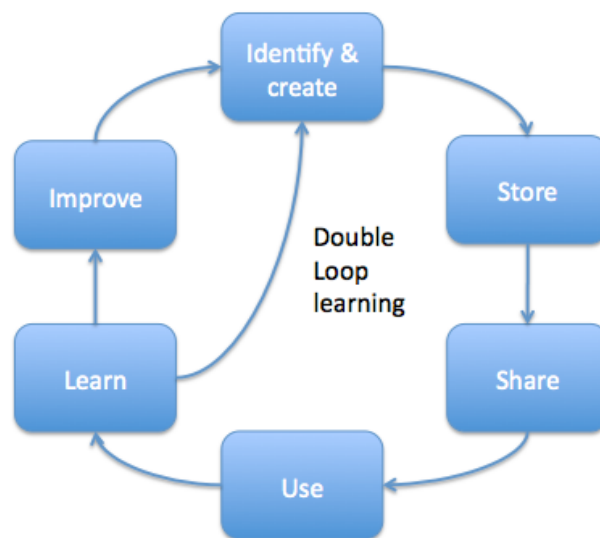
Figure 2: The Knowledge Management Cycle (KMC) Model (modified)
Source: Evans, Dalkir and Bidian (2014).

Stage 1. The identification and creations of knowledge: The first stage is about identifying knowledge that can be useful within the organisation based on the request for knowledge. Request for knowledge can be a result of strategic or operational problem solving, it can be related to decision- making, or related to gap when it comes to knowledge (Evans, Dalkir &

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Bidian 2014). Gap can be viewed as the where the enterprise is at the present time, and where it want to be. Problem solving can be seen as the process when it comes to closing the gap (Mooney 1996). When a request for knowledge is made, the searcher needs to indentify if the knowledge is available or if it need to be created or acquired (Evans, Dalkir & Bidian 2014).

Identifying knowledge can be done through searching for documents that is stored in archives, or it can be through demonstrations, brainstorming or networking (Evans, Dalkir & Bidian 2014). Networks in this study are viewed as several organizations that are depended on each other in order to achieve a common goal (Hall & O'Toole 2000). Networks allow sharing of organizational knowledge and at the same time building new knowledge (Pemberton & Stonehouse 2000). If no knowledge were found within the network, then new knowledge assets would be created. New knowledge may also have to be created if the existing knowledge assets only partly satisfy organizational needs (Evans, Dalkir & Bidian 2014). Knowledge creation and the identification of knowledge can also be hindered (Pemberton & Stonehouse 2000). This can happen if e.g. the searcher fails to seek out observed or conceptualized knowledge (Evans, Dalkir & Bidian 2014).

Stage 2. Storage of knowledge: "*Once the knowledge has been deemed valuable to the organization, based on the analysis and assessment in the identify and create stage, it is stored as an active component of the organizational memory*" (Evans, Dalkir & Bidian 2014: 93). This process involves remembering, accumulating and embedding knowledge and then storing it (ibid). The stored knowledge can be held in the employees mind or in more tangible forms, such as documents that are stored in archives (Evans, Dalkir & Bidian 2014, from Wiig (1993). Knowledge must be structured so it is possible to retrieve and share it for future use (Evans, Dalkir & Bidian 2014). One of the ways that organizations remember is through the developing of standard operational procedures. Through the use of standard operational procedures it is possible to encode inferences from history, which in turn affects the organizational behaviour (Crossan et al. 1999).

Stage 3. Sharing of knowledge: In this stage knowledge is retrieved from the organizational memory, in order to be shared. The knowledge can be shared both internally and externally" (Evans, Dalkir & Bidian 2014). The sharing of knowledge can either be in a more formal

way, through pre-established arrangements, or it can be arranged through more ad-hock arrangements. The sharing of more tacit form of knowledge often happens through face-to-face interactions (Holste & Fields 2010 from Nonaka and Takeuchi 1995) this because workers often learn tacit knowledge through close observation and interaction with people who are already in the possession of that particular knowledge (Holste & Fields 2010). Tacit knowledge is used to describe knowledge that cannot be explicated and that is embodied through practise (Swart & Kinnie 2003, from Polanyi 1966). This kind of sharing of knowledge can be done through coaching, mentoring or storytelling (Swap et al. 2001; Peroune 2007). Personnel transfer effectively act as a mean to gain access to tacit knowledge between different enterprises (Inkpen 1998). An important part of knowledge sharing is training. Training is based on learning, and this learning has to interactive processes where the individuals are involved and active receivers instead of passive ones (Pemberton & Stonehouse 1999).

Stage 4. The use of knowledge: When knowledge has been shared it would be possible to actively use this knowledge. This can be done to solve problems or make decisions (Evans, Dalkir & Bidian 2014). This is usually done by dwelling or assimilating in the activity or in the artefact (Evans, Dalkir & Bidian 2014, from Tsoukas 2005). The most common activities that take place in the use stage are developing communities of practise (i.e. exercises).

Stage 5. Learning: The knowledge that has been shared can be used to create new knowledge, or it can be used to refining the existing knowledge within the organisation. The use of knowledge where experts provide contextual understanding can lead to the individuals at the workplace gain more understanding, as a result of that they can better interpret the impact their decision have on their environment (Evans & Ali 2013). It is in this stage that the existing procedures in the form of regulations that exist in the organizations memory are challenged. If knowledge is viewed incomplete or insufficient, then stage one or two is activated again. Then additional knowledge is either identified or created, based on the gaps when it comes to knowledge. It is in this stage that the possibility for what Argyris and Schön (1996) have called double loop learning. This can happen when the individuals reflect around the value and the applicability of the knowledge that they have acquired (Evans, Dalkir & Bidian 2014).

Stage 6. Improve: Learning that have been taking place in the previously phase leads to refinement of knowledge within the organisations (Evans, Dalkir & Bidian 2014). New values are either identified or created on the basis of the existing knowledge. Updates and addition to the new knowledge are being made, to keep the values up to date within the organization memory and applicable to the context. There are several activities that contribute to the improvement of knowledge. This can for example be through the adaption of lessons learned, or it can be review of the actions that have been made (Evans, Dalkir & Bidian 2014). In his study the review of actions that have been made happens through evaluations. The lesson learned from when employees evaluate themselves can contribute to new organizational learning (Evans & Ali 2013). Lessons learned have to be institutionalised in the form of rules, standard operating procedures, and policies, in order to be available for the different actors (Mahler and Casanayou 2009).

2.5 Single or double loop learning:

This study will focus on two different learning aspects, single and double loop learning, which was first introduced by Argyris and Schön (1978) (see figure 3.

Guidance / values → Action → Okay / Error → Single loop learning → Double loop learning
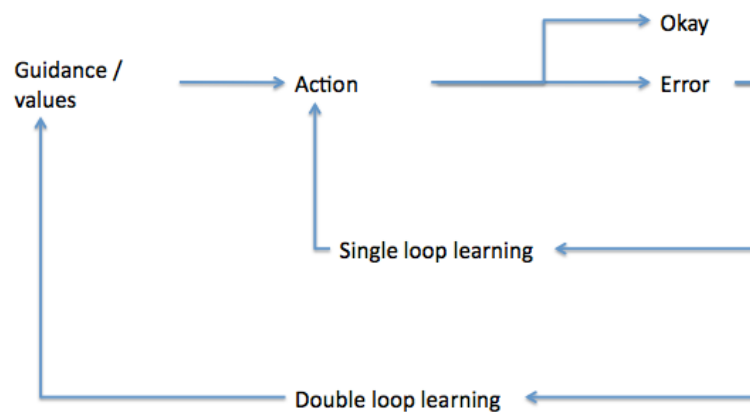
Figure 3. Illustration of Single- and Double Loop learning.
Source: Argyris & Schön (1996).

Argyris and Schön defined single-loop learning as responding to changes in the environment without changing the core set of organizational norms, while double loop learning is about responding to changes in the environment, by changing the core set of organizational norms

and assumptions (Argyris and Schon 1978). In other words, single-loop learning is learning within a given framework, and double-loop learning is learning by changing the framework itself (Bierly, Kessler & Christensen 2000). Therefore single loop learning only improves a single process or situation, while double- loop learning improves the system as a whole (Argyris & Schön 1996). In this way single- loop learning can be seen as a more quick fix solution, like for example technical corrections, skill training or disciplinary actions (Lukic, Littlejohn & Margaryan 2012).) It "*allows the organizations to do the same thing better*" (Moynihan 2009: 189). While double loop learning on the other hand, creates change in values, assumptions and strategies (Argyris & Schön 1996). In this study the framework is viewed as all the enterprises within the industrial safety and preparedness system (henceforth ISEP system). If there are changes in values and assumptions that affect all the enterprises in ISEP- system, then it will be viewed as double loop learning.

One of the most common examples that are used to describe single and double loop learning is taken from cybernetics (Blackman, Connelly & Henderson 2004, from Argyris 1991; 1999), also known as regulatory systems. A thermostat reacts on the environmental condition if it is too hot or if it is too cold, this by turning on or off to a fixed temperature, without questioning why the fixed temperature is ideal. So when there is a mismatch between the expected temperature and the experienced temperature the thermostat takes action and adjust the temperature so the expectancy are in line with the experienced. This processes does not require that new knowledge have to be added, since the thermostat only apply what it already know. Therefore this can be seen as single loop learning. If the thermostat questioned why the temperature was set to that particular temperature, then it will require new knowledge in order to understand the question, and therefore this can be seen as double loop learning.

2.6   Analytical implication:
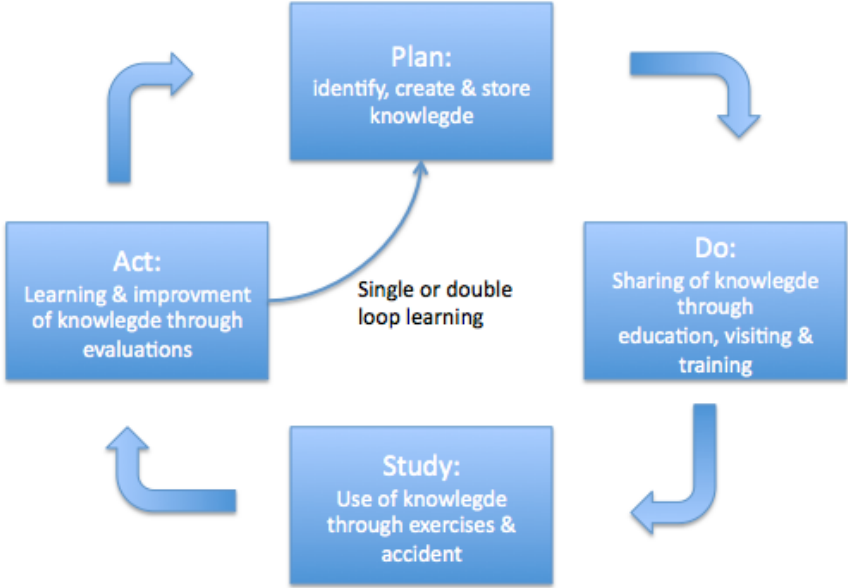
Figure: 4: Combination of the PDSA cycle and knowledge management

In this study the knowledge management cycle by Evans, Dalkir and Bidian (2014) are integrated with the PDSA cycle as illustrated in figure 4. Lim et al. (1999) describe the connection between the knowledge management and the PDSA cycle. They explain that capturing and creating knowledge happens in the planning phase of the PDSA cycle. E.g. risk analysis, emergency plan, rules, and new skills are indentified and/or created and then stored. Sharing of knowledge happens in the do phase (Lim et al. 1999). In this case the sharing of knowledge take place in the form of education, training and visiting. The study phase is where the outcome is measured (Lim et al. 1999). This is where the outcome of the training and education is studied in the form of exercises and occasionally incidents. The last phase is act where learning and improvement takes place (Lim et al. 1999). This happens through the evaluations of the learning from previously phases. By applying theory related to single or double loop learning it would be possible to evaluate if the learning and improvement that takes place in the act phase can contribute to single or double loop learning.

It is important to be aware that in real life these phases and stages they overlap. For instance it could have been possible to place exercises and accidents as a part of the do phase, and evaluation in the study phase. Therefore this can be seen as a more loosely interpretation of the PDSA model. The same goes for Evans, Dalkir and Bidian (2014) knowledge management cycle. The stages in the knowledge management are closely interconnected and they overlap therefore it can some times be difficult to distinguish the stages from each other. For instance when knowledge and learning is working together, it creates more s spiral of knowledge and learning (Pervaiz, Lim & Loh 2002). Therefore it is important to be aware that these models only represent a simplification of a phenomenon. The phenomenon is in reality is much more complex (Thagaar 2009).

3   Chapter three: Methodology

In this chapter is going to look closer at the methodological approach applied for in this study. It will give an overview of the methods that were used to collect the data, why those methods were selected, the processes of gathering the data. At the end of this subchapter the robustness of the thesis is addressed.

3.1   Qualitative Methodology

Social research tries to contribute with knowledge about the reality in the world we live in by applying research methodology. Methodology means to follow a specific pathway to reach a goal (Johannesen Tufte & Christoffersen 2010). Therefore methodology can be seen as a tool that has been used in this study in order to answer the research question and gain more knowledge related to the field that this study is focusing on, which is emergency preparedness (Larsen 2007). The study have used a qualitative approach to collect the data, by this methodology it is possible to get a deeper understanding of the field that is being studied (Larsen 2007), like the processes and the structures that influence learning.

A case design for this study was selected based on the research questions that were developed and the analytical framework that was selected. It was clear that I wanted to study a few unites within a given time period. A case study is an empirical inquiry that looks at a

contemporary phenomenon within a real life context (Yin 2009). Cause study focuses on few units of analysis over a limited time period (Johannesen Tufte & Christoffersen 2010; Yin 2009). The data in this case study have been collected by combination of interviews and document analysis. Case studies are used to analyse both organisations and managerial processes (Yin 2009). This has naturally limited the collection of data to a specific area. This study looks at joint industrial safety and preparedness system (henceforth ISEP- system) within in the industrial park (henceforth IP) therefore this is viewed as a single case study. This research have been based on the two main data in social research; primarily and secondary data (Blaikie 2010). This in turn makes the generalization of the data difficult (Johannesen Tufte & Christoffersen 2010).

3.2 Interviews:

One of the main sources of empirical data in case studies is interviews (Yin 2009). The most common used method in social research for the gathering of data is the use of interviews (Larsen 2007). This study has been built on semi-structured interviews (Blaikie 2010). The qualitative interviews have been done in a semi- natural setting, this means that the informant's report on their own and other individual's activity, motives, and the social processes and institutional practises that take place within the study (Blaikie 2010). In this study the informant's perception, knowledge, values and belief are an important part of the data that is gathered (ibid). Qualitative interviews are based on collection of soft data. These data can be categorised as texts, quotes and pictures (Johannesen Tufte & Christoffersen 2010).

Table 1. List of informants.

List of informants:							
Informants:	**Involvement**	**Utilities**	**Place**	**Time**	**Date**	**Org.**	**Rank**
Inf. 1	High	Audio records & Notes	Office hours	90 min.	04.03.12	Org. A	Management
Inf. 2	Low	Notes	Outside work hours	30 min.	19.03.15	Org. B	Worker
Inf. 3	High	Audio records & Notes	Office hours	60 min	23.03.15	Org. B	Management
Inf. 4	High	Audio records & Notes	Outside work hours	45 min.	07.04.15	Org. B	Worker/ emergency personnel

The list shows and overview of the four different informants that was selected for this study. In order to protect the informant's personal information it was created fictive names on the informants in the form of numbers. This has been used in the empirical chapter as references. list shows their degree of involvement in the ISEP- system. High involvement means that they have been involved in over fifteen years. Low means that there is no direct involvement in the ISEP- system. The rest of the list shows which utilities that were used to collect the data, where the interviews took place, how long the interviews did take, the date of conduction of the interviews, which organizations the informants belong to, and at last which organizations the informants belonged to, by giving the organizations letter A or B.

The lists have not been made more detailed in order to ensure the informants and the organizations anonymity. The informants had long experience when it comes to working at the IP. They also had been involved in the ISEP-system since it first was established, beside informant 2. Informant two had no direct involvement in the ISEP system. Therefore he has gotten categorized as low in the table. Informant two in a way acted as a liaison that helped me to come in contact with the other informants and to deal with more practical questions. This was about what kind of production facilities that exists at the park. What kind of risk exists related to the different facilities? This has helped me establish a picture of the challenges the emergency personnel have to deal with at the IP.

The advantages when it comes to the use of semi-structured interviews are that it would be possible to get close to the informants meanings and their interpretations (Blaikie 2010). This form of data collection gives little limitations for what kind of information the different informants can give away (Jacobsen 2000). It is possible that the data have been interpreted in a different way if it had have been collected in a natural setting (ibid). A natural setting in my case would involve the study the informants while they were doing rescue operations, risk analysis or excises. Because access limitation and time, it was not possible to collect the data in a natural setting.

The informants have been selected based on their involvement and knowledge related to the ISEP- system. The purpose with the use off qualitative methods is to get close to the informants thoughts, experience and viewpoints regarding actions and events (Nilssen 2012; Ryen 2002). Therefore the focus has been on conversation in the form of interviews in order to get the informants knowledge, view and thoughts (Nilssen 2012). Economy and time is the biggest limitation it comes to the number of informants that have been selected (Ryen 2002). The biggest challenges have been time, given that the data have been collected in Norwegian and have to be translated into English, which have been time consuming. Therefore this has had an affect on the number of informants that have been selected in this study.

In a qualitative research it not always that the different informants get the same status (Johannesen Tufte & Christoffersen 2010). This is the case in this study, where the first informant was considered the key informant. This is because the document analysis and the rest of the interviews are all structured and built around the first interview. Another factor have been the accessibility when it comes to different informants. It was more challenges to gain access to the emergency personnel. This has to do that emergency personnel are working in zones that have been categorised as high risk, so it have not been possible to do the interviews during work hours. When it comes to the managers their have been much more easier to arrange meetings, since they work at an office. In order to conduct the face-to-face interviews during work hours it required that I had to get security clearance in order to get access to the IP, which had been done in beforehand of this study.

The collection of data:

Information that was discussed during the first interview was also brought up in later interviews, in order to get more information about the phenomena. In that way I could get informants to confirm what the other informants have told me. The first interview was a much more extensive compared to the following interviews. Two of the interviews were done at the informant's office during work hours, while the other two interviews were done outside work hours. The data that where collected outside work hours where arranged because of the difficulty to find a suitable time during office hours. This is as mentioned because of the safety clearance to gain access to the facilities and the because of the limited time the informants had to participate during the regular work hours.

My experienced was that the two interviews that where done during office hours felt more formal. Doing interviews during office hours, had one obvious disadvantage, and that was some disturbances since other people wanted to talk to the informant's. Therefore there were taken break during the interviews, but I did not feel that that had any stressful effect on the informants. Another thing was that the first interview with my first informant took much longer time than I had estimated, which at the end did make the informant seem a little more stressed since the informant also had some worked that needed to be done after the interview. The positive thing with doing interviews during office hours was that the informant had access to documents on his computer, which was used as examples when answering the interview questions that I had. For instance the informant did go through different evaluation schemes that were related to previously exercises.

The interview effect or control effect is one of the most obviously disadvantages when it comes to use of qualitative interview (Larsen 2007). The interview effect is about how honest the informants reply on the question. This could be that the informants answer what they believe I wanted to hear during the interview, or that the informants answer in that way to give a good impression of his work or of the enterprise, or what they believe could be the right answer (Larsen 2007). It is difficult to know if such an affect has taken place during the interviews. By explaining to the informants that there is no wrong or right answer, and that the informants and organizations have been anonymous, may have helped to reduce the

interview effect. Another thing is that I have tried to be aware of how my present can affect the interview situations and the informant's behaviour (Nilssen 2012). I as a researcher will always affect the situations in some way or another. This can be through how I ask the questions, how I dress, how I behave, and how I react to the different answers (Nilssen 2012). This is something that I have tried to be aware of.

I have also tried to be aware of any biases that could have been collected. This is often called reflectivity, which means that I have actively tried to be aware of my potential biases, so that my personal view has not become dominant when it comes to how the data have been interpreted and how the research is conducted (Johnson 1997). Still my background has had an affect on the interpretations of the data that have been collected (Johannesen, Tufte & Christoffersen 2010). Since I have studied societal safety and worked in the process industry for a short time period, this would also have an affect on how I understand and interpreted the data that have been collected. I felt that his have given me some advantage. It made it easier for me to understand both the work processes, and the emergency preparedness processes that take place at the IP. However this can also have a disadvantage because of the established pre- assumptions. This is something I have been trying to be conscious of through the processes of collecting and interpreting of the data.

3.3   Document Analysis:

In addition this study also builds on document analysis in the form of texts. Document analysis is a form of secondary data; this is raw data that have not been collected by me, and that have been collected for a different purpose (Blaikie 2010: Thagaar 2009). The use of secondary data has some advantages such as saving time and cost. Secondary data can also have some disadvantages that this study has to take into consideration. For instance the criteria when it comes to secondary data have been that it could not be more than five years old. Data that is older than this would not been include in this research. It can be difficult to measure the quality of the secondary data Blaikie 2010). I have therefore tired to be aware of what kind of sources are behind the secondary data.

By using mixed method it is possible to increase the validity of this study (Johannesen Tufte & Christoffersen 2010**).** The collection of textual documents did in this case study provide

useful background information before the interviews was conducted (Yin 2009). Ringdal (2009) mentioned that the there is a possibility that the informants do not remember correctly, so by using secondary data it have been possible sometimes to double-check what the informants are telling, this have increased the reliability. The experience from this study is that the combining primarily data in form of interviews and secondary data from the document analysis have increased the reliability of the empirical data. This because it has been possible to control facts related data that have been given by the informants. This has been done through checking documents, when it comes to dates, years and specific episodes and so on. The document analysis has also contributed to data that have been represented in the empirical chapter. Not all of the documents that have been used as a part of the empirical chapter are available in the reference list. This has to do with the protection of the enterprises and informants anonymity. This study has categorized the document analysis into internal and internal documents.

Internal documents are documents that produced by the different enterprises in this study. The internal documents that are being used are more fact-based documents. They show the list of equipment, number of emergency personnel, number of exercises, what kind of training the emergency personnel need and so on. It also involved the IP emergency plans from 2014 and 2015, and the risk analysis from 2014 and 2015. During the interviews with the informants, there were also asked some control questions, to check if the information in these documents where up to date and reliable. It was then clarified that the documents had to be sent to different supervision authorities for approval, so therefore they had to be up to date and correct. Based on this information the internal documents have been deemed to have a high reliability. Another thing that can have negative effect on the reliability is that the internal documents are not available due to the anonymity of the informants and enterprises.

The external documents are not produced by the enterprises themselves. They are produced by external sources. The document analysis of the laws, regulations, and instructions have given insight when it comes to how the ISEP- system function and how it is organised. The following external documents have been used: Forskrift om industrivern (2011), NSOs[2]

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[2] In Norwegian: Næringslivet sikkerhetsorganisasjon

yearly report (2013), the magazine Safety (2010-2015). The articles that had been selected from the magazine Safety had the following sources: NSO, NSR[3], Police Academy, Norwegian First Aid Council[4]. The information that have been collected from these document where seen as reliable, given that this is information that is produced and quality assured by public institutions. The information that have been selected are mostly written by the source it selves. Therefore the credibility of the data is viewed as high. The topics that were selected varied, it could be information regarding the establishment of laws and regulations, or it could be related to organisational changes and challenges when it comes to ISEP- system. The articles from NSO are not a part of the reference list. The reason for this is because they also had some articles that where directly linked to this case study. Therefore I could risk exposing the enterprises if the references where made directly to those articles.

3.4   Ethical Considerations.

In social research there are some ethical dilemmas, consideration and accounts that a researcher has to deal with through the whole research process (Nilssen 2012). This is especially the case when the collection of data affects people (Johannesen Tufte & Christoffersen 2010). I have a duty to respect the informant's private life, and to avoid any kind of harm or stress on the informants (Nilssen 2012; Ringdal 2009).

This study has been based on informed consent to make sure that the informants are aware of what kind of study there are participating in and what the purpose of this study is (Nilssen 2012). I have tried to be as open as possible when it comes to informing the informants about this study. There was not given any written formulary that the informant had to sign. Such a formulary could be viewed as a written agreement that the informants could not withdraw from. Instead the informants were informed through e-mail or phone. All personal information have bee treated confidentially. It is only the author of this study who has had access to the data that have been collected. The records have been stored in a password-protected computer until the data had been transcribed. During the transcription all personal information was removed. After censorship, all data that was related to this study was deleted.

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[3] In Norwegian: Næringslivetssikkerhetsråd
[4] In Norwegian: Norsk førstehjelpsråd.

Participation in this study was based on volunteerism. Therefore the participants could at any time withdraw their consent without giving any reason. It was clear in the beginning of this study that personal information regarding the informant's profession in combination of recording of their voice through the audio recorder made it necessary to report this study to the Data Protection Official for Research.

3.5   Research robustness:

To make sure that the methods that have been used in this study are reliable and that the conclusion is valid this thesis have used validity and reliability. The validity is about how credible the data that have been collected is. The external validity is about the generalization of the knowledge that has been collected in this study to other areas (Johannesen Tufte & Christoffersen 2010). Reliability and validity are interconnected. To have high validity you need to have high reliability. Reliability is affected by random errors that are made during the study while validity is affected by consciously errors that are made thought the study (Ringdal 2009).

Through the use of qualitative interviews it have been possible to increase the validity of this study. This has been done using semi-structured interviews that have allowed me to ask follow up questions during the interviews. This have made it possible to for me ask the informant to elaborate more on the reply that they gave (Larsen 2007). It is easier to ensure high validity in qualitative studies when semi structured interviews are used, this because it gives the informants and myself the opportunity to speaks more freely, which makes it possible to clearly ambiguities (Larsen 2007). The validity of this study has also been strengthening with the use of mixed methods. This study have combined both the use of interview with textual document analysis, by combining these two analytical method have made it possible for me to gain accesses to a broader set of data that have been helpful when it comes to establish an understanding of the phenomena that I am studying.

External validity is about the possibility to generalize the result from this study to other cases (Johannesen Tufte & Christoffersen 2010). This means that the data that are collected is valid when it is being compared to similar studies (Jacobsen 2000). Case study is often criticized

for lacking the basic for generalizations (Blaikie 2010; Larsen 2007; Yin 2009; Johannesen Tufte & Christoffersen 2010). According to Yin (2009) this is because the case study explores phenomena in a specific context, in that way the information that in gathered relies on the contexts it is gathered from. The data is context sensitive, and therefore it is not possible to generalize it (bid). When it comes to industrial safety, Ramli, Mokhtar & Aziz (2014) point out that IPs are context related due to different factors like local culture, legislative systems, physical design of industrial park, types of industries, readiness and openness of the industry.

Even thought the study is context specific, there is to some degree possible to have a certain amount of transferability (Larsen 2007), also known as generality (Johannsen, Tufte & Christoffer 2010). For instance Pilemalm, Anderson and Mojir (2014) says that the purpose when it comes to rescue operations, does not differ among other rescue organizations, even if they have different organizational or institutional framework. They argue that such studies could to some extend be applicable to other setting that are operation with emergency preparedness. Therefore the findings in this study will be seen in context to previously research when it comes emergency preparedness. It is also possible to use so called replication logic (Johnson 1997). The more times the study is replicated with different people and places with the same result then it is possible that the study may apply to other similar phenomena. This can also happened with the use of the theory. By applying the result of this study to the theory that have been selected it is possible to transfer the knowledge to a broader set of similar cases (Yin 2009).

Another terminology that is frequently used in research methodology is reliability. Reliability is about how reliable and accurate the data in this study is, what kind of data that is the used, how the data are collected, and how the data have been processed (Johannesen Tufte & Christoffersen 2010; Larsen 2007). The reliability in this study has been strengthen through describing the methodology approach in detail (Johannesen Tufte & Christoffersen 2010). The interviews have also been done face-to-face. This is also something that can increase the reliability of the study because it was be possible for me to observe the informants (Johannesen Tufte & Christoffersen 2010). Since this case study is anonymous it would also have an affect on the reliability. It would not be possible to replicate this study. Even if the same study have been conducted in the within the same IP, there is no guarantee that the same

informants would have been selected. The timeframe would also have an affect. If the interview has been conducted half a year from now, it is possible that some changes have taken place, which could have affected the outcome of the study.

The data that have been collected with the use of audio- recorder, this can be seen as an important factor to increase the reliability of the data that have been collected (Tjora 2010). The use if audio- records made it possible to more precisely reproduce the information that was given by the different informants (Larsen 2007). It also made possible to listen to what the informant is saying and to ask follow up question instead of spending time taking notes. The use of audio- recorder also made it possible for me to represent direct quotations from the different informants. The interviews have also been done face-to-face. This is also something that can increase the reliability of the study because it was be possible for me to observe the informants, which is a rich form of communication (Johannesen Tufte & Christoffersen 2010).

3.6   Limitation of the data that have been collected:

The number of interviews that have been done could have been more extensive. For instance it could have been relevant to interview the instructors and the people from the emergency services that also can be seen as a part of the ISEP system.   By doing so all representatives from the different levels in the ISEP system would have been covered. Another ting is that this study has not had accesses to the records related to the different exercises that have been held. These records contain information about the goals and feedback regarding the exercise. This study has as mentioned earlier not done any observations. By observing exercises it can have been possible for me to get a better understanding of what the different organizations benefits in the form of learning and knowledge by having joint exercises. All of these remarks could have helped improve the quality of the findings. However I would also like to point out that I do not believe that more data would have changes the findings in this thesis.

4   Chapter Four: Empirical Data.

In this chapter the finding from my interviews and my document analysis be represented. The first sub chapter will first represent data related to how the emergency preparedness is establish through collaborative efforts among the enterprises within the industrial park (henceforth IP). The second subchapter will represent the different learning platforms that have been established as a result of the collaborations related to the emergency preparedness and how they utilize joint earning.

4.1 The establishment of the industrial safety and emergency preparedness system

The enterprises have established collaborations that consist of a total of then enterprises. This collaboration has existed for over two decades. Where they have developed a quite complex and advanced Industrial Safety and Preparedness system (henceforth ISEP- system). The main purpose of the ISEP system is: "*to ensure that enterprises have robust systems for industrial safety and emergency response which in a prudent and effective manner are capable of limiting the consequences of undesired events on life, health, the environment and property and to contribute to speedy normalisation*" (Forskrift om industrivern 2011: § 1[5]).

The ISEP- system consists of volunteers from different enterprises at the IP. The volunteers are then educated and trained at the SC. When volunteers have past the education and training they then become emergency personnel (Inf.1; 2; 3; 4). The emergency personnel from group one are first at the scene after an unwanted event. Then the second respondents are from the SC, which consist educated and trained fire fighters. The third respondents are the emergency services from outside the IP, which consist of the city's fire department, police and the ambulances (Inf.1; 2; 3; 4). But sometimes the SC is there before the emergency personnel from the different enterprises. This is because the SC are ready to respond at all time, while the rest of the emergency personnel have to leave their regular work to get dressed before they can respond to a situation (Inf.4).

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[5] Translated from Norwegian by NSO:
http://www.nso.no/filestore/Engelskversjonmedendringeneinnarbeidet_ny.pdf

The SC act in a way as a coordination centre when it comes to emergency preparedness. The SC has gotten most of the responsibility to coordinate the emergency personnel from the different enterprise (Inf.1; 3; 4). The SC has the responsibility to develop the overall risk analysis for the whole IP and develop the shared emergency preparedness plan. IP also have gotten a common pool of resources in form of emergency personnel and equipment that they share. The SC has its own training centre where the emergency personnel from the different enterprises can train on scenarios related to fire. The SC also has a fire truck and an ambulance that are used by the professional firemen that are located at the safety centre. There are in total two fire men that are stationed at the SC at all time twenty four seven. These are professional firemen that are part of the ISEP- system. The rest of the emergency personnel are volunteer workers that have been recruited from the different enterprises. (Inf.1). There are in total of then enterprises that are a part of the ISEP- system (Inf. 1; 3; 4).

Today the IP have developed as cost- efficient ISEP- system (Inf.1; 3; 4). The informants are pleased with the collaborations that they have mange to establish. With no joint ISEP- system things would have been a whole different. The commitment and involvement in the form of time and resources would have been a lot for a single enterprise to handle, especially for the process industries (Inf.3). It would have taken a lot more commitment for each enterprise if they were supposes to do it them selves. Therefore the arrangement where the enterprises could rely on the SC knowledge when it comes to emergency preparedness is view as a god deal (Inf.1; 3; 4). The SC is involved and make sure that the emergency personnel have the necessary training. The SC has developed a program for how everything is going to be done, and they call in people for training and exercises. The SC is a really good support for the enterprises. It is organized in that way that the SC is doing what they know best, and that is emergency preparedness, so the enterprise can concentrate on producing goods (Inf.3). Even so they wish that more enterprises within the IP had joined the ISEP-system. It was believed that the main reason why not more people are joining the ISEP-system is because of the cost to participate (Inf.1; 3; 4). The collaboration has made it possible for the different enterprises to learn from each other through different learning platforms.

4.2   The different learning platform within the PDSA Cycle:

In this subchapter the different learning platforms that have been identified. The learning platforms have been categorized within the different phases of the PDSA cycle. In the planning phase risk analysis was identified as a major learning platform. In the Do phase training and education was identified. In the study phase exercises, incident and visiting was identified, and in the act phase evaluations and the QHSE Group was identified as formal learning platforms.

4.2.1 Plan: The risk analysis as a learning platform:

The different enterprises collaborate when it comes to develop the over all risk analysis (Inf.1; 3; Risk Analysis 2014; Risk Analysis 2015). The risk analysis has been done in a working group. This working group consist of quality, health, safety and environment leaders (henceforth QHSE leaders) from the different enterprises (Inf.1; Risk Analysis 2014; Risk Analysis 2015). The QHSE leaders from the different enterprises had on beforehand done an internal risk analysis for their enterprise. By combining the risk analysis from the different enterprises, the working group was able to identify the potential larger unwanted events by establishing an overall risk picture. Based on this analysis the working group choose the scenarios that they want to look closer at (Inf.1; 3)

Based on the resources that they have available, they have picked some events that they had to make dimensional. When the events have been made dimensional, the working group started to pick apart those dimensional events that they have identified, to see how they were able to handle them. This they done by going through the identified scenario, and looked at how this scenario potentially is going to develop. Then the working group have looked at what is need when it comes to personnel, materials, equipment, and plans in order to handle that specific scenario (Inf.1; Risk analysis 2014; Risk analysis 2015. If they were equipped and trained to handle large-scale scenarios, then they also would be able to handle scenarios of much smaller scale (Inf.1).

> *"If we manage to handle a scenario with fire in a large production facility, that contains over a 100 people, then it would also be possible to handle a small fire in a barrack"* (Inf.1).

In the over all risk analysis the working group also tried to identified events that to some degree have some distinctiveness between them, so that there is not only a focus on fire (Inf.1). In total of 18 scenarios was a part of the risk analysis in 2014. The working group have looked at events with over bottling, explosions in slag, traffic accident, dust explosion, gas leak etc. (Inf.1; Risk Analysis 2014). They have even looked at events when it comes to terror attack against some of the facilities. (Inf.1; Risk Analysis 2014) If this happens, then they should be able to handle such scenario. When it comes to reduce the likelihood for such an attack it has been regarded as too expensive, considering the likelihood for such events is low (Inf.1).

> *"The likelihood for such an attack is going to take place here is low, considering there are many other targets in Norway that have much higher likelihood for such events."* (Inf.1).

This analysis is revised every year (Inf.1; 3; Risk analysis 2014; Risk analysis 2015). The SC talk to all the enterprises here and see if there is something that has changed in their organisation related to the risk picture. Is there a new situation here that makes it necessary to update the risk analysis (Inf.1). Both the risk analysis from 2014 and the risk analysis from 2015 have been reversed. The risk analysis from 2015 was reversed because one of the enterprises had left the collaboration. The working group also added a scenario as a result of an incident that they had in one of the enterprises (Risk analysis 2014; Risk analysis 2015; Inf.1; 3).

The overall risk analysis is based on risk analysis that has been done in the different enterprises. These can be quite heavy risk analysis that takes several months to do, depending on the type of enterprise. If the risk analysis in the different enterprises shows something that could be relevant to implement into the overall risk analysis they would then report it the SC. (Inf.3). Based on this they would have a discussion to see if the risk is something that needs to be a part of the over all risk analysis (Inf.1; 3). The SC has been hired to do the risk analysis in the process industries. Therefore they are aware of what kind of risks that exist within the

different enterprises. The SC also has the risk analysis from the process industries stored within their database, so it is available when they are going to do an overall risk analysis for the IP (Inf. 3).

Still if the SC is hired in they mostly guide and supervise the risk analysis (Inf.1; 3). It is the people from the enterprises that are involved in doing the risk analysis. The people are from different part of the enterprises. It can be safety delegates, people from mechanics and electricians because they have specific knowledge about the operations and activates in that particular zone of the enterprise. They also have involved the leaders from different departments. So there are a lot of people involved in the risk analysis (Inf. 1; 3). One of the enterprises had a new evaluation of their internal risk analysis for just one month ago. This involved an incident related to an activity with the risk for radioactive radiations (Inf.3). Based on an incident the enterprise and the SC had a discussion if this potential risk should be taken into the overall risk analysis for the IP (Inf.1; 2; Risk analysis 2014; Risk analysis 2015).

4.2.2 Do: education, courses, training and visiting as learning platforms.

The risk analysis said something about the personal equipment that each person need to have, and what kind of training they need (Inf.1; Risk Analysis 2015). The personnel shall have training in fire protection, fall safety, rope rescue, rescue in the height, order and security. (Inf.1; Risk Analysis 2015). It is a relative large course package so they have made a system on how to manage the courses and get everyone trained (Inf.1). The content in the different courses that the SC has developed, have been based on what they have learned at external courses, like The Norwegian Fire School, and The Norwegian Research School in Innovation (henceforth NORSI) (Inf.1).

Before SC also use to take courses that were developed at NSO. The personnel did feel that they had outgrown those courses, so SC gave it more or less up, and focused on fire schools, and other course centres like the chemical diving centre etc. The IP did find out that if they where going to have the competence they could have the courses here at the SC with the same

standard, if not better. So therefore the IP have a course centre at the SC where the emergency personnel can get the education, training and exercises that they need (Inf.1). It is all organized so that the joint collaboration when it comes to the ISEP system circle around the SC (Inf.1). The other enterprises have other main tasks, like producing goods. Therefore it is believed that the knowledge related to planning for excises that are developed at the SC would be much better than if it where developed internally in each enterprise or externally outside the IP (Inf.1; 3).

The SC usually first arrange some theoretical lectures for the emergency personnel, and then they have more practical training where the emergency personnel learn through ands on experience how to use the equipment like stretcher etc. The SC creates more practical exercises where they get use the theoretical part that they have been training on, so they are capable to evacuate people and manage the situation in a reasonable way (Inf.4). The Instructors learn a lot on these courses that they have, and then the SC hire people from the fire school, and they come back with new knowledge. In that way they are always updated on the rules and regulations that are always changing (Inf. 1; 4). The instructors from the SC do a great job when it comes to education the emergency personnel. They manage to get people involved and interested (Inf.4). But it was also pointed out that ISEP- system was not for everyone even though it is based on volunteerism. This is something that people would learn through training and educations. It may be the person is afraid of heights or that that person got claustrophobia being in a small smoked covered room (Inf. 4).

 It was also mentioned out that that different enterprises where invited to be a part of the safety inspections at some of the enterprises, where they walk around in the enterprise and observe how the work is done in accordance with the safety procedures (Inf.1; 3). When it come more to the preventing side they also have visited other enterprises elsewhere in the country (Inf.1).

One example that was given was from an American owned enterprise in Norway. It was pointed out that the Americans are extremely strict when it comes to safety and preparedness. When people from the IP were guided through the enterprise in one of the safety tours in the

American company, the safety leader in the enterprise reacted that one of the worker only used one safety line when he was working at heights. He stopped the whole working group and called a meeting where the safety leader gathered the whole group. The IP as visitors could not understand what the safety leader was reacting on, because as far as they did see the worker had the safety equipment on. Then the safety leader asked the worker how he managed to get up there? How did he move from point A to B? How did the worker manage to stay safe while moving from point A to B? In turns out that the worker only had a single safety line, and of course the worker loosened that safety line in order to move from point A to B (Inf.1).

The American company requirements was that the workers should have a double safety line, so that the workers also was secured when they had to loosen one of the safety lines in order to get from A to B. The visitors from the IP view this as quite strict rules and this is something that they had not been considering before the visit. So after the visits the different enterprises had a debate if they also should implement this kind of rules. While they were having this debate, an incident did occur related working at heights at the IP, which could exactly have been avoided if they have implemented the rules immediately. After that incident the regulation when it comes to the use of double safety line was implemented, so now this is something that applies to all the enterprises in the IP, not only the ones that are a part of the ISEP- system. (Inf.1).

> "*Looking back at it this is something that of course should have been implemented right after our visit to the American owned company*" (Inf.1).

The emergency personnel do also visit enterprises within the IP (Inf.1; 4; Risk analysis 2014; 2015). By visiting other enterprises it help the different emergency personnel to get familiar with the different enterprises. So if they have an incident where it will be a need for emergency personnel they at least know about the main rooms and facilities within the enterprise. There are a lot of space and zones that have to be covered. If they have not done these visiting tours it would have been much harder to orientate in the different enterprises in case of an emergency (Inf.1; 4). The SC knows the IP better than the emergency services so

that is also an advantage. They know about the hazards and risks. They also know the facilities and buildings better since they are responsible for the fire safety inspections at the IP. They know the facilities very well and know where they can and cannot go (Inf.3). Even though the SC knows the IP and the different enterprises, the SC point out that they often have to rely on the emergency personnel that is locally known within that specific enterprise in order to navigate (Inf.1; 4).

4.2.3 Study: Exercises and Incidents as learning platforms.

Exercises:

The exercises for the emergency personnel are all developed at the SC (Inf.1). Each year there are developed a range of exercises (Risk analysis 2014; Inf. 1; 2; 4). When an exercise leader plans exercises he can do that without telling a single person. Then the exercise leader just initiated the planned scenario, and then just observes how the organisation handles this scenario according to a checklist that they have developed (Inf.1).

"For example like the exercises I did yesterday, at the post office here" (Inf.1).

They also have observers that look at what the emergency personnel do, and what they eventually not do (Inf.1; 3; 4). The people who get the roles of observers can be everyone. They do not need to have a specific knowledge when it comes to safety or emergency preparedness (Inf.1; 3; 4). It can be good to have people who do not have any knowledge about the ISEP- system, to evaluate the exercises. In that way give more "neutral" information, just explaining what they see, which can be an advantage when it comes to learning. It can also be important to have people that also have some knowledge when it comes to health and safety, like for example safety representative[6] Last time they had a joint exercises at the IP they were evaluated by observers from outside the park (Inf.3).

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[6] In Norwegian: Verneombud

"When you are really involved in what you are doing, it can be difficult to see the strength and weaknesses. Therefore it can be good that have someone from the outside, than can to observe and give feedback" (Inf.3).

The Focus when it comes to the different exercises is where it should be. There is a lot a focus on first aid and this is important because there are lot of workers here getting older. A person are working shifts and as the years passes, people health are not the same as it used to be because they are getting older (Inf.4). It is important for the emergency preparedness personnel to rehearse and train on the same thing over and over again so they are able to do the ting that they are suppose to do (Inf. 4).

When the enterprises are going to do their own exercise, they ask the SC for help. So quite often the SC have the responsibility to supervise that exercise. The reason why the SC is asked is because the SC is the one that have the knowledge when it comes to emergency preparedness. They have built up that knowledge over time. It can be possible that they want to have a lager exercises and then the SC know how to do that. SC got the contact network so they know which strings to pull, especially when it would be necessary to involve the police, firemen and ambulances and so on (Inf.1; 3; 4). The SC also got necessary equipment like smoke machine, ambulance, fire truck etc. This is equipment that can be useful when enterprises hold larger exercises (Inf.1; 2; 3; 4).

Resources and the framework create limitation when it comes to exercises and what it is possible to learn from them. The one of the criteria's is that the exercises should be as realistic as possible. Therefore it would be regarded as unrealistic to have exercises where all the personnel are trained at once. There is also a limitation when it comes to the number and the variation of exercises that they have time for during a year. The exercises are often done to test the personnel, equipment and systems. Exercises can show that there is a need to install more alarm system in a facility, because it is not possible to hear the alarm during work activates.

It can be difficult, especially exercising the emergency leaders in a realistic way, because they especially need people to lead during an exercise (Inf.1). The emergency leaders also have other roles. An emergency leader can also be a smoke diver (Inf.1; 4). It says in the emergency plan that SC is going to take over the emergency leader role when they arrive at the scene. Still it is important that there is locally known emergency leader present that can guide the different emergency personnel that arrive at the accident scene. This because the SC and the emergency services are not that well known in all the enterprises (Inf.1).

Incidents as learning platforms:

The SC describe that they have a unique situation up here, they are so close to all the enterprises. If a fire alarm goes off in one of the enterprises the IP emergency personnel can be almost immediately in place. A fire develops quickly in just in 2 - 3 minutes. They have detecting system that can register fire, smoke or gas. In this way the emergency personnel can arrive early, so it is possible to stop the coffee machine that are not turned off before the smoke covers the whole building (Inf.1).

> *"I have been in with the emergency personnel for over 15 years and I have never experienced a major accident at the IP"* (Inf.4).

Since there are lack of major incidents most of the emergency personnel draw learning experience from smaller emergency situations where warning, notification, and the collaboration between the emergency services are tested. In most cases these are done in according the procedures (Inf.1; 3; 4). The One example is an incident is from 2014. The alarm at the SC went off. There had been an accident at one of the enterprises. There was one person that had received seriously crush injuries. It took about 4 minutes before the emergency personnel where in place. Both the emergency leader and SC with its own ambulance and fire truck where there. The emergency- and fire personnel transported the injured into the ambulance (Safety 2010-2015).

Another examples related to learning were an incident that happened during an exercise at one of the enterprises, which caused a very abrupt learning curve (Inf.1; 2; 3; 4). It turns out that

there was not good enough information, when it comes to what they where going to do in an exercise. The SC was hired to be the exercise leaders. There was a fire distinguish system placed in that room, that had a cartridge, that contains a gas to distinguish fire. The SC had have placed a cursor in that room, and when they activated the smoke machine, the fire system was also activated. This caused a loud bang and gas for extinguish fire was realised into the room, and as a result of this, the cursors got really frighten. They also had blocked the emergency exit, as a part of the exercise, so he did not manage to get out from there (1; 2; 3; 4).

This is an example on a situation that has caused changes en the regulations. If the SC is going to be the exercise leader in an enterprise, they need to have a checklist that the enterprise has to do in advantage. In that way the enterprises are responsible for indentifying the potential risk at their workplace. This has to be in place because the SC cannot know about what exist of risks in the form of hidden facilities and constructions in the different enterprises. So when SC are going to be the exercise leader, they want to have a named person from enterprise that checks the facilities for potential risk and eventually turn of different systems (Inf.1; 3; 4). This is a change that affects all the enterprises at the IP (Inf.1).

> *"This was an expensive learning lesson. It did cost a half a million to replace that cartridge"* (Inf.1).

The last incident was related to fire and the risk for explosion in one of the facilities. The challenges was at that time that the communication equipment that they had failed. It was difficult to know who was doing what and where everyone was situated at any given time. They had to have an overview of the emergency services, the emergency personnel, the worker etc. This they solved with using mobiles phones to communicate. In that way they managed to make sure that people were evacuated from the zones that were necessary to get them out from. It all went well regarding the circumstances. The procedures failed in that way that the communication radio that they used had a breakdown. As a result they recently have invested in new communication system in the IP (Inf. 3).

4.2.4 Act: The evaluations of the learning platforms and the establishment of the QHSE group.

Evaluations:

They have evaluation where they give feedback after the different exercise and training. Then they have to look at the goals that they had decided to have. What did go well with this exercise? What could have been done differently? The feedback is also something that have gotten better and better by the years. Evaluations take place in all the learning platforms. When they have evaluations they do it together in a room where everyone that have been present at the excises are gathered. In the evaluation the emergency preparedness personnel are given feedback on what they have done. This is can be what went good and what eventually could be improved. The feedback is also regarding the planning of the exercises, for instance if there is something that needs to be changed regarding how the exercise was executed. It is the SC that has the responsibility for the evaluation. In the evaluations SC look at what was a success when it comes to the exercise? What could have been done better? What the emergency personnel feel like they want to rehearse on and so on (Inf.1; 4). These feedbacks are then given to the exercise leader. Then the feedback is analysed, based of the result of the analysis different actions are taken. (Inf.1).

If they discover that a routine have not been followed then they investigate why this is the case. Is it because the worker does not know the routines? Is it because the worker does not care about the routines? Is it because the worker chose to take short cuts? (Inf.1). They also try to improve routines at all levels. There is no different between exercises or those working at the office. They are both viewed as work activity that the enterprise needs to have routines and plans for. These routines described the working process from A-Z. (Inf.1).

The feedback they have gotten is then eventually after being considerate implemented into the planning process of new exercises. Then they make plans that stretch over time several years. They look at what they previously have exercises to see what they have covered before, and then they develop new exercises so they make sure that the exercises cover all the scenarios that they have identified (Inf.1). In that way it becomes a circle that they are trying to reach through. So even though right now they are planning for the exercises in 2015 they look at

what they did in 2014, 2013 etc. (Inf.1). There is also constant organizational changes that happening at the IP that are necessary to monitor. In 2015 they decided to add a new scenario. This was something they where a little unsecure about if they have covered before, and that is over tapping of steel (Inf.1). The changes that take place are updated into the risk analysis plan (Inf.1; Risk Analysis 201; Risk Analysis 2015).

So there in no doubt that the ISEP- system has gained learning that have help them move forward (Inf.1; 3; 4). Before you almost had to fight to get you own smoke diving mask, such things are viewed as granted today (Inf.1). Back in the day's equipment and clothing was not something the enterprises wanted to spend money on, but today this has changed (Inf.1; 4). Today they have much better equipment, clothing, etc. The first years when the ISEP- system was established over two decades ago, they were only a support crew. The emergency personnel could not directly engage in an emergency situation because they did not have the right equipment or skills. Now they have become a professional team that can participate in emergency situations. The last decade there has also been a change from consequence reduction to preventing unwanted event from happening. Today the enterprises focus more on how they are going prevent unwanted events before they initiate (Inf.1; 2; 3; 4).

The establishment of the QHSE group as a learning platform:

The QHSE Group was originally project that was initiated by Norwegian Labour Inspection Authority[7]. The purpose of the group is to act as a pool where it would be possible to share information between he different enterprises regarding incidents. In this way the enterprises would be able to draw learning lesson from each other (Inf.1; 3). The problem is that this QHSE group has not been very operative lately (Inf.1; 3). It can be quite difficult to find cases that everyone find interesting. Another thing could be that the enterprises often had internal matters to think about. One case that interested them all is working at heights. This was easy to involve many of the enterprises because this was something that they could relate to and this is a risk that they that potentially can happen in many of the different enterprises. When it comes to fire and explosions related to slag, this becomes to specific. This is not something that the enterprises that work with mechanics can relate to (Inf.1).

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[7] In Norwegian: Arbeidstilsynet.

There should have been more sharing of information between the different enterprises in the IP (Inf.1; 3). It has been difficulty to get people to commit to the QHSE Group (Inf.1; 3). It have been tried a few times to get this group up and running, but it have been difficult because of lack of involvement and interest from the different enterprises (Inf.3). It was also mentioned that it should not have been difficult to learn from each other. They have a lot of things in common, e.g. people are hired from the different enterprises to do work for each other, they have close proximity, all are a part of the IP, three of the enterprises are process industries, everyone drives and walks around in the park, use trucks and lifts, work shift, so the enterprises share many similarities. Therefore it should not be any reason for not having such collaboration in place (Inf.3).

There are pointed out that enterprises managed to get this to function internally then it should be possible external. Some of the enterprises even learn from their sister enterprises that are located in different parts of the country or in other places in Europe. In these cases they develop a learning example from an incident where they explain what happened, what they did and what they could have done to avoid it, and then it is shared with their sister enterprise. If they manage to do that they should be able to manage to share information regarding an accident that happens here at the IP (Inf.1; 3).

5 Chapter Five: Discussion.

This chapter consists of three subchapters that are structured after the research questions. The first subchapter address the overall organization of the ISEP. The second subchapter represent the learning platforms within the PDSA Cycle. The third subchapter looks at single and double single and double loop learning.

5.1 How is the ISEP- System organized.

The ISEP- system has been created based on collaborations the different enterprises at the IP. The collaboration is over then decades long. This has been defined as a collaboration because it extend further than what is required by the authorities. The collaboration is built on a

communicative process between the different enterprises. This collaboration has been established as a result of an agreement between the different enterprises that was made for more than two decades ago. This have then have developed into an alliance.

Alliances can be viewed as governance mechanisms that make it possible to pursue collaborative interest between two or several enterprises (Park & Ungson 2001). In this study the alliance have taken form of the ISEP system. This system acts as a governance mechanism that takes the form of the ISEP- system. This alliance can be seen as a more formal relation in the form written agreements (Winkelen 2010). The different enterprises have followed an old agreement that was developed (Inf.1). The main purpose of this alliance is to exploit current resources and eras of strength more effectuality or efficiently (Winkelen 2010, from Johnson and Scholes 2002; Child 2003). In this case study the enterprises share resources in the form of emergency personnel and equipment so it is possible to collectively respond to incident. They also had a close collaboration with the SC, which acted as a coordination centre. Another reason is to learn from the expertise of their partners within the alliance. This happens through sharing of hazard information to create an overall risk picture, the sharing of accident information so it possible to prevent accident, and collectively educate, train and exercises the emergency personnel and shared evaluations.

The empirical data from this study has show that it is possible to develop a join ISEP- system based on the collaborations between different enterprises within an industrial park. The collaboration was more developed when it did come to the focus on reducing the impact of negative consequences, than reducing the likelihood of initiating an unwanted event. This collaborations act in a way as a substitute for knowledge that the enterprise does not manage to create on it own (Inkpen 1998). The enterprises are completely depended on the collaborations because most of the acquisition of knowledge is in form of skills, are stored within the emergency personnel. As a soon as emergency personnel retires, the enterprise loose the knowledge. Therefore the enterprises have to rely on the SC for education and training new ones.

The question of organizational knowledge benefits all the enterprises and the SC but in different ways. The SC acquire knowledge related to how to develop emergency preparedness plan, how to do overall risk analysis, train and educate the emergency personnel and how to develop excises. This is viewed as a good arrangement because then the enterprises do not have to spend time on developing the competence especially when it comes to excises, they can concentrate on their main purpose and that is to produce goods. In the next subchapter the learning platforms that act as knowledge connections point between the different enterprises would be discussed.

5.2   The different learning platforms within the PDSA Cycle:

This sub chapter discuss the different learning platforms that take place within the ISEP - system, and discuss what kind of knowledge that is acquired through these learning platforms. The empirical data have been structured after the PDSA Cycle that has been represented in the analytical chapter. In this study the PDSA Cycle can be used to explain the emergency preparedness process and helping categorizing the different learning platforms that have been identified within the emergency preparedness process. The plan phase begins with the gathering of data through combining the different risk analysis from the different enterprises. These risk analysis are then used to create an overall risk analysis for the IP, which act as a foundation for creating the emergency preparedness plan. Next is the do phase, where the plan is implemented. The risk analysis that has been done is used to dimensioning the ISEP system through deciding what kind of emergency personnel, training and equipment that the IP need. Then the study phase is activated where they have exercises and incident can be used to see if the training has brought about the anticipated improvement. The last phase is act. It is in this phase is where they evaluate the previously phases and try to learn and gain improvement. In this subchapter the different phases that have been represented in figure 5 will be discussed in detail.
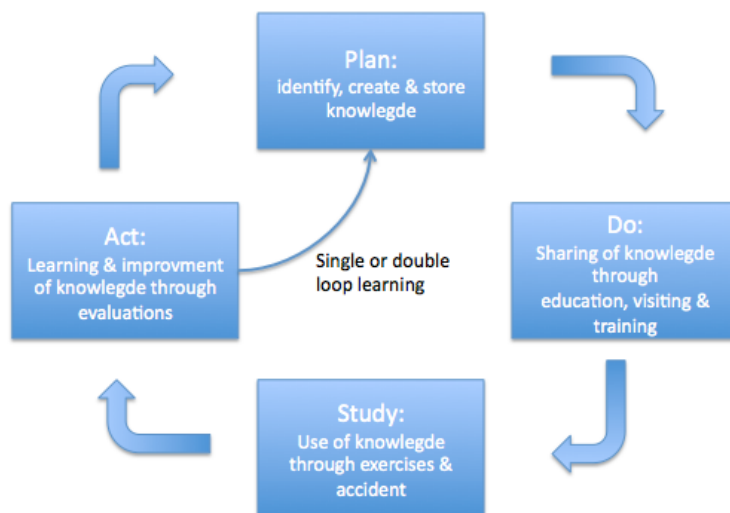
Figure 5: The PDSA Cycle combined with the knwolegde management cycle.

5.2.1 Plan: Risk analysis as a learning platform.

The risk analysis can be seen as a major part of the planning process when it first was established back in 2011, as a result of the new requirements. These new requirements created a request for new knowledge, when it comes to identifying risk and hazard information. The different enterprises had to establish a platform where the individuals from the different enterprises came together to discuss and share knowledge related to what kind of hazards and risk that exist within the IP. By sharing the knowledge of risk between the different enterprises and between the individuals through the pre- arranged meetings they would be able to create a risk picture over what kind of hazards and risk related to large-scale events that could affect several of the enterprises at the IP. The risk analysis act platform for learning, where the QHSE personnel discuss and share their belief and knowledge bout the hazards and risk that potentially may exist within their enterprise. When they all have come to an agreement on which potential major risk that are going to be a part of the overall risk picture this is then stored organizational knowledge at there website and then shared between the different enterprises. In that way the all the organizations in the IP have an overview over the overall risk that have been identified.

The over all risks that that have been identified hare then turned into scenarios. That describe what, where and whom they affect. Further they then try to establish causations for how the scenarios are going to develop (Alexander 2000). This they do by looking at each scenario and try to break the scenarios down into manageable pieces. They then look at how many people they need to be able to handle that scenario. What kind of training and equipment is it necessary for them to have in order to mange that particular scenario? In this way the IP try to draw learning lesson from the different scenarios. A Known problem is that risk and vulnerability analysis often ends up in the stored in the archives, instead of being put into actions (Aven et al. 2004). This case study shows that the risk analysis affects the whole emergency preparedness process. It is not only a document that is "updated" each year. It affects the dimensioning of the ISEP- system, what kind of equipment is invested in, what kind of training and exercises it is necessary to have in order to be able to respond effectively to an incident. In that way they draw learning lessons from the risk analysis that are actively used in the next phases in the PDSA cycle.

There exist a safety centre (henceforth SC) that has the responsibility to train and educate the different emergency personnel. This SC has educated their own instructors that have the responsibility to train and educate the emergency personnel. The instructor gets the knowledge and skills that they needed through external courses. This can be seen as a search process, where the SC identifies what kind of knowledge that the emergency personnel need to acquire through education and training. By identifying the risks, they also identify what kind of the knowledge the instructors need to have in order to teach the emergency personnel. The knowledge that the instructors have gained is through external networking outside the IP through courses and education like the Norwegian Fire School and The Norwegian Research School in Innovation (NORSI), but also through their experience as professional fire personnel are used to educate the emergency personnel within the joint collaboration. The knowledge that they have gain through the courses is mostly stored in the individuals as active components in the enterprises memory in the form of skills.

5.2.2 Do: education, courses and training and visiting.

This knowledge that the instructors have stored within their memory are then shared through education and training of the emergency personnel, from the different enterprises at the IP. This happens through programs that can be seen as pre- established arrangements where the different enterprises sign up the emergency personnel that need to have the required training and education (Inf.3). When the emergency personnel have passed the theoretical part they then go through a training course where instructors teach the emergency personnel (Inf.1; 4). Alexander (2000) mentioned that in order to manage emergencies there need to be a combination of both classrooms learning and learning by experience. In the case study there where a combinations of both classroom and practical experience. The classroom took form of courses that the different emergency personnel attended. Most of the knowledge that is transferred is combination with observation and mentoring where the instructors teach the emergency personnel. In this way the different emergency personnel get the tacit form of knowledge through close observation and interaction with people who already possesses that knowledge **(**Holste & Fields 2010).

Therefore the training of the emergency personnel is a form of coaching (Swap et al. 2001; Peroune 2007), where they gain knowledge if form of skills in order to handle an incidents. Pemberton and Stonehouse (2000) point out that new knowledge can be acquired by getting new members within the organization. It was mentioned that when the SC hired new personnel from the fire school they and they also had new knowledge that they have gained from their education that was then shared between the emergencies personnel in a systematic way through education and training.

The education and training are platforms where assumption when to comes to the different emergency personnel is tested. Not everyone is fit to be a part of the emergency personnel. It may be the person is afraid of heights or that that person got claustrophobia being in a small smoked covered room. In that way the individual assumptions are tested through the education and training, which causes the individual to gain the necessary knowledge that makes them qualified as emergency personnel. As soon the individuals have been quailed as emergency personnel they can participate in the exercises.

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The visiting where the emergency personnel visited different enterprises was more related to information when it comes to how the facilities in order to be able to orientate in the different facilities in the case of an emergency. The enterprises have learned that if they are going to collaborate it is important that the emergency personnel are familiar with the different facilities so they are able to orientate and avoid the potential hazards in an emergency situation. There was also more informal visit that where done that ha more focus on prevention. During these visits the potential for inter- organizational learning was much higher. Enterprise did invite another enterprise to take a safety tour within their enterprise to observe how things were done. In this way it was possible to get feedback from the visitors on how they viewed the safety related to work processes etc. The potential for organizational learning can happen since the visiting can creates request for new knowledge in the form of regulations, this is the American owned enterprise an example on. The visitors from the IP have seen that it might be a good idea to have regulations when it comes to the use double safety line and that it should be developed overall regulations at the park that made sure that all the workers followed those instructions.

5.2.3 Study: Exercises and Incident as learning platforms.

The study phase is where the implementation of the plan have brought the anticipated improvements that have been implemented in the do phase (Maruta 2012, from Imai 1986). This phase is according to Evans, Dalkir and Bidian (2014) is where it possible to use the knowledge that have been stored and shared. In this study the use of knowledge happens through exercises and incidents.

Exercises as learning platforms:

Exercises can be seen as the establishment of operational settings, where it is possible to study and examine operational details (Perry & Lindell 2003, from Ford & Schmidt 2000; Simpson 2001; Alexander 2003). Exercises themselves represent opportunities to test the plan, protocols, equipment, personnel training, facilities and materials (Perry and Lindell 2003; Perry 2004), which is done in this case study. There exist a number of different exercises that have been used to train the emergency personnel. This can all be from small,

medium to large-scale exercises. The small-scale exercise contains a minimum of five people (Inf.1). While large scale exercises can involve emergency personnel, the local police, fire department and the ambulances (Inf. 1; 3; 4). The exercises can be seen as platforms for encourages questioning, debate, and discussion of exciting practises, makes it possible to accelerate the individual process for learning, through the sharing o knowledge. Compared to the risk analysis this can be seen as a platform for learning that is more hands on. They are actively using what they have learned during training to solve problems. The problem that they have to solve is often related to the scenarios that have been developed.

For instance they have made a scenario where a worker is unconsciously in a lift. Then the emergency personnel have to figure out how to get him down. Then they have to be creative and use the knowledge that they have gain in the training and education (Inf.3). During the exercises the emergency personnel are able to test what they have learned through their education and training through solving problems, make decision, and promoting innovative thinking between the different members of the emergency personnel. In that way it is possible to see if the emergency personnel have gained the knowledge to solve the problem through a scenario. If they manage to handle the scenario through problem solving, then this shows that the emergency personnel learned the necessary knowledge to handle a situation like that. If the emergency personnel do not mange to handle the scenario, then there is a request for new knowledge that can make it possible to handle the scenarios.

Another thing that exercises do show is that things have to be repeated over and over again (Inf.1; 4). When it comes to skills like for instance the use of fire hoses had to be maintained. This has to be trained over and over again because this kind of skills has to be maintained or people forget (Inf.4). This is accordance with the Perry and Lindell (2003) that says that skills deteriorate over time. Therefore they need to bee continuously maintained. But even if the skills of emergency personnel deteriorate the knowledge is till not lost. It is still a part of the network of the ISEP- system. The knowledge is stored within the network through professional firemen and instructors that still possess that skill and will be able to share that knowledge. In that way the knowledge will still remain within the network even though some emergency personnel retires.

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Incidents as learning platforms:

Visiting, exercises and incidents can be viewed as the study phase. In this phase the knowledge that that have been shared with the different emergency personnel through training and education (do phase) are put to use. In this way it is possible to study if the knowledge that they have gained is complete or it is necessary to update the knowledge. When they have accident they get to test if the scenarios and the assumptions that they have developed and trained on really fit with the real life. For instance in 2014 the alarm at the SC went off. There had been an accident at one of the enterprises, where a worker that had received seriously crush injury. Everything was done according to the procedures, both the warning, notification, and the collaborations between the emergency services (Safety 2010-2015). In this case the emergency personnel and the enterprises managed to coordinate and handle everything according to the procedures like they had have trained on. They have managed to handle the unwanted event through problem solving that result a positive outcome. This is an example that shows that education, training and exercises that the emergency personnel go through can have a positive affect when it comes to achieving the goal of the ISEP- system.

In another examples there was an incident that happened during the exercises, which caused an abrupt learning curve. SC had have placed a cursor in a closed room, and when they activated the smoke machine, the fire system was also activated. This caused a loud bang and a gas was realised into the room (Inf.1; 2; 3; 4). This caused changes in the regulation. If the SC are going to be the exercise leader in an exercises that take place in one of the enterprises, they need to have a checklist, they have to make sure that the enterprise is responsible for indentifying the potential risk at their workplace, because SC do not know about what different types of risks are hidden in the facilities and constructions in the different enterprises. So when they are doing an exercise they want to have a named person that checks the facilities and eventually turn of different systems and identifies certain risk (Inf.1; 3; 4).

This is an example where incident have caused change in both values and assumptions within the ISEP- system. After the incident they updated the procedures and regulations that apply for the ISEP- system. Again this incident shows the importance when it comes to local

knowledge within the enterprises. Each time they are going to have a exercises and the SC is going to supervise it, the host enterprise have to identify what kind of risk that could be related to having the excises in that particular facility.

5.2.4   Act: Evaluation and the establishment of the QHSE group as a learning platform

The learning that have been taking place in the previously phase in the PDSA cycle to refinement of the knowledge within the SC. New values are either identified or created on the basis of the existing knowledge. There are several activities that contribute to the improvement of knowledge. This can for example be through the adaption of lessons learned, or it can be review of the actions that have been made (Evans, Dalkir & Bidian 2014). The lesson learned from when employees evaluate themselves can contribute to organizational learning (Evans & Ali 2013). This happens after the exercises where the different emergency personnel give feedback on what they felt they managed to handle, and what they felt they did not manage. The emergency personnel also get feedback when it comes to how they performed from observes that have been present during the exercise. In that way they can correct their actions. Which is accordance to Evans, Dalkir and Bidian (2014). For example the layout of the water hoes, that results in development of new exercises. The lack of knowledge for how to layout the water house created a request for knowledge. This knowledge did already exist within the network through the instructors so therefore it only had to be shared again. The evaluations also focus on what could have been improved regarding planning of the exercises. In this way the SC can find out what kind of regulations or procedures that are lacking or are needed to improve. This can be seen as updates and addition to the new knowledge that are being made, to keep the values up to date within the organization memory and applicable to the context (Evans, Dalkir & Bidian 2014).

Before it was a struggle to get the right equipment, now it is granted that the equipment should be in place. This as more been an evolutionary process where the changes have happen gradually over time. Changes in values have brought changes when it comes to the willingness to invest in equipment and tools to handle unwanted events. This can be seen as adoptions of lesson learned. Lessons learned have to be institutionalised in the form of rules,

standard operating procedures, and policies that are common for all the enterprises that is a part of the IP (Mahler and Casanayou 2009).

Quality, Safety Health and Environment Group:

The informants (Inf.1; 3) did mention the quality, health, safety and Environment group (henceforth QHSE group) have been established as a result of a project in collaborate with the Norwegian Labour Inspection Authority. The purpose of this group is to establish a platform for sharing of information between the different enterprises in the IP. This group was suppose to act as a platform where the different QHSE leaders from the different enterprises could meet and share information related to incidents and unwanted events that they have experienced within their enterprise, which could have resulted in more extensive learning and improvement. Inkpen (1998) point out that when collaborations are established there may be some uncertainties about how to work together. This seems to be the challenges it this case too. The problem with this learning platform is that the QHSE leaders have had difficulties finding learning objectives that they believe can be useful for the different enterprises. This because it was believed that the different enterprises at the IP have difficulties when it comes to seeing what they can learn from each other. Pemberton and Stonehouse (2000) point out that the creating of knowledge can be hindered. This can happen if the searcher fail to seeks out conceptualized knowledge, which this QHSE group is an example on.

Enterprises have different functions and that they produce different goods and services. Therefore they do not always view some of the risk relevant for their enterprise, they do not believe that this is something that does not affect them. Different enterprises have different production system and therefore it can be difficult to see what kind of risks that they have in common. But still the different organisations shares a lot of the same risk e.g. truck driving, crane driving, fire etc. It was also possible that the exercises within each enterprises is still viewed as more personal and that this is not something that needs to be shared between the different enterprises. A third reason and what was believed to be the strongest reason was commitment from the management. Inkpen (1998) also mentioned that without active management in the learning process and understanding the nature of this collaboration could lead to that many of the opportunities for the enterprises to gain knowledge, could remain

unexploited. This is something that the empirical data also shows that there was lack of commitment or interest from the management that have lead to the breakdown of QHSE group as a learning platform.
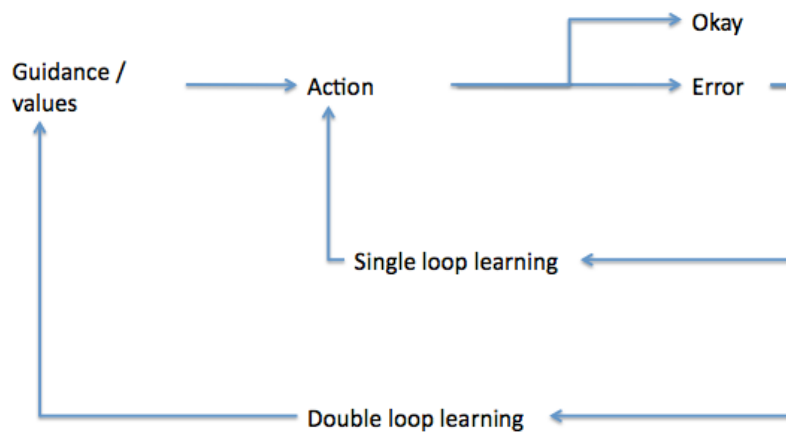
5.3   Single and double loop learning:

Figure 6. Illustration of Single- and Double Loop learning.

Perry and Lindell (2003) mentioned that skill deteriorated over time. This was the case in this study where the fire hose was first a skill that they did manage to do when they had the first excises, but when they had the same exercises six month later the emergency personnel did not manage to lie out the fire hose according to the procedures. Then the feedback was that they had to rehearse more often in this. This one of several examples when it comes to single loop learning that has taken place within the ISEP-system. An example on this is that after one of the accident where the communication equipment broke down this lead to the investment in new communication equipment. All of these examples are related to what Lukic, Littlejohn and Margaryan (2012) have called quick fix solutions, which are technical corrections and skill training. Moynihan (2009: 189) point out that *"single loop learning allows the organizations to do the same thing better"*. Which can be seen as the case here, where the system has been improved over time through skills, procedures that allowing the ISEP- system to be able to respond to incidents in a more efficient way.

The evaluations processes can be compared to the to the example with the thermostat that have been used in the analytical chapter (Blackman, Connelly & Henderson 2004, from Argyris 1991; 1999). In this case the ISEP- system can be viewed as the thermostat. The thermostat reacts if the environmental conditions are too hot or too cold. The same does the ISEP- system by measuring the goal of the exercise. If the emergency personnel during the exercise did not manage to fulfil the goals it can be seen as a mismatch between the systems expected outcome and what it experienced. Because the system expects that the emergency personnel should manage to fulfil the goals. If there is a mismatch the thermostat take actions and adjust the temperature. The ISEP system does the same in a way. If the goals are not accomplished then it the ISEP system implement the necessary measures tot hat the goals can be accomplished. For instance the example where the personnel did not manage to lay out the fire hose. Then system just implements another training sessions that concentrate building that particular skill. This processes does not require that the system ads new knowledge since it already exist within the system stored in the instructors. The system just applies what it already knows the same way as the thermostat. That's way this can be viewed as single loop learning.

In another example that have been used the system questions why it does the way it does. This has to do with the incident where the smokes machine the activated the fire system. When this happed the ISEP system stared to question why things where done the way it was done. In the same way that the thermostat question why it was set to a particular temperature. By doing so it can acquire new knowledge. This can be seen as the same what Evans, Dalkir and Bidian (2014) calls request for new knowledge. The ISEP- system did find out that it had to create new procedures. There had to be a person that did a risk analysis of the facilities before the exercises. The ISEP system has then required new knowledge in order to understand the question (Blackman, Connelly & Henderson 2004, from Argyris 1991; 1999).

The empirical data show two cases where double loop learning has happen. Both of them were related to incidents. The two cases were related to working in heights and the incident that happened during an excises where the fire detecting system where activated. This has caused changes in values, assumptions and strategies. The values have been changes through the update of the rules and procedures. It is possible to say that both incidents caused an

abrupt change in the assumptions. The assumption for example related to the incident when it comes to working in heights shows that they firs viewed it as overregulation when it comes to the use of two safety lines.

After the incident with the smoke machine and the fire detector the regulation was implemented immediately. This shows that there has been a change in the values and assumption that lead to the new knowledge. The assumption changed in the way that this was not viewed as something that should concern each enterprise instead this is something that affect all of the enterprises and therefore there must be a common regulation that adjust the action to all personnel that are working in heights. These new assumptions are stored in the form of knowledge in the organizations memory through the creation of common procedures that apply for all the enterprises at the IP. In this way double loop learning has occurred since it affected all the enterprises within the IP. This study also shows that the potential for double loop learning between the different organizations often remain unexploited. This can be seen in the relation to failure of establish the QHSE group as a learning platform, where the different organisation could create and share lesson learned.

6 Chapter Six: Conclusion.

This subchapter will give a summary of these thesis findings where the results from the last chapter will be represented. herefore it will also be made some reference to other research. At the end there will also be given recommendation for further research.

6.1 Research questions:

Research questions 1: How is emergency preparedness established and organized through collaborative efforts among the enterprises in the industrial park?

The empirical data shows that it is possible to develop a join ISEP- system based on the collaboration between different enterprises within an industrial park. The collaboration was more developed when it did come to reducing the impact of negative consequences than reducing the likelihood of unwanted event. Therefore there lies a potential when it comes develop the collaboration further. This is something Gibbs and Deutz (2007) have pointed out that most of the IP are at a early stage when it comes to developing such networks, the linkages between the enterprises at the IP is more potential rather than real (ibid).

The collaboration between the SC and the enterprises act as a substitute for knowledge that the enterprise does not create on its own. In this way they are completely depended on the collaboration because most of the acquisition of knowledge is in form of skills, are stored within the emergency personnel. As a soon as emergency personnel retires, the enterprise loose the knowledge. The question of organizational knowledge benefits the SC most, they acquire knowledge related to how to develop emergency preparedness plan, how to do overall risk analysis, train and educate the emergency personnel and how to develop excises. This is viewed as a good arrangement because then the enterprises do not have to spend time on developing the competence especially when it comes to excises, they can concentrate on their main purpose and that is to produce goods.

When it comes to the collaborations among the enterprises this is also viewed as a good. There have been wishes that more enterprises had joined the ISEP- system. Many have been quite positive to but the economical commitment, which is expensive. Therefore many of the enterprises seem sceptical to join the ISEP- system.This is similar to Ramli, Mokhtar & Aziz (2014 findings that the inter-company safety collaboration is being hindered by fear of risk analysis cost.

Research question 2*:* **What kinds of learning platforms are established as the result of collaboration on emergency preparedness and how are they utilized for joint learning.**

This thesis also shows that risk analysis, visiting, hosting, training, excises and evaluations are all important learning platforms that take place within the ISEP- system. They act as learning platforms that connect the different enterprises. The learning and sharing of knowledge happens in different ways in each platform. The different learning platforms are connected to each other. Through the risk analysis the enterprises share locale knowledge related to risks that are related to work activates in their enterprise. This is important in order to establish the overall risk picture within the IP. When the risk picture is established they then break it down into scenarios. Each scenario represents a potential incident that can happen at the IP. They then look at what kind of equipment, how many personnel and what kind of skills that is needed in order to handle that particular scenarios. Then the SC uses this knowledge to develop courses, training and exercises that are based in these scenarios. In that way the risk analysis are not something that is stored in an archive like Aven et al. (2004) says is common. In that way the over all risk analysis act as a learning platform, where they establish knowledge related to potential risk and hazards.

This in turn creates what Evans, Dalkir and Bidian (2014) calls request for knowledge. The request is based on knowledge that is needed in order to handle the different scenarios. The enterprises mostly identify the knowledge that is needed through their internal network inside the IP or through their external network that consist of NORSI and Norwegian Fire School. Thos knowledge is mostly stored within the instructors that then share this knowledge through education and training. Based on the scenarios the ISEP- system is dimensioned. Workers are recruited from the different enterprises that collaborate. The workers are then educated and

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trained by the instructors. People are involved through observing the instructors and through more hands on experience where they actively conduct first aid, extinguishing fire etc. This is accordance with what Alexander (2000) says, that in order to manage emergencies there need to be a combination of both classrooms learning and learning by experience. That the emergency personnel have grown closer through the education, training and exercises is something this study also implies. The emergency personnel do not often interact during regular work since they are from different enterprises. So it is only through the education, training, exercises and occasionally accidents that the emergency personnel interact and have the opportunity to learn from each other. Studies from Berlin and Carlström (2015) and Perry (2004) have looked at collaborations when it comes to exercise. Their findings show that exercises contribute to learning that can be useful in actual emergency work.

The exercise as a learning platform is where the enterprises have the opportunity opportunities to test plans, protocols, equipment, personnel, facilities and materials (Perry and Lindell 2003; Perry 2004). It is from the exercises that the enterprises have learned a lot. During their exercises they can discover mismatches between the expected outcome and the experienced outcome that can be corrected. Exercises can for example discover what kind of skills that the emergency personnel lack. For instance lack of skills related to how to use the fire hose, or that there is needed to install an alarms system in that zone because the workers could hear the alarm during an exercise. This can be seen as a state of understanding that form and shape actions (Pervaiz, Lim & Loh 2002). The actions in this case lead to the correction of the mismatch between the expected and the experienced (Argyris & Schön 1996), e.g. installing new a new alarm system and training on that particular skill that is lacking.

Sometimes learning is being hindered. For instance the exercises have shown that workers that have gotten the task to be emergency leaders often do not get the necessary training when it comes to how they should act in emergency situations. They have learned that they lack a particular knowledge in the form of skills (how to be an emergency leader), but they have not managed to find out how to solve the problem. The same thing is related to the exercises where the emergency services (police, firemen, and medical personnel) are attending. These excurses have shown that the there is difficulty when it comes to communication and coordination between the emergency services and the IP emergency personnel. It has become

better over time, but still it is one of the major challenges. When it comes to emergency personnel at the IP, it is mentioned that they manage to cooperate together. This can be related to that the different emergency personnel train and exercise together.

The emergency personnel also visit other enterprises. It was pointed out that it is important that the emergency personnel got familiar with the different enterprises. Because in the case of an emergency situation they need to be able no navigate within the different enterprises. There are a lot of tunnels, hallways and rooms that need to be covered. It can also be quite risky to move around in some of the enterprises, especially the processes industry at the IP. Therefore it is necessary that the emergency personnel also know about the different hazard that exists within the different enterprises. There was also other form of visits that occasionally could happen. This could be that some enterprises invited people form other enterprise to be a part of a safety tour. In that way the people who were invited could observe the work processes that did take place within the enterprise and come with input and advice related to safety at the work place.

There have also been established a QHSE group for sharing of learning lesson between the different enterprises that are a part of the ISEP- system. This group has not been that successful. At the moment the different learning lesson remains within the each enterprise where the incident have happened and are not shared between the enterprises. The main reason for this can be seen as lack of commitment from the management in the different enterprises. The reason for lack of commitment can be a result of a combination of factors. Unlike the joint ISEP system that is required by law to be in place, the QHSE Group is based on volunteerism from the different enterprises. There are no regulations that require that they should share this information between them. Therefore may not get prioritized since the enterprises have other things to concentrate about. It can also be as a result that the enterprises are so different from each other and that they therefore believe that they do not have much in common. But it is also pointed out that still if they do not produce the same products and good, they still have things in common where they can share learning lessons. These finding is what similar to Ramli, Mokhtar & Aziz (2014) empirical finding that point out that there is a need for a coordination body that act as a centre for accident sharing.

Research question 3: **Does the evaluations of the learning that have taken place within these platforms, facilitate single or double loop learning?**

All of these learning platforms are then evaluated. The outcome of the evaluation presses can lead to single or double loop learning. For instance that the exercises have shown that the emergency personnel lack skills, then action are being taken to try to make sure that they gain that skills by implementing into the next training. The exercises have also lead to technical corrections like for instance the installations of alarm system. These can be seen as a form of singe loop learning. There have also been events where double loop learning has taken place. This has all been related to incidents or accidents that have taken place at the IP. But these seems to be much more rare that single loop learning. One example related to double loop learning was related to visiting where the observed the use of double safety line. This was something that they then considered implementing as a regulation for the whole IP. But it was not before after an incident that took place that this regulation was implemented. Another example was related to an incident in one of the exercises. They realised that it was necessary to point out a locally known person to do a risk assessment of the facility before the exercises where conducted. In that way the where aware of the potential hazards that that could take place. This also applies to all the enterprises at the IP.

There are also potential to increase double loop learning. The QHSE Group could have been the platform that could contribute to double loop learning, since this have been the platform where the different QSHE management could meet and discuss different learning lesson. This lesson could then be integrated into the different enterprises. Another potential for double loop learning is visiting. Through visiting it is possible that the enterprises could have learned from each other. But as this study has shown that double loop learning is rare. This is consistence with what other research have shown. For example Mahler and Casanayou (2009) mentioned that after the challenges accident at NASA the opportunity for double loop learning where abundance, however instead of creating knew remedies the process took form of single loop learning.

6.2   Contribution to the research field:

As mentioned the findings in this study cannot be generalized but they can be compared with other studies in order to show to some degree of transferability (Larsen 2007; Yin 2099). The empirical findings in this study share similarities with another case study that have been by conducted by Ramli, Mokhtar & Aziz (2014). Both this study and Ramli, Mokhtar & Aziz (2014) study show that collaboration can have positive outcome like the establishment of emergency response planning, sharing of hazard information and resources. There was a similarity related to problems with collaborating. Some organizations were reluctant to be a part of the network because of the cost related to such participations. The lack of commitment from the management can be a hindrance when it comes to such an establishment. The large scale enterprises where more willing to participate in the collaboration than the smaller ones. It could be difficulty to collaborate because the enterprises could be unique in their operations and they may have incident related to hazard that is not suitable to share.

6.3   Recommendation for future research and limitation of this study:

The findings of this study should be with caution in the context of the study's limitations (Nordtvedt et al. 2008). Given that this study was limited to two enterprises in this study, it could be interesting to see if these findings are applicable to other enterprises that are a part of the ISEP- system. Luic, Littlejohn & Maragryan (2012) point out that it could be necessary to integrate both informal and formal learning activities. Therefore it could be interesting to see if there exist informal learning activities that could be integrated into to the ISEP- system. It could also be interesting to see if there is a need to develop guidance or regulations that encourages collaboration between enterprises further. Because of empirical similarities between this case study and Ramli, Mokhtar & Aziz (2014) study, it could also have been interesting to look at other IP in order to see if these challenges and benefit when it comes to collaborative relationships are shared.

6.4   Founding's:

This master thesis has not received any founding.

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Appendix 1: Informed Consent.

1. About me:

I am a student at the University of Tromsø, where I study Societal Safety. I have also a bachelor degree from University of Tromsø in Societal Safety and Environment. This means that I have knowledge in the field of safety management and emergency preparedness. I have previously worked in the process industry so I also have some background knowledge related to the field.

2. Background and purpose of this study:

Through this study I want to find out what the organization learn from cooperation when it comes to emergency preparedness that take place at the IP. This thesis is the formal conclusion of the Master program "Societal Safety."

3. What does it mean to participation in the study?

Participation in the study involves an interview of around 30-45 minutes, which is carried out at a suitable place. The questions that are asked will be related to the collaborations when it comes to emergency preparedness. The interview will be recorded by the use of audio recording and later transcribed. If you as a participant do not accept the use of audio recording, then the data will be collected with the use of pen and paper.

4. What happens to the data that you give?

All personal information would be treated confidentially. It is only the author of this study, who will have access to the data that are collected. The records will be stored in a password-protected computer until the data have been transcribed. During the transcription all personal information the may have been collected will be removed. In that way it will not be possible to identify any participants after this study have been published. After censorship, all data that

is related to this study will be deleted. The name one the company and its location, will neither be mentioned in the final report.

5. Voluntary participation:

It is voluntary to participate in this study. You can at any time withdraw your consent without giving any reason. If you do that, all the data about you will be deleted immediately. If you have more questions about the study you can contact me through phone or by email.

8   Appendix 2: Interview Questions.

General:

What is your background?

What is your position?

How long have you had your position?

How long have been in the ISEP- system?

Learning Platforms / Arenas:

Learning through risk analysis:

How many risk analyzes are carried out?

Is it builds on other analyzes?

What is the purpose?

Who is present in connection with these analyzes?

How have you organized the work?

Have you learned anything personally by attending these risk analyzes?

Is this something you have adopted further in your organization?

Do you think those who here has been to participate have learned much through this process?

What specific changes have resulted in the risk analysis when it comes to management systems, procedures, rules, etc.?

Learning through planning:

Who participates in the planning of the exercise?

Who is involved in establishing the courses?

What do you learn from the planning processes?

Learning through training:

What do you use to train on?

How are these mugs for training developed, it is something you have developed or are the courses?

You see a change in attitudes and values as you exercise?

Learning through exercises:

How many exercises are conducted annually?

Do you have specific goals for what you want to achieve for each of the exercises?

Do you think there's a lot you learn through exercises that are not directly measurable?

Who is present in conjunction with the exercises?

Safety personnel from other businesses?

What have you learned in connection with the exercises?

What is the feedback you've got when it comes to exercise?

Have exercises given concrete changes in management systems / procedures / policies etc.?

Learning from accident and near misses:

Have you experienced unwanted events that you have seen the opportunity to learn from?

Conducts ye investigations of these critical incidents?

What affects timeliness when it comes to the possibility of learning from past events?

What steps have you taken as a result of critical incidents?

Is there some other learning platforms or arenas that take place at the IP?

Learning through courses?

Conferences?

More general questions:

Do you think that the collaborations that you have to day between the different enterprises are optimal?

Is there any thing else that you would like to elaborate?