Aalto University
School of Business

Middle managers' experience of enhancing safety culture in Finnish nuclear power plants

MSc program in Management and International Business

Master's thesis

Jenni Haavisto

2016

Department of Management Studies
Aalto University
School of Business

Aalto University
School of Business

Aalto University, P.O. BOX 11000, 00076 AALTO
www.aalto.fi

Abstract of master's thesis

Author Jenni Haavisto

Title of thesis Middle managers' experience of enhancing safety culture in Finnish nuclear power plants

Degree Master of Science in Economics and Business Administration

Degree programme Management & International Business

Thesis advisor(s) Janne Tienari

Year of approval 2016 **Number of pages** 100 **Language** English

Abstract

Middle management and their contribution to organizational performance has been a continuous topic in management studies over the past years. Middle managers have an influential position in the middle of the organization, affecting both workforce and top management decision-making processes. The position of middle managers has been studied in different industries and types of organizations. In this study, middle managers' experiences are studied in the context of nuclear safety management. Safety management is a central issue in the nuclear business, and a concept of safety culture has been developed in the industry to address the importance of organizational aspects to the safety of a nuclear power plant. "A good safety culture" is an objective required from the nuclear power organizations by the regulatory bodies, and the concept of safety culture has been studied widely in the field of high-risk organizations. In addition to defining the term safety culture, many studies have also focused on developing measurement criterions for the state of safety culture.

In this thesis, middle managers' experience of enhancing safety culture in Finnish nuclear power plants is investigated in a qualitative study. The empirical study consists of 12 middle manager interviews from the operating nuclear power plants in Finland. The objective of the study is to investigate how middle managers understand the concept of safety culture, how they experience their own position in safety culture enhancement and how they experience methods to enhance safety culture. The thesis is an explorative study and complements previous research by examining the phenomenon of safety culture from a perspective of managerial experience. The middle managers' experiences are analyzed with the regulations and safety culture policies of the nuclear power organizations.

The main findings of the study show that the concept of safety culture is used extensively on the strategic level of the power companies but the lower organizational levels find the abstract term hard to define. Middle managers experienced a lack of common understanding of the meaning of the term. The interviewees gave numerous examples of the methods they use to enhance safety in their work practices but hesitated to call it safety culture enhancement. Furthermore, the middle managers experienced that safety culture enhancement was embedded in all practices and was everyone's responsibility, instead of stating it as managerial responsibility to be enhanced. The study concludes that the safety culture enhancement is embedded in work practices in Finnish nuclear power plants but also reveals a need for future development to increase managers' awareness and abilities to enhance safety culture systematically.

Keywords Management, Middle management, Safety management, Safety culture, Organizational culture, Nuclear energy, Nuclear safety

Table of contents

List of tables and figures

1. INTRODUCTION

In management studies, middle managers' strategic contribution has been highlighted by many researchers (Currie & Procter, 2005). Although research questions have varied widely, many studies share the statement that middle managers have fundamental role in explaining organizational outcomes (Wooldridge et al., 2008). Middle managers' contribution has been acknowledged to be an essential factor of organizational performance, as their intermediate position in the organization connects policies and strategies into work practices (Floyd & Wooldridge, 2000).

Nuclear industry is a challenging environment and a fruitful context to a management study. Organizational factors that affect nuclear safety have been acknowledged widely in the past decades. Accidents have been noted to be caused by separate events that are linked together (Weick, 1990). Nuclear industry is highly regulated and good safety culture is one of the aspects required from the licensee organizations, the nuclear power companies who hold the official license to operate. The International Atomic Energy Agency (IAEA) launched the term "safety culture" to nuclear industry after the Chernobyl nuclear accident in 1986. IAEA accident investigation report stated that the lack of safety culture was one component of the accident (INSAG, 1986). Since the term has been acknowledged, many accident investigations have cited lack of safety culture as a contributor of accidents in high-risk industries (Morrow et al., 2014). The phenomenon has been studied widely in the industry since the term was established in the 1980s and researchers have discussed the meaning and measuring aspects of the phenomenon continuously.

Safety culture is acknowledged to be an essential element of nuclear safety. Good safety culture is expected from nuclear power plants by various formal bodies (Oedewald et al., 2015) on national and international levels. As organizational culture is a unique construction, the guiding instructions are general in nature. Licensee organizations are responsible for applying safety culture requirements in practice and developing strategies to increase good safety culture in nuclear power plants. After a licensee has

determined its own principles on how to maintain and develop safety culture on a strategic level, the task to embody good safety culture on an operational level lies on the shoulders of middle managers, as they are in charge of the operations. The role of middle managers is complex, as they work in between organizational policies and shop-floor workforce (Floyd & Wooldridge, 2000).

The study of the use of the term safety culture is important because the term is widely used in the industry but its nature is very abstract. The term has been used widely to emphasize the essential need for good safety culture but the meaning of the phenomenon can be understood in multiple ways. In different ends of the spectrum, some practitioner engineers see safety culture as a mechanic need to ensure employees' attempt to follow orders, whereas scholars talk about safety culture as values and artifacts that lead the actions.

In this thesis, perceptions of enhancing safety culture are studied from middle managers' perspective. Organizational factors that affect nuclear safety have been widely acknowledged in the field of safety science but the leadership role has been studied hardly at all (Martínez-Córcoles et al., 2013). The managerial approach of this study complements the previous research of the field well.

1.1. RESEARCH AIM AND QUESTIONS

The focus of this study is on safety culture in high-risk organizations and especially in nuclear power plants. The definition of the term has no universal agreement (Clarke, 2000) but many studies have discussed the concept and factors of safety culture in the context of nuclear industry (Oedewald et al., 2015). Researchers have created theories and assessment criterions for safety culture evaluation, and the phenomenon and development methods have been widely discussed. Even though the need for good safety culture has been acknowledged and its meaning has been studied, Fukushima Daiichi accident in 2011 showed once again that further understanding of safety culture

still needs to be developed. The accident underlined the importance of different actors' role in the ensemble (Oedewald et al., 2015).

The complexity of middle managers' role offers a great environment for this study. In the beginning of the research process, the overall framework was to research safety management and the study was narrowed down to safety culture development in Finnish nuclear power plants. The research will help Finnish Radiation and Nuclear Safety Authority STUK to improve understanding of how safety management takes place in nuclear power plants, and the study signifies the meaningfulness of safety culture regulations.

This master's thesis complements previous literature by studying how middle managers experience their role in enhancing safety culture in Finnish nuclear power plants. The complexity of middle managers' role offers a great environment for this study as it indicates (1) how middle managers understand the concept of safety culture, (2) how they experience their own position in safety culture enhancement and (3) how they experience methods to enhance safety culture.

The research questions are:
How middle managers understand the concept of safety culture?
How middle managers experience their own position in safety culture enhancement?
How middle managers experience methods to enhance safety culture?

1.2. KEY CONCEPTS

There are some concepts in this study that need to be discussed before entering deeper into the academic and empirical research of the phenomenon of managing safety in nuclear industry from the middle managers' perspective. Many terms used in this study lack universal agreement in their definition, and therefore it is essential to understand how this study interprets the key concepts used through the investigation. The terms introduced in this section are central in understanding the topic of this thesis.

Middle managers

A manager is a person who is responsible for employees in the specific function and/or for the performance of the function. Many scholars define middle manager from the vertical axle of an organization chart (Wooldridge et al., 2008). Therefore, middle managers would be the ones who are in the middle of the organization chart. Some scholars have argued that middle managers should have at least two hierarchical levels under them (Staehle & Schirmer, 1992). Curries & Procter (2005) has studied middle managers focusing on the professionals who work in contact with operations and limited administrative middle managers out of the focus. In this study middle managers are seen as the persons whose position in the organization touches both shop-floor employees and administrative work. Therefore, middle managers of this study are comparatively low in the vertical organization charts, because this study investigates the managerial attempts to enhance safety on the operational level.

Safety

Another term that is easy to bypass without closer consideration is the concept of safety. Safety is something that we all understand but an abstract phenomenon that is hard to define explicitly. Safety is an outcome of valued performance and it is easily forgotten unless safety problems actually occur (Reason, 1998). Safety does not come as a benefit, but it has to be built inside practices (Gherardi & Nicolini, 2002). This study examines industry where safety is the most critical element of the whole operation, and therefore, safety is an essential concern of the research. Safety in this study is seen as a phenomenon that ensures safe outcome of the operations by ensuring safe operations by high-quality preparation.

Safety culture

In this study safety culture is understood as the part of organizational culture which affects safety. The concepts of organizational culture and organizational climate were largely under discussion in academia in the 1970s and 1980s (Guldenmund, 2000), and the difference between these two has already in the 1980s been described to be that climate research has a much more quantitative focus while culture research tends to

focus on qualitative methods (Glick, 1985). To define the difference between these two concepts, Guldenmund (2000) stated that culture is the underlying processes and the term climate means the manifestation of organizational culture. The term safety culture is used as a concept to analyze organizational behavior concerning safety-related issues, and therefore, it is an aspect of the organizational culture. It is essential to recognize that in this thesis safety culture is viewed specifically from a perspective of nuclear safety, and therefore, other important factors of safety culture, like security issues and occupational safety where culture is also a critical aspect, are not in the main focus of the study.

Organizational culture

The understanding of organizational culture in this study is based on the work of Edgar Schein (1985). He defines culture as an organic phenomenon that is created and constantly developed in interaction. Culture sets the rules of how people are supposed to behave and feel in interactive situations and therefore sets the social order of behavior (Schein, 2004). The interpretive perspective to organizational culture (Glendon & Stanton, 2000) is adopted to enable studying safety culture as a phenomenon that is built in interaction of individuals.

With these small concept clarifications, the environment of this thesis study can be understood and the content followed through the investigation. These key concepts are defined in a deeper manner during the academic and empirical research phases of the study. Therefore, these concept clarifications work only as guidelines for the reader to develop understanding of managerial experiences of enhancing safety culture in Finnish nuclear power plants.

1.3. RESEARCH METHOD

This thesis is a qualitative study using interviews as primary empirical data and documentation as secondary data. As the importance of safety culture has been widely acknowledged in nuclear industry, an investigation shall be conducted to find out how

the term has been defined in academia as well as by practitioners and in what connections the term safety culture is used in the industry. This thesis will gather different definitions together and construct a coherent entirety of the use of the term. The focus of the study is on the Finnish nuclear industry and requirements that concern Finnish nuclear power plants. The investigation of the material concerning safety culture is limited to the use of the term safety culture.

As the official documents are layered together as an umbrella that determines how safety culture shall occur, it is essential to understand what actually has been said of the meaning of the term and how different parties understand its meaning. By systematically studying the documents emphasizing the objective of safety culture together with studying the managerial views to the phenomenon, this thesis will introduce an overall picture of the phenomenon in the Finnish nuclear industry.

The definition and documental sensemaking of the term safety culture are reflected on middle managers' experiences of safety culture, which are based on and planned to support the official requirements. This thesis is intended to determine how middle managers experience their role in turning safety culture into practice. Effectiveness of interventions aiming to improve safety performance have been rarely studied (Hale et al., 2010), and in this study middle managers' experiences about what they see as effective methods to improve safety culture in nuclear power plants will be emphasized. This study is important because middle managers' role is fundamental in the overall performance of an organization, and it has not been studied in the context of safety culture enhancement.

The primary empirical material of this study consists of 12 interviews conducted in operating Finnish nuclear power plants. The interviewees were chosen for this study based on their position in between the organizational strategy and shop-floor workers. They were chosen from middle management of maintenance, operations and engineering functions of operating nuclear power plants to gather a coherent picture of middle managers' perceptions of enhancing safety culture.

The study is limited to operating nuclear power plants in Finland. The limitation helps to construct an overall picture of the demanding position of middle management. Construction projects were left out of the scope because of their fundamentally different characteristics in managing safety and in building safety culture into their operations. Limiting the study into Finnish context helps us to focus on the safety-critical aspects of culture, while expanding the study into other countries and cultures would complicate the study radically by bringing in the different national cultures, as well. In the Finnish context, the organizational culture varies but is based on similar assumptions of culture, whereas the context would change radically if the companies included in the study would come from very different countries and cultures.

1.4. STRUCTURE OF THE THESIS

The structure of this thesis follows common guidelines for an academic research paper. The thesis consists of literature research as well as empirical research of the phenomenon. In the following chapters, the study carries the reader from academic knowledge to the empirical study, justifying the research on its way.

Chapter 2 introduces academic literature that concerns the concepts under investigation. Literature review starts with middle manager studies, as they are the center of the research. Middle manager studies in general are introduced for building a coherent background, and after that, middle managers' connection to safety is discussed. After the managerial approach of the literature review, safety & culture studies are introduced. The second section of the chapter presents academic discussion of the term culture and its abstract nature and explains how the term is understood in this study. Moreover, a basic overview of cultural studies is given and discussion of the development of the concept is summarized. In this thesis, cultural aspects are looked through the work of Edgar Schein (1985), and therefore, his views are presented in a subchapter of its own. After that, the debate of the concept of safety is introduced and the focus is on safety culture studies and the section tends to clarify the concept of safety culture in more detail. Both theoretical and empirical safety culture studies are introduced. Finally,

Chapter 2 ends by introducing a theoretical framework for the study where the different fields researching middle managers, safety aspects and culture are tied together as a conclusion of the literature review, and the framework of this thesis is introduced.

Chapter 3 consists of the introduction to the empirical research approaches of the study. Research method and methodical decisions of the study are presented and validated in the chapter. The empirical research of this thesis consists of qualitative study of the use of the term safety culture in Finnish nuclear industry and middle manager interviews, which are conducted to investigate middle managers' perceptions of safety culture and safety culture enhancement.

Chapter 4 introduces the empirical findings of the study. The chapter starts with investigating safety culture regulations and requirements in the Finnish context and continues with the licensees' safety culture statements. These are studied to understand the environment where the middle managers work, and the base and need for their interventions. After these, the middle manager interviews are analyzed. The findings are opened up and several quotes are expressed together with the analysis to emphasize the findings. The chapter ends by summarizing the findings together.

Chapter 5 sums up the research as a conclusion chapter. The last chapter provides an overview to this master's thesis and connects its different parts as a coherent ensemble. First, the main findings of the study are discussed. Furthermore, managerial implications are introduced to conclude the analysis. Nevertheless, suggestions for further research are discussed as a last part of the conclusion chapter.

2. LITERATURE REVIEW

In this chapter, the theoretical framework of the study is introduced. The chapter is divided into three sections to construct an overview to the academic literature and discussion of the themes of the study. Middle managers are the focus group of the investigation, and therefore, the chapter starts with an overview of middle manager studies. After that, the discussion over managerial attempts to enhance safety is presented.

The second section of this chapter concentrates on explaining the concept of safety culture through examining (1) culture and especially organizational culture and (2) safety and safety culture. Culture has been studied in many disciplines and the abstract term needs to be discussed deeper before entering into the discussion of safety culture and the empirical research of this thesis. Culture studies are first introduced on a general level and after that, the focus is on Edgar Schein's work, which has been selected to be the base of the understanding of culture in this thesis. This simplification has been made, because studying the concept of culture is not in the focus of the study and narrowing the understanding of the term helps us to focus on the safety-critical elements and managerial aspects of the phenomenon.

As the context of the study is on nuclear industry, safety is one aspect of the investigation. After discussing the concept of safety, safety culture research is investigated. Safety culture has gained a lot of attention in safety studies and many researchers have studied safety culture also in the nuclear industry.

Finally, this chapter of literature review ends by presenting the theoretical framework of the study. As the study is investigating a phenomenon of culture as a middle manager experience, the framework will collect all subheadings of middle managers, culture studies and safety. Connecting these elements together will provide a rich base for the study where managerial perspectives to enhancing safety culture are investigated.

2.1. MIDDLE MANAGERS

Leaders and managers are in the central position in enhancing desired organizational culture and performance in every organization. Top management sets the goals for the performance and decides how the mission and vision will be achieved through the strategic plan. On the operational level, team leaders look after their employees and make sure that they are together working towards the desired direction. Team leaders have essential role in motivating employees in the shop-floor activities.

Between top management and team leaders, most organizations have multiple levels of managers who work in the middle trying to translate organizational level policies into operational practices and vice versa (e.g. Rouleau & Balogun, 2011). Literally, the definition of middle management would indicate any of those professionals who work in managerial position in the middle of the organization in the vertical axis (Dutton & Ashford, 1993). Furthermore, middle managers' position makes unique their access to both top management and operations (Wooldridge et al., 2008). Therefore, the definition of a middle manager could be based on the access to these stakeholders. In this study, middle managers are understood as the people who do not work primarily on the operational level but have clear connection to the employees, and therefore, work as the translators between organizational policies, purely administrative staff and shop-floor operations. This definition, therefore, includes in the discussion both functional managers and line managers.

In this section, an overview of middle manager studies is first introduced to develop an understanding of their essential position. Middle management research in management studies focuses on strategic issues, but those studies indicate also elements that are interesting from the point of view of this study, as safety is clearly one of the key elements that nuclear power companies value as a core strategic issue, as well. After the summarizing introduction to the middle manager studies, the next section focuses on previous research of managerial attempts to enhance safety. This section ties middle managers closer to the investigation of safety culture enhancement in safety critical organizations.

2.1.1 OVERVIEW OF MIDDLE MANAGEMENT STUDIES

The number of middle managers increased fundamentally, as the industrialism developed. Currie & Procter (2005) call the phase from the 1900s to the 1970s as the golden age of middle managers. After the second World War, organizations started to get bigger, create more hierarchy, and therefore, middle managers where needed increasingly. The trend led eventually to a situation where productivity decreased as an outcome of an increased number of employees in administration functions (Cameron et al., 1991).

The second phase of new competitive reality started from the 1980s as the outcome of deregulation and increasing global competition (Currie & Procter, 2005). Downsizing and restructuring organizational structures were used as a solution to cut costs (Balogun, 2003). In this phase, the number of middle managers decreased as organizations tried to form effective functions by cutting all the slack from the hierarchy levels they had developed before the new price competitive environment (Floyd & Wooldridge, 1994; Stoker, 2006). Currie & Procter (2005) also recognize a third phase, where organizations have realized that lower hierarchies have not produced desired effective organizational performance. In addition, Floyd & Wooldridge (1997) discussed the destructible effects of organizations' large-scale restructuring decisions. They state that the social network of an organization suffers fundamentally from de-layering activities, as middle managers have a central contribution to the social elements of an organization.

Middle management and managers' contribution to organizational performance have been studied particularly during the last 30 years (Wooldridge et al., 2008). The importance of middle managers' contribution to strategy gained attention as the strategy process started to interest researchers increasingly (Mantere, 2008). Before that, management was seen as a top-down process without deeper analysis of the processes between top management and organizational performance. Strategy making was seen as a top management performance still in the first phase of increasing the amount of middle managers.

Social learning perspective shifted the focus from top management into a perspective that recognizes multiple actors that affect the performance (Wooldridge et al., 2008). From this perspective, social learning is an essential element of strategy work and lower levels in the organization have a fundamental role in forming new leads and ideas. Scholars had argued about the importance of social and political factors before (Schilit, 1987) but the work of Mintzberg (1978) is one of the popular early studies arguing that strategy formulation and implementation cannot be studied separately as they are deeply interlinked. That means not only the issues under discussion but also the people performing these tasks. Mintzberg (1978) discussed about emerging strategy, which refers to the strategic activities and performance rather than to the plans on paper. Middle managers and social aspects of the performance started to interest researchers and many of the early studies recognized the impact of middle managers on the strategy process (Burgelman 1983; Schilit, 1987).

The activities and behaviors of mid-level professionals have been recognized as an important contribution to organizational performance during the past years. Wooldridge et al. (2008) conclude that the studies concerning middle managers' role and influence are mostly developed through themes of corporate entrepreneurship, innovation and organizational learning, strategy implementation or strategy-making processes. The conclusion that middle managers are important factors of organizational performance have been shared in all these research areas. Moreover, Stoker (2006) introduces the "quality movement" where middle management studies have focused on new responsibilities of middle managers. These responsibilities include performance, measurement and efficiency on employee satisfaction and other "soft" objectives of the management. Middle managers' competence in achieving these goals has been emphasized in these studies (Ellinger et al., 2003; Stoker, 2006).

One of the key assets of middle managers is the social networks their position enables them to affect (Westley, 1990). Middle managers are able to influence other employees to adopt their point of view (Rouleau & Balogun, 2011), as they interact in several directions inside the organization. These influencing activities that middle managers pursue have been investigated in studies that focus on issue-selling (Dutton & Ashford,

1993; Dutton et al., 2001). They emphasize middle managers' sensemaking and discursive perspective (Mantere & Vaara, 2008; Rouleau & Balogun, 2011) as well as their contribution to generate shared understanding (Hoon, 2007). Nonaka & Takeuchi (1995) described middle managers as the ones who create the knowledge in an organization, as they shift information from the middle to both top management and employees.

Middle managers' effect on the organizational performance has been studied mostly through strategy work where middle managers' contribution to organizational performance is divided into developing better strategies by involving middle managers in decision making and into improving performance by middle management involvement by increasing consensus of the pursued strategic goals (Wooldridge & Floyd, 1990). Rouleau & Balogun (2011) use terms strategy formulation and strategy implementation to discuss these same states of middle manager involvement. Moreover, middle managers' role in social interaction of strategy process has been studied and Mantere (2008) calls this a strategic agency. Wooldridge et al. (2008) conclude that studies from middle managers' strategic perspective can be divided into three categories; strategic roles, involvement in strategy and middle managers' strategic behavior and organizational outcomes.

Middle managers as contributors to organizational strategy is a multi-dimensional scope as the results of their work cannot be measured as easily as top management's efforts to increase organizational performance as a whole (Rouleau, 2005). Wooldridge et al. (2008) suggest that middle management research lacks cumulative research that is conducted from top management, because their efforts cannot be measured directly from the organizational performance. Research of middle managers' contribution has been more focused on middle management involvement in strategy implementation (Floyd & Wooldridge, 1994). Middle management research also explores more intermediate outcomes of organizational performance and performances of separate functions rather than the organization as a whole (Wooldridge et al., 2008). The primary purpose of their efforts might not be increased organizational performance as such, but a smaller focus area inside it (Dutton & Ashford, 1993).

To summarize the overview of middle management studies, contribution of middle managers' efforts to the organizational performance is hard to measure. Effectiveness of their interventions towards improved performance is hard to define even though the importance of these elements in organizations are widely recognized. It is even more problematic to measure how middle managers' contribution to safety can be recognized. In the next section, studies of middle managers' efforts to enhance safety are discussed. These studies are rare but combining studies of middle management and managerial attempts to endorse safety provides the knowledge needed to discuss also middle managers' possibilities to enhance safety.

2.1.2 MANAGERIAL ATTEMPTS TO ENHANCE SAFETY

The question of middle managers' contribution to strategic performance has been the main approach of middle management research in management studies. Middle managers' essential position has been discussed mainly by approaching the dilemma from a strategic viewpoint but the same ideas can also be configured by looking at middle managers' contribution on enhancing safety, as safety is one of the critical strategic components of nuclear power companies.

Leaders and managers have a crucial role in enhancing organizational culture and developing it to a safe direction. Organizational culture is fundamentally affected by leaders' beliefs and manipulation (Schein, 2004) and middle managers' perceptions are essential in enhancing the organizational culture towards a safe direction. On the other hand, middle managers are the ones who translate top management policies into operations, and their understanding of the meaning of safety culture determines how top management intends to develop safety culture and how it is actually translated into practices inside power plants. Their role is also essential in pushing forward the desired behavior and actions.

McAllister (1995) asserts that employees' trust in management affects critically their individual work performance. Managers' abilities to enhance commitment to the organization will show as employees' attempts to act responsibly as their confidence

and faith in their managers grow. Konovsky & Pugh (1994) studied employees' attempts to perform above the expected and summed up that the managers' interventions are in the central role in enhancing the organizational behavior that endorses acting beyond the call of duty. Essential elements in building this kind of over-expected performance are the manager's trust and justice as well as the quality of managerial relationship (Konovsky & Pugh, 1994). In management research, high wage rates (e.g. Bloom, 1999), participation in decision making (e.g. Mantere & Vaara, 2008) as well as training opportunities are often listed as means to enhance employee commitment. Research has shown that high-performance work practices are associated with organizational performance and financial outcomes and these efforts have impact on overall success (Huselid, 1995).

Managers' complex position and responsibility for the employees challenge the action of offering trust on employees' activities. The importance of trust is easily undervalued and has also lacked systematic theoretical attention (McAllister, 1995). Trust in employees is especially challenging in high-risk industries where the slightest mistakes can lead to problems. Detailed instructions and monitoring operations prevent negligence mistakes, and even when trust would lead to superior performance, the cost of a human error can be extreme.

Management practices that engender trust and commitment are essential in enhancing safety. Barling & Hutchinson (2000) investigated managers' safety enhancing strategies and their effect on the performance of the employees. The study is conducted in the field of workplace safety, which is one of the components of the overall safety that this study is investigating. Barling & Hutchinson (2000) studied the differences of control-based safety principles versus commitment-based and evaluated how they affected employees' safety practices and safety climate. Control-based safety principles mean the mandatory requirements and processes that are forced to be conducted in organizations. Control-based approaches can include rules and punishments together with rewards for achieving safety goals. These approaches are traditionally seen as effective ways to increase safety in organizations. Commitment-based approach to enhance safety is argued to be more effective than traditionally highly valued control-

based methods (Barling & Hutchinson, 2000). Their results suggest that organizations may benefit from a commitment-based approach to enhance workplace safety. This result is not directly comparable to the safety-critical industries, but indicates the importance of commitment over control, which is important to acknowledge also in the nuclear industry.

Safety management practices have been studied in safety-critical industries especially in quantitative researches. Mearns et al. (2003) studied offshore oil and gas installations and reflected employees' safety climate survey results to a questionnaire of senior management's safety management practices. Vinodkumar & Bhasi (2010) conducted a large survey among employees of eight major accident hazard process industrial units in India. Both of the studies stress the importance of safety management and coherent safety management system. Middle managers are not mentioned in the studies. Grote & Künzler (2000) studied employees' perceptions regarding operational safety on different organizational levels and stated that most studies focus on assessing a formal safety management system instead of studying employees. They claim that qualitative study helps to gain a better understanding of safety management and safety culture together with the quantitative methods. Pilbeam et al. (2016) studied safety management and noted that many researchers use transformational-transactional scale to measure safety management with vague outcomes. They state that the results of different studies vary and other measurement scales should be found to evaluate safety management.

Fruhen et al. (2013) studied senior managers' influence on safety culture in air traffic management organizations, but studies of safety culture often focus on low-level workers (Silbey, 2009) and organizational, structured forces that influence it. Middle managers' influential position is highly acknowledged in managerial studies, but their contribution in enhancing safety in high-risk industry lacks research. The importance of management is emphasized in various studies in safety science but studies which focus on managers or management practices are rare. Safety performance is hard to measure, as safety is the outcome of operations where nothing unexpected happens. Hale et al. (2009) studied effectiveness of safety management interventions and highlight the importance of management support on improving safety culture. Monitoring behavior

and hazards continuously are also in their study recognized as an essential element of safety culture. In the next section, studies of culture and safety will be introduced to construct a better understanding of the research done in the field.

2.2. SAFETY & CULTURE

A range of meanings has been addressed to the term safety culture in academia (Glendon & Stanton, 2000) but still the definition of the term has no universal agreement (Clarke, 2000). The debate of the definition is similar to the discussion of the definition of organizational culture. Both of them are complex terms trying to explain a phenomenon that has several features. Even when it was defined that safety culture is the safety-critical part of organizational culture, the first interests towards safety culture did not rise from the theoretical base of organizational culture. Clarke (2000) stated that it is fair to suggest that these two concepts share many features, even when it is noted that the use of the term safety culture did not start from the base of organizational culture theories.

Disagreement upon the definition of safety culture is primarily based on understanding of the term "culture". Therefore, it is important to determine, how culture and especially organizational culture is understood in this study before going deeper into the phenomenon of safety culture. Some researchers determine it differently, but in this thesis, safety culture is understood as a part of organizational culture that affects safety. It means that safety culture is not an isolated phenomenon but a part of the bigger construction of organizational culture. Therefore, investigation of safety culture in this study starts with defining it first through organizational culture.

2.2.1 OVERVIEW OF ORGANIZATIONAL CULTURE STUDIES

Organizational culture is a concept that has been studied widely across different disciplines. The lack of an agreed definition and research from different perspectives

has determined various overlapping studies, which makes it hard to say whether they are discussing about the same phenomena (Frost et al., 1991). Researchers through decades have categorized organizational culture studies into new frameworks to explain the differences of the studies.

Scholars have argued upon the nature of culture and some see culture as something that an organization is while others see culture as something that an organization has (Smircich, 1983; Reason, 1998). Both approaches are important, but have very different nature. Smircich (1983) describes the view of culture as something an organization is as a root metaphor for conceptualizing organizations. "Culture as something an organization is" approach promotes an understanding of expressive, ideational and symbolic aspects of organizations (Smircich, 1983) while "culture as something an organization has" approach refers to matters that are easier to manipulate (Reason, 1998).

To introduce a complex version of the studies determining scholars' understanding of organizational culture, Meyerson & Martin (1987) suggested a framework where different views to understand organizational culture were categorized into three paradigms according to the perspective of the researcher. The paradigms' integration, differentiation and ambiguity differ in terms of consensus that the members of the organization have towards the culture. Meyerson & Martin (1987) state that in organizational culture studies, the main difference in approach is whether the culture is studied as a shared consensus, subcultural consensus or inconsistent in nature. These examples show how other scholars look at the aspects that form the culture, whereas others focus on the human experiences of how the culture is understood.

Most of the organizational culture studies use only one perspective to study the dilemma. Researchers easily focus on one aspect of the phenomena in their work. Meyerson & Martin (1987) argue that it would be essential to look at the organization from many perspectives to see the whole picture. The one-perspective studies are usual and not any less true but because of the narrow perspective on culture, they present only a part of the phenomena. It is very challenging to use a multi-approach method, as mind

is naturally focused more closely on some aspects and it is not easy to see the differences (Frost et al., 1991).

As researchers have been trying to construct a clear definition of the meaning of organizational culture, different distinctions have been made. The 1970s and 1980s were decades of great discussion of organizational culture and organizational climate and many studies defining the phenomena can be found from that era (Guldenmund, 2000). The terms organizational culture and organizational climate have overlapped and been brought together in many studies (Glendon & Stanton, 2000). Organizational climate was widely in use in the 1970s but eventually culture replaced the term climate in the 1980s (Guldenmund, 2000).

Where climate was particularly seen as the common characteristic of behavior, culture has been used for a bigger entity that takes into consideration also the background of values and beliefs. The difference between these two concepts has already in the 1980s been described to be that climate research has a much more quantitative focus, whereas culture research tends to focus on qualitative methods (Glick, 1985). To define the difference between these two concepts, Guldenmund (2000) stated "research on culture is much more focused on the dynamic processes at work in an organizational culture, continuously creating and shaping it" (p. 220).

Bate (1984) described organizational culture as follows: "people in organizations evolve in their daily interactions with one another a system of shared perspectives or 'collectively held and sanctioned definitions of the situation', which make up the culture of these organizations". This definition works as a good solidification of the complex dilemma. Bate's definition shares the understanding of culture as attitudes determining the actions and practices that affect others and therefore reform the culture in the organization.

Another persistent debate in the 1980s was the levels of culture that can be found from an organization. Multiple researchers have framed different levels of culture when the theme boomed in the 1980s after the term culture got the expanded attention of

researchers. Many researchers have collected these studies together. Guldenmund (2000) collected these studies together to construct a coherent picture of the similarities of the studies. Different researchers framed the levels differently, but the core is constructed of values or basic underlying assumptions, which is the case in the work of Edgar Schein. His work is introduced in the following section.

2.2.2 MODEL OF ORGANIZATIONAL CULTURE BY EDGAR SCHEIN

In this thesis, culture is understood through the work of Edgar Schein (1985, 2004). He structures the concept of culture into four categories of which organizational culture is in the focus in this study. He states, that culture is a phenomenon which is shaped by individuals and their interaction. At the same time, culture sets the rules of how we are supposed to behave and feel in interactive situations and therefore sets the social order of behavior (Schein 2004). Schein (1985, p. 9) summarizes the meaning of culture to be "a pattern of basic assumptions that has worked well enough to be taught to new members as the current way to perceive, think, and feel in relation to those problems".

The work of Edgar Schein has been highly valued by practitioners. In this study, the concept of culture is not in the focus of the research. Therefore, it is justified to (1) form an overall picture of the studies focused on culture through time but moreover to (2) focus on explaining the phenomena according to a scholar whose perspective is commonly recognized to form a base to the study that does not focus on the culture itself but on a small part of it. Therefore, the work of Schein is used here to determine how organizational culture is understood in this study.

The base of the concept how Schein (1985) structures culture is through three levels of culture. Culture can be defined by using three main levels, which are artifacts (1), espoused beliefs and values (2) and underlying assumptions (3). By the levels, Schein means the degree of visibility that a cultural phenomenon has. These can be described as an iceberg where only artifacts are visual, and rest of the culture cannot be seen without closer examination.

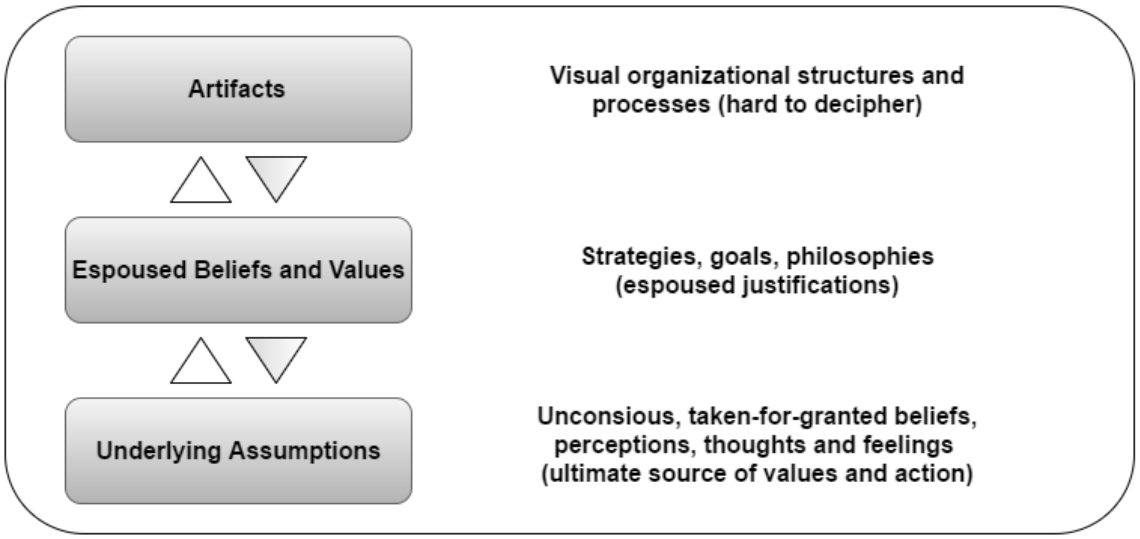

Figure 1. The Three Levels of Culture (Edgar Schein, 2004)

The model has been cited widely, and many studies have been based upon the work of Schein. What is important in this study is the base that safety culture as a part of organizational culture has different levels and aspects that affect the culture differently. Some parts of the culture are visible and known by the members of the culture or even visible to outsiders, but other ones are invisible and even unconscious. These embedded basic assumptions that are rooted behind all the visible signs of culture have to be taken into consideration, too. Schein (2004) calls these as the essence of culture. Observers easily measure only the artifacts that are visible to them and assume the underlying parts of the culture based on their own knowledge and experiences. This is an easy pitfall that happens commonly when humans evaluate cultures they are not part of. Schein (2004) writes that observers can see and feel the visible parts, but that alone does not reveal the meanings that those things signify to the members of the culture.

The next level behind the visible part of artifacts in Schein's model is espoused beliefs and values. These values and goals are constructed in social processes and transformed through time. These conscious beliefs and values predict most of the behavior that is visible in the level of artifacts (Schein, 2004). It is important to note that the beliefs and values of a culture can be claimed to be other that what they actually are. This can be seen in an organizational setting where values are stated to be greater than what the

actions reveal. This point is essential in the empirical research of this study as it indicates how to relate to the safety values that middle managers present in their interviews.

The deepest level of culture, the basic underlying assumptions, are unconscious manners that are hard to measure. They determine behavior on a taken-for-granted level. The basic underlying assumptions are non-negotiable and therefore extremely hard to change (Schein, 2004). In the context of this study, safe operations are assumed to be a taken-for-granted commission of the organizational culture that employees are not ready to negotiate in any manner and the assumption will be reflected in the empirical findings.

The development of organizational culture is highly influenced by the core mission and the main opinion leaders of the organization. Taking the role of an opinion leader is easiest for leaders and managers as their position already offers them power over other members. Schein (2004) states that originally leadership is the source of beliefs and values. Managers' actions and perceptions lead the development of the organizational culture. These activities are essential as a new organization form, because the basic structure of the culture develops in the beginning. Leaders' assumptions become easily shared assumptions of the culture.

Schein (2004) states that organizational culture gets stable as the work environment matures and activates again as new aspects arise to the ensemble. It is essentially harder to change the shared values after an assumption is attached to the organizational culture. It is even harder to change the basic underlying assumptions. Managers' role is fundamentally important in developing organizational culture into a desired direction one step at a time.

As the operating nuclear power plants in Finland have been running for decades, the focus of this study is on developing matured cultures into desired direction by active leadership. Managers embed their beliefs, values and assumptions in their management practices, which are everything from what they notice and comment to the ways they

measure, reward and control their team (Schein, 2004). The studies have shown that development is still needed to ensure safe operations. The critical component is the awareness of the manager. His or her actions reform the culture more effectively than any others', so they have to be aware of their critical role in the ensemble.

2.2.3 DEFINING SAFETY CULTURE

Before going deeper into safety culture studies, it is essential to understand why good safety culture is needed in nuclear industry. Nuclear industry holds high risks. Not only economical but also massive risks to the environment as a whole. Safety is an essential element that makes it possible to use nuclear power. Without extremely high safety levels, nuclear power could not be used because of the consequences that nuclear accidents would generate. In this kind of business, safety is the lifeline of the whole production.

Safety is invisible, because safe performance does not capture attention (Reason, 1998). Problems occur when safety fails. The term safety has been used in different purposes, but the main insight of the term is to prevent unwanted consequences from happening. Gherardi & Nicolini (2002) state that safety is not something that could be just added to action, rather it has to be built into the practices. The difficulty is that building safety into practices demands heterogeneous implementing methods, as individual employees understand safety differently because of their cultural backgrounds (Gherardi & Nicolini, 2002). Individuals come with their earlier experiences and beliefs, and therefore, building safety inside work practices demands purposeful hard work towards the goal.

This study examines safety with the cultural approach. To build safety into organizational practices and employees' routines, safety culture needs to be enhanced to integrate safety into the mindset of all doing. Safety is an essential element that needs to be built into culture of determining practices in nuclear power plants and that mindset has to reach all employees. Välikangas (2010) use the term unthinkable-to-describe situations, where imaginative thinking is needed to cope with issues that are possible but

unlikely. Safety has to embedded into practices, even when accidents are unthinkable by their nature.

Safety culture is a term that is commonly used in high-risk industries to discuss organizational aspects that affect safety (Flin et al., 2000). Safety culture as a term was established 30 years ago when it came into discussion that social and organizational forces affect safety together with technical and human errors that have historically been understood as the components of safety. In safety science, organizational aspects of nuclear power plant performance were raised into an issue in 1979, when U.S. Nuclear Regulatory Commission's (NRC) investigation report of the accident of Three Mile Island stated the problem in the first line of their report summary.

> *"The one theme that runs through the conclusions we have reached is that the principal deficiencies in commercial reactor safety today are not hardware problems, they are management problems" (Rogovin, 1980).*

The quote shows clearly the importance of management that was acknowledged in the investigations. As the technological robustness has developed, accidents tend to be results of organizational aspects rather than design failures in the technology (Silbey, 2009).

The actual term "safety culture" was introduced by IAEA after Chernobyl nuclear accident in 1986. IAEA's accident investigation report stated that the lack of safety culture was one component of the accident (INSAG, 1986). IAEA has defined safety culture as "The assembly of characteristics and attitudes in organizations and individuals, which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance". In IAEA documents, the definition has remained untouched until today. Since the term has been acknowledged, many accident investigations after 1986 have cited lack of safety culture as a contributor of accidents in high-risk industries (Morrow et al., 2014). The use of the term safety culture has expanded from the nuclear industry also to studies of other safety critical industries and the term has gained a lot of attention among researchers lately (Sibley,

2009). Lack of safety culture has been mentioned as a reason for accidents in different type of organizations for the past 30 years.

Another popular definition of safety culture commonly used in literature was made by the U.K. Health and Safety Commission's Advisory committee on the safety of nuclear installation (ACSNI) in 1993. Their definition of safety culture "The product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organization's health and safety management" is referred to in many academic papers (Clarke, 2000).

These definitions of safety culture are made by people who do not have roots in anthropology where the concept of culture has been studied for decades before the theme started to interest safety-critical organizations (Haukelid, 2008). This cultural turn in safety science has its roots in the military and engineering professions, and culture is looked as a way to ensure technological efficiency (Silbey, 2009). Researchers who have actively discussed the concept of safety culture are mainly from the fields of engineering, management and psychology, accompanied with sociology and political science (Silbey, 2009).

Safety culture has also been studied through different terms. Safety climate and safety attitudes are terms that are also used in literature to investigate phenomena close to safety culture (Glendon et al., 2006). Safety climate and safety culture have been historically studied independently but in many studies, safety climate is seen as one component of safety culture (Guldenmund, 2000). In these studies, climate is seen as a visible or measurable part of safety culture when culture is understood as a long-term strategic aspect that is harder to measure (Glendon et al., 2006). Moreover, Silbey (2009) criticizes that safety culture studies often use surveys to collect empirical data but the questions tend to focus on safety climate even when the researcher has claimed to study safety culture.

Safety culture affects the way an individual recognizes safety hazards in work performance, and therefore, the culture is a major force of individual work performance (Reason, 1998). Oedewald et al. (2015) define that the essence of good safety culture are organizations' ability and willingness to prevent hazards in their daily operations. Good safety culture is needed to make sure that individuals remember the hazardous character of their work even during the times when no mistakes have been made. That is the hard part in sustaining safety. Maintaining good safety culture during times when no accidents have occurred is a challenging task for all safety-critical industries (Carroll, 1998), it is extremely hard to maintain the desired safety culture even when it is known that, as the technology has developed, the problems that occur are increasingly caused by human and organizational hazards rather than technical problems. Human mind tends to forget its own limitations and that can lead to extreme accidents if the level of safety culture manages to decrease over the accident-free periods.

The understanding of social safety aspects has led to a shift from looking at personal performance and technical features to evaluation of the effects of the organizational aspects (Mearns at al., 2003). Organizational aspects are noted to cause accidents more likely than human errors because it is organizational aspects and unsafe culture that contribute to the leak and gaps in defenses-in-depth (Reason, 1998). These gaps are created in organizational manners, not by individual human errors.

It has been noted, that even when the term safety culture was established to determine organizational aspects affecting safety performance, the term has been increasingly used to measure individual behavior (Mearns at al., 2003). Organizational safety culture can be seen as a component that affects individual behavior, and therefore, safety culture is also used to measure individual behavior expectations (Glendon et al., 2006).

Reason (1998) characterizes the differences of individual and organizational accidents by the consequences. Organizational accidents may be rare, but their consequences are widespread when individual accidents tend to have only limited consequences and short history. Organizational accidents are the ones that are protected by multiple complex

defenses but still manage to happen. These accidents are the ones that safety culture is trying to prevent from happening.

The concept of safety culture has been criticized as well as valued among researchers (Cox & Flin, 1998). It is argued, that the harmony model of organizational life has shortcomings that undermine the whole concept (Antonsen, 2009). Safety culture is argued to be overrated and lack empirical validation (Clarke, 2000). Antonsen (2009) studied the relation between power and culture and tried to explain the problematic nature of the term. He states that some organizational safety researches have abandoned the term in total because of the mixed understandings that people tend to have towards it.

A famous organizational safety scholar Charles Perrow is known for his lack of use of the term. He abandoned the whole term culture from his famous book "Normal Accidents (1984) where he analyzes the social side of technological risk especially in high-risk organizations. Perrow (1984) studies the importance of management and training but avoids talking about culture as he sees power relations to be in the center of safety. The power-oriented perspective to organizational safety takes in to consideration the power relations that need to be analyzed deeper than organizational culture studies typically tend to address (Antonsen, 2009).

Studies of safety culture have been criticized for simplicity and narrow understanding of the concept of culture (Haukelid, 2008). Sibley (2009) states that safety culture studies invoke the iconic concept and leave outside much of the work sociologists and anthropologists have done to build a coherent theoretical edifice to the phenomenon. Studies of safety culture, however, have helped high-risk industries like nuclear industry to develop their understanding of maintaining safe operations and to open up their engineering-based approach.

2.2.4 SAFETY CULTURE STUDIES IN THE NUCLEAR INDUSTRY

Researchers have created theories and assessment criterions for safety culture evaluation, and the phenomena and development methods have been under discussion widely. Many of these studies have discussed the concept and factors of safety culture in the context of nuclear industry (Oedewald et al., 2015). Silbey (2009) states that the term safety culture has even become a constantly repeated mantra in the industry. Even though the need for good safety culture has been acknowledged and its meaning has been studied, Fukushima Daiichi accident in 2011 showed once again that further understanding of safety culture still needs to be developed. The accident underlined the importance of different actors' role in the ensemble (Oedewald et al., 2015).

Reason (1998) pointed out that safety culture has a bigger role in preventing accidents in high-technology industries like nuclear industry. He stated that the complex defense-systems reduce the likelihood of the accidents to the point where employees easily start to forget the importance of all the layered defense-systems. The importance of safety might be forgotten when the technology is so advanced and robust that the employees start to feel that nothing can happen in their advanced safety environment (Carroll, 1998). Safety science community has developed criterion for developing and analyzing safety culture but the question of integrating this knowledge into practices of the nuclear licensee organizations might still need optimizing (Oedewald et al., 2015).

Empirical evidence of operational safety contributors in nuclear industry is still rare (Sorensen, 2002). Management and organizational factors influence is more readily available in other high-risk industries. It is agreed that worker attitudes towards safety make a difference although the mechanisms by which it happens are unclear. Many studies assume indirectly that plants with low accident rates most probably have better safety culture (Lee, 1998). Sorensen (2002) states that the statistical evidence that links safety culture with the safety performance is surprisingly rare in the nuclear industry.

Reason (1998) proposes that the best way to sustain awareness of safety issues in practice is to gather continuous data of incidents and near misses as well as proactive

activities. The objective is to create a safety information system that informs the employees continuously about the knowledge available about the human and technical as well as organizational and environmental factors that affect safety. Moreover, Reason (1998) states that information is the best way to sustain a respectful wariness in times when no unwanted events have occurred. To reach the environment of open information flow, he suggests building systematically a culture of reporting where the smallest slips and mistakes would be noticed in a positive light to increase the level of knowledge of the hazardous nature of the work.

Some researchers have focused on evaluating the influence of safety management and culture interventions. Carroll (1998) studied learning practices in the nuclear industry to analyze linked assumptions and logics to organizational learning. He places culture as one of the resources for organizational learning in his study. Morrow et al. (2014) describe that only from the 2000s researchers have activated to measure the link between safety culture and safety performance in the nuclear industry. Moreover, Morrow et al. (2014) showed in their study that the relationship between safety culture and safety performance is highly depended on the measurement criterion in use.

Lee (1998) described that the methods that mostly have been in use to measure safety performance have been the key performance indicators and safety audits. He highlights the importance of safety surveys to accomplish the previous methods. When the key performance indicator is a numeric index of performance and safety audit emphasizes that the methods needed are in use, safety surveys can be used as indicators of the employees' perception of the safety culture.

Mengolini & Debarberis (2007) studied the implementation of a methodology for safety culture enhancement and investigated it in the environment of a research reactor. They studied how the IAEA guidelines for safety culture can be implemented in practice. Their study emphasized the importance of leadership and management commitment among other measures.

To continue to studies which evaluate situations appearing in the nuclear power plants, García-Herrero et al. (2013) conclude in their study of safety culture in the nuclear industry that the principal acts to achieve results in safety culture would be looking for errors, not keeping out of sight when difficult situations arise, and resolving conflicts constructively. The study did not consider managerial efforts to achieve safe results.
Mariscal et al. (2012) assessed safety culture in a nuclear power plant through work groups and concluded that involving employees in a safety culture assessment is an effective way to cultivate interest among employees and draw attention to the safety culture improvement. Motivation, commitment and visible leadership are highlighted in the study. They also underlined the importance of management's belief that safety can always be improved.

Martínez-Córcoles et al. (2013) studied how team leaders' behavior affects employees' safety performance and found out in their quantitative study of the Spanish nuclear industry that leaders' empowering behavior cultivated active safety compliance among the employees. Their study is highly important and one of the few studies focusing on managers' direct effect on safety in a nuclear power plant.

In the newest studies of safety culture in the nuclear industry, Gotcheva et al. (2016) have investigated cultural features of design in nuclear industry. They considered that after the Fukushima accident in 2011 the design and construction phases of a nuclear power plant have to be measured again. Their study of a Nordic nuclear industry perspective described that cultural features of design showed that the temporary and complex nature of a nuclear power plant design project makes it extremely difficult to manage and understand the overall picture, and it provides a great challenge to safety management and safety culture.

In Finland, a safety culture assessment methodology DISC (Design for Integrated Safety Culture) has been developed by VTT (Technical Research Centre of Finland) to measure safety culture assessment in nuclear industry (Reiman et al., 2012). The DISC model uses a fixed criterion to measure organization's potential for safety. The framework is developed to measure organization's safety culture, understanding the

dynamic nature of the phenomenon (Oedewald et al., 2015). Safety culture is continuously reforming phenomenon and DISC model emphasizes the need to recognize this feature in the assessment.

Figure 2. The DISC model (Reiman et al., 2015)

The DISC model provides criterion for evaluating the state of safety culture. It specifies the kind of culture desired from a safety point of view (Oedewald et al., 2015). The criteria are not very detailed because of the uniqueness of organizational cultures, and therefore, Oedewald et al. (2015) underline the importance of the assessment team's knowledge of the phenomenon as well as good understanding of the model in use. The framework evaluates culture on an organizational level.

Oedewald et al. (2015) suggest that safety culture assessment should always consist of multiple data collection methods. In addition, other researchers have used triangulation to determine safety performance (e.g. Hale et al., 2009; Reiman et al., 2005) because of the nature of the phenomenon under investigation. As culture is not constructed only by

individuals, it is essential to measure culture as a collective phenomenon. Safety culture studies are criticized for forming assessments of culture too easily by investigating only individual opinions (Guldenmund, 2000).

Safety & culture are both abstract concepts, and as they are tied together as a concept of safety culture, it is no surprise that the phenomenon is challenging to define, without even talking about measuring it. In this section, the concept of safety culture is discussed through investigating the phenomena of culture, safety and then safety culture. In the next section, the academic context of this study is combined together as the framework of this thesis.

2.3. RESEARCH FRAMEWORK

In this literature review chapter, academic literature that concerns the topic of the study has been introduced. The literature has been gathered under two main subheadings, middle managers and safety & culture. Understanding these concepts is essential for the empirical research of this study. In this section, the academic literature is first summarized and after that, the theoretical framework of the study is presented.

Middle management is the starting point of the study and of the literature review. The meaning of this investigation is to examine middle managers' experiences of their work. The area of their work this study investigates is safety management and especially safety culture, as it is internationally used in the industry and regulation STUK Y/1/2016 section 25 determines that "a good safety culture shall be maintained" in nuclear organizations.

Safety culture has multiple definitions as discussed earlier in this chapter but this study examines it as a part of organizational culture. Therefore, main principles of organizational culture are discussed in the academic research. The phenomenon under examination is investigated in the context of nuclear power industry, and therefore, safety and regulations are essential parts of the study.

The figure 3 is determined based on the academic literature of the study and research environment reviewed in this chapter. The study has two main elements in which the perspective of the investigation is built on: middle managers and nuclear industry's special need for safety culture.

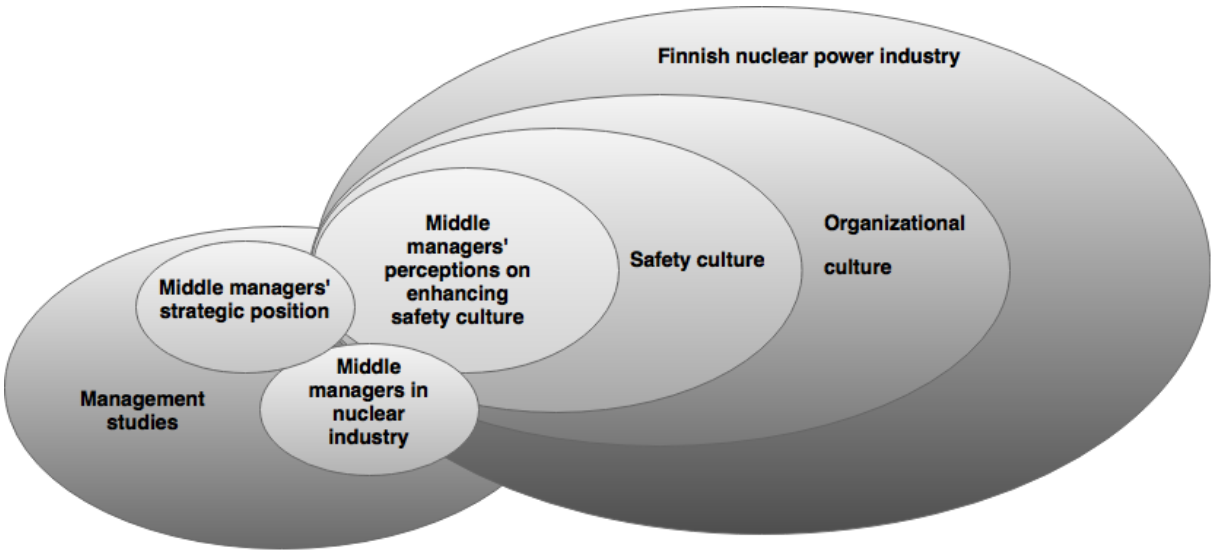

Figure 3. Summary of the research environment

The literature review of this thesis consists of multiple pieces tied together from several disciplines. Management studies and organizational aspects are investigated in the context of highly technical nuclear industry where mostly engineers have developed organizations from their perspective. This thesis is investigating a complex phenomenon but to form a coherent research question, the focus is on middle managers and managerial aspects. The research is based on management studies as a research background, and there especially middle managers' strategic position, and middle managers in nuclear industry are in the focus of the literature review. The context of the study is the Finnish nuclear industry, and as the investigation focuses on middle managers' experience on enhancing safety culture, safety culture and organizational culture has to be studied to understand the phenomenon. Together the aspects of the study form a research environment, which produces a fascinating research gap from a managerial perspective.

Theoretical framework can be called as observations that are looked from a particular viewpoint (Alasuutari, 1995). The data sample could be investigated by various approaches and the theoretical framework explicitly illustrates the approach chosen for the study. The theoretical framework of this study is summarized in the figure 4 to explicitly illustrate the point of view this study takes to look at the phenomenon of safety culture. This study tends to get behind the abstract safety culture talk in the nuclear industry and investigate middle managers' experiences.

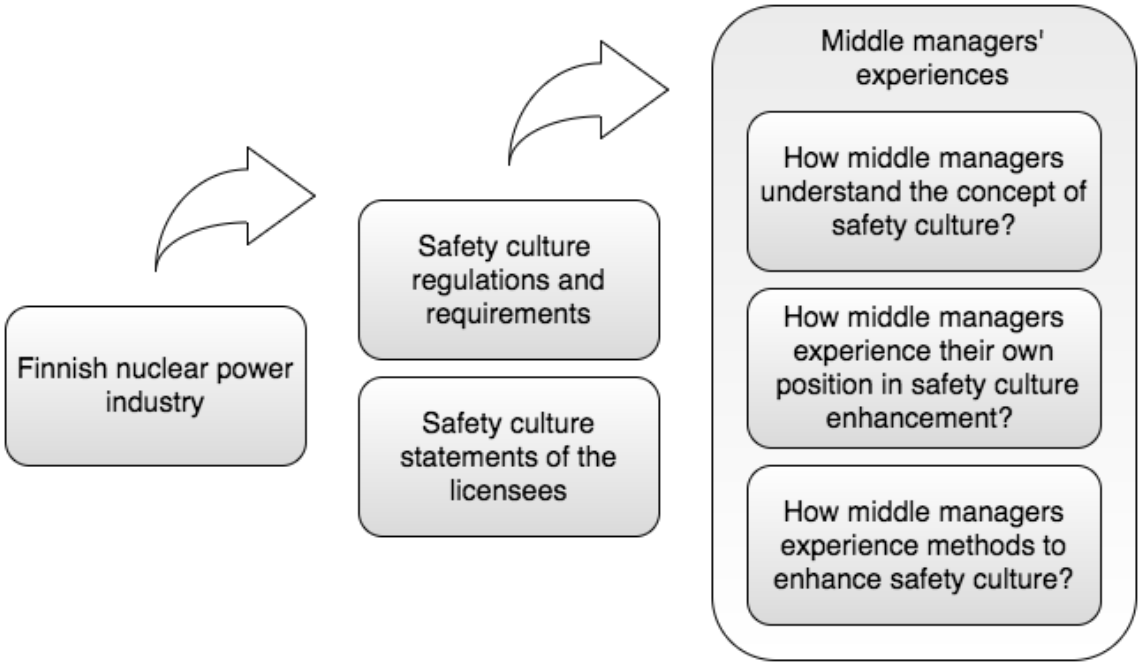

Figure 4. Theoretical framework of the study

The framework introduces how the research questions in the right column of the figure are formed from the context of the study. Middle managers are investigated because according to the literature introduced in this chapter, they hold a key position in enhancing safety culture, and a good safety culture is a requirement that STUK regulates in the context of Finnish nuclear power industry, and nuclear power companies are expected to enhance safety culture as they see fit in their organization. The study investigates middle managers to complement previous research of safety culture from a managerial perspective of safety culture enhancement.

3. METHODOLOGY

This chapter is dedicated for presenting and justifying the methodical choices made for the empirical study. Research perspective, method and methodology will be presented in this chapter together with introduction to the licensee organizations. The chapter ends with evaluation of the trustworthiness of the study.

3.1. RESEARCH APPROACH

Academic research is often categorized into either qualitative or quantitative research (Alasuutari, 1999). Quantitative research is often based on surveys and numeric data and the focus is on large samples and therefore reliable results, when qualitative research approach focuses on the quality and depth of the data, and therefore, uses more ethnographic methods to research (Eriksson & Kovalainen, 2008).

Many studies of safety culture are based on quantitative data and surveys. Research based on surveys is essential in understanding an organization's development state of safety culture on a wide scale across the organization. On another hand, qualitative research is needed to understand deeper the phenomena in practice. Mengolini & Debarberis (2008) found in their comparative study that survey-based safety studies gave generally more positive results than interview studies. Studies of safety culture have shown that multiple research styles need to be conducted to understand safety indicators, as one study alone can be misleading because of the complexity of the phenomenon (Reiman et al., 2005). This thesis is looking at the phenomenon from a managerial viewpoint in an in-depth study. The objective is to complement existing research of safety culture. Qualitative research method helps the study to seek for rich data with complex and multidimensional expressions (Alasuutari, 1999). Qualitative research approach has been chosen because it allows the study to better investigate how middle managers experience safety culture.

The ontological starting point estimates that the data collected in this study provides a representation of experiences, which can develop during time and change in interaction. The research approach of this study is critical realism where the assumption is that social actors produce reality but the presence of the existing structures are acknowledged (Eriksson & Kovalainen, 2008). Edwards et al. (2014) summarize critical realism as follows: "critical realism holds that an (objective) world exists independently of people's perceptions, language or imagination. It also recognizes that part of that world consists of subjective interpretations which influence the ways in which it is perceived and experienced". The approach is used to focus on middle managers' experiences in the fixed context and in the regulatory environment. Critical realism is often used for finding the basic conditions of the phenomenon studied (Danermark et al., 2001), which in this study means the middle managers' experiences. The philosophical base of the study points out that collected data offers an example of interpretations, and it should not be simplified to be the only truth of the phenomenon.

The approach to empirical research in this thesis is research-question driven. The need to study middle managers' experiences of developing good safety culture has risen from previous research in the field of safety culture studies in high-risk industries. The question has evolved from the need to understand better how practitioners experience safety culture development when it is recognized that the abstract term safety culture is mainly in use on the management level. This study contributes to the existing literature by concentrating on middle managers' sensemaking of the phenomenon. The focus of the study is on the meaning that middle managers give to the phenomena, but also on how they think that they can affect the development of the safety culture, their experiences and the shared meanings in the power plant. The content of empirical data is important, but the interaction in the interview gives the study an optimal environment to deeply understand the meanings of the sentences together, the complexity of sensemaking.

The study is chosen to consider all operating nuclear power plants in Finland, as there are only four operating reactors. The operating plants belong to two licensees, which both operate 2 reactors. The organizations are introduced in more detail in the next

section. The analyses include studying the context in which Finnish nuclear power companies operate, the national requirements and international standards.

In this study, middle managers are seen as the managers of the team leader or supervisor level. This means the level of managers, who supervise shift managers in the organization. The idea of this limitation is to focus on managers who are somewhere between the organizational strategy making and shop-floor workers. The study tries to emphasize the complex role of these managers who work in the cross pressure of the workforce and strategy.

The study takes into consideration the interviews of managerial experiences as a primary source of empirical material and investigates the documentation of safety culture that affects the work of middle managers in the context of Finnish nuclear power plants. In other words, official documentation of safety culture objectives and requirements is studied as written secondary data. Academic definitions of safety culture have been gathered together by several researchers (Guldenmund, 2000). Viitanen collected practitioner-based safety culture statements together even in the Finnish context in Oedewald et al. (2015), but this study will focus on the context of written definitions by practitioners of the field to construct a coherent entirety of the use of the term safety culture in official documents. The study will develop a complete picture of the rubrics and policies that might affect the emerging safety culture in the nuclear power plants. Even though the middle managers perhaps will not connect their understanding to the official standards, the base of the development of "good safety culture" in Finnish nuclear power plants lies in the official specifications. For conducting this study, it is important to understand from where the assumptions and understandings of middle managers develop.

3.2. RESEARCH LICENSEES

The sample has been narrowed to operating plants to focus on a clear target group. Middle managers in operating plants indicate stable operations situation and can be seen

as a holistic picture of the phenomenon. As the core of this study is to investigate middle managers' role in enhancing safety culture concerning nuclear safety and if the research questions had taken into consideration middle managers of all nuclear organizations, the focus would have changed, as all organizations are not yet operating a plant because they are in design and construction phases. Therefore, the meaningful study of Finnish nuclear power plants' safety culture development from the perspective of middle management was decided to be concentrated only on the plants in operation.

The organizations operating nuclear power plants in Finland are introduced in this chapter. In Finland, two organizations have the license to operate nuclear power plants. Both of the organizations operate two reactors, and in both organizations, the reactors are operated by the same organization. The licensee organizations themselves are different in nature. The companies are introduced to outline the environment where the middle managers work. The different nature of the organizations also helps to form a clearer picture of how Finnish operating environment and Finnish regulations affect safety management, as the organizations themselves are different.

One of the two licensees is a Finnish nuclear power company that only operates in the field of nuclear energy. It is a public company that produces electricity to its shareholders in cost price. The shareholders of the company are Finnish power companies. The company operates in Finland, and in 2015, the average number of personnel was 791. The organization was founded in 1969 and has been operating one of the two Finnish nuclear power plants since the construction of the plant.

The other research organization is a Finnish corporation operating in the energy industry and nuclear business is one of their business areas. The organization co-owns nuclear capacity altogether in eight reactors in Finland and Sweden (2015). The plant this study focuses on is fully owned by the company and is located in Finland. The number of personnel in the end of the year 2015 was 7835. The corporation is structured into three business divisions and the division that operates nuclear power also includes, for example, hydro and thermal power production.

Both nuclear companies are hierarchic organizations and have structured the technical operations in a fairly similar way. The organizations have similarities in the organizational structure where operations, engineering and maintenance functions could be adjusted as the core trio. The operations functions in both companies are structured similarly so that the basic idea is that the employees working with the different reactors are separated in different teams that work in the power plant around the clock. In general, the shift-teams have team leaders, shift supervisors and a function manager. In the maintenance and engineering functions, different teams in both organizations are organized to work with specific specialization areas in teams.

The charts of the organizational structure of the nuclear power plants are rather low as the number of permanent employees is compact. The middle managers in this study are working below the executive board and the functions are very different in nature. Middle managers are responsible for teams, which differ in the size, structure and education level. Some of them have immediate supervisors working under them, but some of the middle managers were working directly as immediate supervisors in small teams.

3.3. DATA GATHERING METHOD

Empirical data is often gathered for business research in forms of primary or secondary data (Eriksson & Kovalainen, 2008). In this study, both primary and secondary data are used. Secondary may have been collected for other purposes that can be different from the purpose used in the study (Ghauri & Grønhaug, 2005). The secondary data used in the study is based on public documents. Primary data is collected for the specific problem to help to investigate the research problem (Hirsjärvi & Hurme, 2004).

In this study, middle manager interviews were conducted through the link to the authority. The study is a commission to Radiation and Nuclear Safety Authority in Finland. The link was helpful for gathering data, as it enabled the researcher to access nuclear power companies, which have very high safety and security requirements.

Access to the Finnish nuclear power companies has been utilized through the authority and the link to the authority also provides a great environment for understanding the context of the study. The access to the organizations is easier in this study but it does not automatically come with trust towards the thesis study. The trust of the organization has to be built personally (Eriksson & Kovalainen, 2008). The study is conducted to investigate middle managers' challenging role in the context of Finnish nuclear industry, and there is no motive to analyze individual performances or organizations' capabilities to enhance good safety culture alone. Political threats and fears to let an outsider into the organizations' work life is risky (Brayboy & Deyhle, 2000) as the intents of an unknown person cannot be known, and this is especially so in nuclear industry, which the media always finds interesting. This study is not evaluating the company or their employees but tends to find new knowledge of the middle managers' experiences.

3.3.1 SECONDARY DATA

Secondary data can be used to find information but also to understand the phenomenon under investigation (Ghauri & Grønhaug, 2005). Secondary data provides information that is important in research, as the written rules and regulations are increasingly determining the world (Eriksson & Kovalainen, 2008). To understand better the context where middle managers operate and how they base their understanding of safety culture, together with interviews, practitioners' official definitions of safety culture are discussed in written format. The empirical study is limited to focus on Finnish nuclear industry, an in-depth study of the situation in Finland. To be able to focus on matters that concern Finnish nuclear industry, the investigation of written material is limited to documents that directly affect Finnish nuclear power companies' activities. The investigation takes into account organizational documents, national regulations and international requirements that concern Finnish nuclear industry.

The empirical study of the written documents is focused on documentation that explicitly states the term "safety culture". Because of the high regulations, written

materials of nuclear operations and management systems are plenty, and therefore it is meaningful to limit the study explicitly from the beginning. Written documents are found from organizational company level, concern level, national level and international standard level by multiple international organizations. The study consists of (1) gathering the materials that explicitly say something about safety culture and (2) analyzing the context of the references. From these angles, the study tries to emphasize the complexity of the term and the different meanings that parties give to the term in the nuclear industry.

The objective to study documents together with the interviews is to study the role of middle managers and the challenging aspects of implementing organizational policy and regulations into a good safety culture. Therefore, personal performance of middle managers is not evaluated in this study or their capabilities to follow regulations concerning safety culture. The study will draw an overall picture of the essential role of middle managers in developing good safety culture in Finnish nuclear power plants.

3.3.2 MIDDLE MANAGER INTERVIEWS

Interviews are one of the most used data gathering methods. They are used to understand individual aspects of a research phenomenon (Hirsjärvi & Hurme, 2004). Interviews are used to collect primary data that help to answer the specific research problem. Data has to be collected from the data sources before the study can be conducted (Ghauri & Grønhaug, 2005). Interviews were chosen for primary data because middle managers are not working in a shop-floor context and observation of their work would have been hard to conduct as a person not working in the power plant. Observations would have been another interesting investigation but in this study they were excluded because of the safety-critical specialties of the target organizations. As nuclear power plants are closed work environments, special permissions are needed to enter the plant itself, and therefore, observations of interventions and interaction were not a possibility for this study.

The focus and the interviewees of the study are middle managers because they are the people who actually execute safety culture regulations and organizational strategy & policies. The interviews are semi-structured theme-interviews. The semi-structured interview means that the questions are the same for each interviewee but their answers have an effect on the order of the questions (Eskola & Suoranta, 1998). The interviews were designed in themes, which were based on the preliminary research questions of the study. The theme interviews are based on the themes that are the same to all interviewees but otherwise flexible to follow the interviewees' perceptions (Ghauri & Grønhaug, 2005). Eriksson & Kovalainen (2008) conclude that the major advantage in this type of interviews is the systematic approach in the materials and flexibility to adjust according to the tone of the interview and set an informal interview environment.

The study consists of 12 interviews of middle managers in operating plants. The number of the interviews was chosen based on the need to get interviews from all main functions of operating plants, including individuals from operations, maintenance and engineering functions. The interviews are constructed of 6 middle managers per operating nuclear power plant licensee.

This allocation has been made to get an overall picture of the roles of middle managers in operating nuclear power plants. Operations, maintenance and engineering are all core functions of operating a plant and together they demonstrate the heterogeneity of the middle managers' role, as the functions themselves are very dissimilar. Operations functions are in charge of running the power plant. The function consists generally of employees who work in shifts 24 hours a day to run the power plant. The maintenance function, instead, is responsible for the power plant's condition and maintenance of the systems and technology. The third function, engineering, is responsible for designing new solutions and modifications to the power plant.

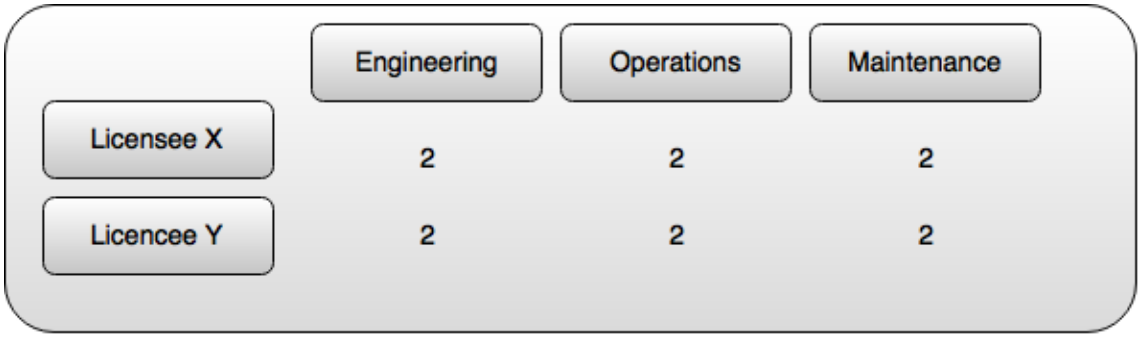

Figure 5. Number of the interviews

The interviewees were chosen together with the licensees, as the organizations are unique and cooperation ensured the interviewees to be chosen meaningfully. The themes of the interviews were (1) middle managers' work and tasks, (2) defining safety, culture and safety culture, (3) safety culture in the target organization, (4) Safety management and leadership and (5) connection to wider context, strategy and regulations. These themes were selected to enable the interviewee to interpret the phenomenon from several perspectives.

The interviews of this study were 60-90 minutes long meetings in the workplace of the interviewees. The environment was common for the interviewees to ease any unneeded tension and formality from the interview. All material used in the thesis is anonymous and a reader nor the organizations will not be able to recognize from which plant the quote is given. This is done because the Finnish nuclear industry concerns only two operating licensees and four operating plants altogether.

3.4. DATA ANALYSIS METHOD

The objective of a qualitative research is to understand the studied phenomena better (Ghauri & Grønhaug, 2005), and the analyses were conducted in themes to collect content of various aspects of the phenomenon. The study was analyzed by thematic analyses. It is a research method, which categorizes data into themes based on the empirical findings. A thematic analysis is a method that can be used in different

theoretical backgrounds, which offers freedom to the researcher (Braun & Clarke, 2006). It also concentrates on the core of the study and forms a thick base for the researcher to use other methods in later studies (Braun & Clarke, 2006). Therefore, using thematic analysis in a thesis was chosen to concentrate on the most important factors, themes of the findings. The approach was chosen to analyze the connections between the interviewees' experiences and to simplify the complex interview data to catch the relevant findings. Thematic approach helps the researcher to find patterns and conduct statements of the findings.

The study is based on the in-depth analysis of middle managers' experiences, and therefore, the interviews are recorded and transcribed. The objective was to analyze the content of the interviews in themes and connect them together. As the analysis method takes into account interview material in a complex entity, word-for-word transcription was needed to analyze the spoken words as they are linked together and create together a bigger meaning than what the sentences alone produce. The transcriptions give the researcher a possibility to find connections between interviews and adjust a coherent entity (Hirsjärvi & Hurme, 2004). As the interviews were transcribed, common understandings and interpretations were linked to each other.

The thematic approach was selected prior to the empirical study as it suited well the structure of the study. The interviews were first analyzed based on the themes recognized before the empirical study and then restructured around the most important issues raised from the study. The restructure method helps to find the important connections and form a logic to the findings (Braun & Clarke, 2006). The themes were settled before the data collection but because the interviews were theme interviews, it was recognized that as the data gets analyzed, the themes might drift and other interesting themes might occur and rise from the data.

The themes recognized before the data was gathered were (1) middle managers' understanding of the concept of safety culture, (2) safety culture of the target organizations introduced by how the middle managers understand it, (3) middle managers' practices of enhancing safety culture and (4) how official safety culture

regulations, international standards and company strategy are seen from the light of the middle managers' experiences. After the transcription process, findings were collected based on these categories but the nature of the study also made it possible to acknowledge new themes that occurred in the interviews. One of the new themes recognized during the process was that majority of the interviewees mentioned recruitment and importance of the new employees. Another theme that arose from the data was trainings held in the organizations. These themes were included in the analysis as important factors of the middle managers' experience of developing safety culture.

The descriptive quotes of the interviews were collected together under the recognized themes and translated into English for the thesis by the researcher. Collecting the quotes together with the analysis started to form a coherent picture of the phenomena and encouraged the research further. After the interview material was analyzed, the findings were organized under the research questions to be able to answer the questions that were placed as the target of the study. The findings chapter was divided into subheadings by the research questions to answer the questions directly. This formulation was helpful for the analysis as the themes and findings needed to be brought together to construct a coherent ensemble.

The themes shifted along the process, and the analysis process also revealed a need to reform the research questions. Qualitative research method enables readjusting the research question when the sample of reality gathered for the study refers to a research question that was not realized to be important before gathering the data (Alasuutari, 1999). Because of the exploratory nature of the study, the research questions were adjusted around the important findings of the study.

The focus shifted towards analyzing deeper the middle managers' own position and experience of the enhancement of safety culture. The practice perspective was limited out of the study to focus on middle managers' perceptions of the phenomenon. The themes that arose as the most important ones were finally reformed around the reformed research questions as a structure of the empirical findings chapter. The findings were

then reflected on literature and previous studies of the phenomenon to find connections and to show how the findings complement previous studies.

3.5. TRUSTWORTHINESS OF THE STUDY

Reliability, validity and generalizability are acknowledged to be the key principles of business research trustworthiness evaluation (Eriksson & Kovalainen, 2008). Especially reliability and validity have been criticized about their quantitative nature (Hirsjärvi & Hurme, 2004). Many evaluation criterions are developed for quantitative research, and therefore, should not be used in qualitative research without closer examination (Golafshani, 2003). Evaluation of a qualitative research always needs to be in line with the research type to get valuable insight of the study (Eriksson & Kovalainen, 2008). It is important to evaluate the study based on the methods used in the exact research. Qualitative research approach enables various methods to conduct a research, and there is no universal way to evaluate qualitative research.

Unlike in quantitative research, qualitative studies have been criticized of vague evaluation of trustworthiness. Qualitative research is deeply dependent on the researcher and the evaluation focuses on the arguments the researcher is capable to address about the trustworthiness of the study (Eskola & Suoranta, 1998). The research itself is strongly influenced by the researcher, and therefore, evaluating qualitative research is an important part of the study. In qualitative research, the study is evaluated repeatedly through the research process because of the nature of the study, which relies on the decisions of the researcher (Eriksson & Kovalainen, 2008). Because of these elements, qualitative research often introduces researcher's decisions in detail through the process.

The evaluation method is chosen based on the nature and audience of the study (Eriksson & Kovalainen, 2008). In this study, classic evaluation criterion, reliability and validity are used to evaluate the trustworthiness. Efforts have been made to emphasize reliability by introducing researcher's decisions through the whole thesis by showing in detail the process and decisions that affect the trustworthiness of the study. The

objective is that a reader is capable of following the researcher's thoughts in detail through the process. The findings of the study are accompanied with several quotes from the data collection to show how the analyses are conducted.

Before collecting data, the reliability of the research questions is an important step to evaluate (Hirsjärvi & Hurme, 2004). In this study, the questions were reflected and cross-checked several times to ensure the quality of the themes and questions. Through the research process, reliability has been highlighted by minimizing the effect of the researcher's own background. It is important to notice that in this kind of research the background and mindset of the researcher, however, affect the way of the study. Even when the analysis would have gotten the same conclusion, it is up to the researchers' mindset, which perceptions one chooses as the most important and interesting findings of the study. The analyses highlight findings that are common in the interviews, but also introduce unique perceptions, which are especially interesting and reflect directly on the research questions.

The quality and validity of the interview material is essential for the reliability of the study (Hirsjärvi & Hurme, 2004). The reliability of the study has been emphasized also by giving the interviewees an opportunity to check the validity of the quotes used in the study. This has been done to make sure, that the researcher has not twisted the message in the translation process by understanding the content of the interview differently than meant to.

The validity of the study has been emphasized by highlighting that the context of the study is the Finnish nuclear industry. The study has focused primarily on the Finnish context, and therefore the results should not be generalized outside the context without closer examination. The objective of the study has been to understand middle managers' experiences in the Finnish context and therefore generalization has not been emphasized. This explorative study has focused on introducing findings of a study which complements previous research by focusing on middle management, and therefore, it is important to acknowledge that the findings are explorative in nature, and do not tend to generalize the nature of the phenomena under investigation.

Moreover, the validity of the study has been highlighted by taking into examination both organizations which operate nuclear power plants in Finland. Triangulation of data is a commonly used method to find multiple perspectives and find trustworthiness to the study (Eriksson & Kovlainen, 2008). This is done in this study to be able to generalize the findings into the Finnish context. By entering two organizations into the study, special characteristics of the organizations and temporary situations occurring in the power plants are not affecting the findings of the study as dramatically as they would in a research conducted in only one organization. Golafshani (2003) states that in qualitative research the stability of the measurement is extremely important. By examining two licensee organizations, the sample can be trusted to illustrate a more stable situation without highlighting specialties of a single organization.

This chapter has altogether introduced the methods and methodology of the study. After stating the research approaches, licensee organizations were introduced and data gathering method was expressed and validated. Furthermore, the data analysis method and trustworthiness of the study were emphasized before entering the next chapter of empirical findings. In the following chapter, the study based on the approaches acknowledged in this chapter is introduced. The empirical findings chapter includes quotes from the data as well as analysis of the research material.

4. EMPIRICAL FINDINGS

In this chapter, the findings of the study are presented. First, safety culture regulations and requirements are introduced and analyzed. After that, the licensee organizations' safety culture statements are investigated to form a picture of the use of the term on the public level. Finally, the chapter introduces the empirical findings of the middle manager interviews. The chapter ends with a conclusion of the empirical findings.

4.1. SAFETY CULTURE REGULATIONS AND REQUIREMENTS

As mentioned before, nuclear industry is highly regulated. In this section, the operating environment of nuclear power licensee organizations is explained from the legal and authoritative viewpoint. This section does not tend to explain the complex regulatory environment as a whole but to introduce the main elements that affect safety culture enhancement processes in the licensee organizations.

A good safety culture is required from the nuclear power licensees, and the licensee organizations have to follow the Finnish regulations in their operations as they in the same time follow the international standards and recommendations of the international nuclear safety organizations. In Finland, Radiation and Nuclear Safety Authority STUK oversees the work of the licensee organizations. STUK oversees that the licensee organizations follow the regulations and determines requirements if the regulations are not met. This work is based on official documentations where the licensee organizations describe their actions and STUK oversees if the regulations are met. The evaluation is based on documentation and inspections.

In this section, the requirements regarding safety culture are investigated to introduce the environment where the nuclear companies operate. The term safety culture is required by the word in the Finnish context, and therefore the focus is on documents that explicitly state a requirement about safety culture.

On the international level, International Atomic Energy Agency IAEA has brought the term into use. They define safety culture as "the assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance." (INSAG, 1991). IAEA has a lot of material available regarding safety culture from the theoretical level to the practical instructions for safety culture embedding work. They have also created a framework for a strong safety culture, which is included in their safety standards. They use the word "strong" to describe the desired safety culture.

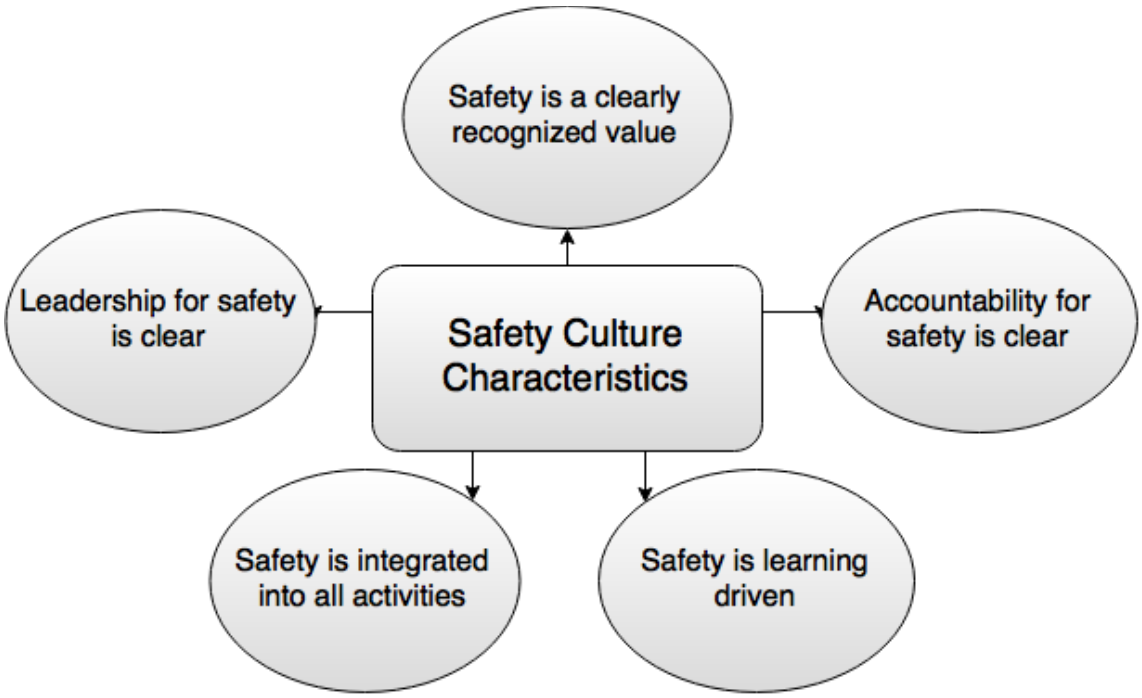

Figure 6. Safety culture characteristics (IAEA, 2009)

The safety culture framework helps licensees to understand how safety culture is formed and which characteristics affect the occurring safety culture in the nuclear power plants. The characteristics are explained in detail in the IAEA safety guide GS-G-3.5, which introduces the desired management system for nuclear installations. The guide is part of the safety series of IAEA. These guides are important, because STUK requires licensees to take into account IAEA's guidelines in their operations.

In the Finnish context, the term safety culture is mentioned in the regulation of STUK. The Radiation and Nuclear Safety Authority Regulation on the Safety of a Nuclear Power Plant STUK Y/1/2016 Section 25, Ensuring safety by management, orgsanisation and personnel, state the main principle of safety culture.

> *"When designing, constructing, operating and decommissioning a nuclear power plant, a good safety culture shall be maintained."*

The regulation itself includes all organization and personnel related issues embedded in the same section, and therefore, safety culture and meaning behind the term is explained in more detail in the explanatory memorandum. In the explanatory memorandum of the regulation, the phenomenon has been referred to multiple times.

> *"…the organization shall have a high level of safety culture" (p.7).*

The phenomenon also has its own section explaining what was meant with the safety culture statement in the regulation.

> *"The licensee and the senior management of the nuclear power plant shall visibly and systematically commit to solutions promoting safety and act in a manner that ensures the safety of the plant at every level and during each procedure. (p.20)"*

> *"The example set by the management plays a key role in maintaining a high level of safety culture. Those working at a nuclear power plant shall have good capabilities for the continuous development of safety. (p.20)"*

> *"The safety culture of nuclear power plants cannot be based solely on following the rules. Training and practical work shall emphasise the necessity for everyone to have the required competence for their work and acknowledge the importance of their task in terms of the safety of the nuclear power plant. (p.20)"*

These examples show the areas on which the explanatory memorandum focuses regarding safety culture. However, it is essential to note that only the sections and documents that explicitly include the term "safety culture" are recognized here.

Under the regulation, more specific series of requirements determine how STUK follows the regulation. The Regulatory Guides on Nuclear Safety, commonly called as YVL guides, are used by both the licensees and the authority to validate the requirements in practice. The YVL guides form a holistic package of information regarding nuclear safety. Two of the guides refer to management and organizations in operating plants and in the following paragraphs, the YVL-guide requirements for safety culture are introduced.

Guide YVL A.3 "Management system for a nuclear facility" has dedicated a whole section into explaining the safety culture required from the licensees. This section is an important guide for licensees as it determines how safety culture has to be taken into consideration in the management system. The section has dozens of individual requirements, and the first two, which are the most essential to this study, are the following.

> *"310. The management system shall support a good safety culture. In a good safety culture, safety is of primary importance, actions are prioritised based on their safety significance, the senior management and the entire personnel are committed to a high level of safety, the atmosphere is open and fosters a questioning attitude, safety is considered systemically, and safety is continuously improved."*

In the requirement quoted above, safety culture is determined as an outcome of the management system. The requirement is written so that it emphasizes the importance of the high level of safety and the entire personnel's responsibility to embed safety into operations. The managerial need to enhance safety is determined in the next quotation.

"311. The concept of safety culture shall be made concrete and communicated so that the personnel of the organisation share a common understanding of the importance of safety culture and its essential attributes and that everyone is able to identify, generally and in their own work, factors that strengthen and weaken nuclear and radiation safety as well as the safety culture."

This requirement emphasizes the need to enhance safety culture. The interesting part here is that the requirement states that the personnel share a common understanding of the importance of safety culture. The requirement could recall only the importance of safety, but it is explicitly required that safety culture needs to be understood among the personnel. These two quotations from the guide YVL A.3 show the level of the requirements. To complement these requirements, guide YVL A.4 "Organisation and personnel of a nuclear facility" has a couple of interesting requirements quoted below. These requirements refer to managerial tasks.

351. Managers and supervisors shall, through their own actions, promote the safe way of working and reinforce good practices. Managers shall develop the values and behavioural expectations of the organisation while setting an example themselves in order to promote these values and encourage the expected behaviour. The general requirements regarding the safety culture are set out in Guide YVL A.3.

The requirement stated above relates generally to supervisors' safety enhancement but also states in the end the connection to safety culture. This quote was brought up among the other ones because the requirement states specific expectations among the requirements, which are more general in nature. Another requirement that concerns the scope of the study and touches the tasks of middle management is also brought up below.

353. Managers and supervisors shall ensure that the working conditions and arrangements promote the safety culture, the employees' motivation, and

competence. Managers and supervisors shall see to it that the performance management and related incentives encourage safe ways of working.

The last quote states explicitly the need for managers and supervisors to ensure and promote safety culture. The requirement is specific, but leaves it to the licensee to decide how to implement it in practice. This is common in the requirements, as the licensees themselves are the best experts on the practices that can be utilized in their organizations. The broad requirement is challenging for both the licensee and the inspectors, as it leaves a lot of space for individual evaluation. However, the main objective is that the licensees are able to fulfill the requirements.

To summarize the safety culture regulations and requirements introduced in this section, the regulation determines the need for a good safety culture and YVL guides list more specific requirements on the management system, organization and personnel and how safety culture in those areas needs to be taken into consideration. The outcome is that many small requirements use the term safety culture and in most cases, the term is used to make sure that a good safety culture is ensured. The style the requirements are written highlights the importance of management and managerial responsibility to enhance employees' commitment to safety. The design of the requirements show that the requirements are based on a normative understanding that safety culture is something that can be managed and supervisors play a key role in the ensemble. The requirements are structured so that safety and safety culture as terms are used hand in hand, and the use of the terminology leaves space for the reader's own reasoning.

4.2. SAFETY CULTURE STATEMENTS OF THE LICENSEES

The licensee organizations have determined their own strategies to develop a good safety culture. In this section, these official definitions and public safety culture policies of the licensee organizations are introduced. The study of licensee organizations' acknowledgement of safety culture is investigated through their official webpages. The nature of the study is not to compare the licensee organizations against each other, and

the objective of this section is to form an understanding of how the term is used in the organizations and in communication. The licensee organizations have different documents available for the public, and therefore it is essential to acknowledge that the amount of information that can be found from the webpage does not mean that it would be all the material there is in the licensee organizations. In this section, the information is introduced and analyzed to form a picture of how the term is in use in the industry, not to compare the licensees to each other.

One of the licensees states in their strategic goals for the year 2015 that they "Include responsible business practices and guide responsible day-to-day work in line with the unconditional safety culture". Improvement of safety culture has been mentioned as one of the development targets of the year 2015. The objective of uncompromising safety culture is repeated in the report continuously. In their annual environmental report (2015) safety culture is also stated as a company-level policy as follows.

> *"[The company] and its entire personnel are committed to a high standard of safety culture. Safety culture is comprised of organizational practices and individuals' attitudes. Thanks to the safety culture, all factors that affect the nuclear power plant's safety will receive attention in proportion with their significance and are given priority in decision making."*

This company-level policy statement underlines the importance of safety culture in treating all factors that affect safety according to their safety significance. In nuclear industry, safety significance and graded approach are used to measure the level of priority and attention given to the factor. The licensee has also created safety culture principles for employees in the corporate social responsibility report (2015).

> *"Safety culture principles:*
> - *Follow the approved procedures and instructions without compromise*
> - *Make sure that you and others use safe working practices and work under safe conditions*
> - *Stop and think before you act, and review the consequences of your actions*

- *Report all problems and deficiencies without delay*
- *Maintain an atmosphere where reporting can be done freely and without blame*
- *Question practices and develop operations in the spirit of continuous development"*

The safety culture principles concretize the behavior the licensee is looking after with its safety culture policy. The principles make it easier for the employees to understand what is needed from them when "a good safety culture" is asked for. The principles show the importance of following instructions and approved work practices. The principles, however, also underline the importance of one's own thinking and perception to maintain and develop the safety culture.

The licensee also has an operating culture section in their webpages that introduces the safety culture policies along with other key principles of the operating culture. Safety culture is introduced as follows.

> *"Safety culture consists of the organization´s operating methods and the attitudes of individual people. It ensures that factors contributing to the safety of the nuclear power plant are given the attention they require, and are given priority in decision-making. "*

The quote is formed as a definition of safety culture. It underlines the operating methods and individuals' attitudes as the main components of safety culture. The definition also mentions the prioritizing of factors that affect safety. These safety culture references in different parts of the public documentation form a picture of the approaches the licensee has towards safety culture. A high safety culture is seen as a mission of the entire personnel and the licensee tends to enhance safety culture by their everyday practices.

The other licensee organization states a lot less in their public web pages. The annual report (2015) of the corporation does not include information about safety culture as the report summarizes information of all business areas of the company where nuclear

power is just one part of the business. This indicates the differences of the organizations where the nuclear power plants operate. The environment report of the power plant (2015) states safety culture as a part of the mission expression of their plant.

> *"Maintaining and developing our own competence in nuclear power is a prerequisite for safety and competitiveness in our nuclear power operations and our nuclear power operations must be based upon a good safety culture."*

The mission statement itself determines the need for a good safety culture. Other reports and action plans are not available in the web pages, but in several parts of the web pages of the power plant, a high-level safety culture is emphasized.

> *"Our operations are based on a high-level safety culture and quality and on continuous improvement." – A page introducing nuclear power*

> *"...power plant has continuously improved its safety through annual investments, plant modifications and development of its safety culture throughout the entire operation of the plant." – A page of safety in the power plants*

> *"All design, constructions and decisions are made with conservative assumptions and high safety margins. Continuous improvement in all aspects of safe operation, including the know-how of the personnel and safety culture, are a high priority.." – A page about safe and reliable production*

The quotes show that the phenomenon is included as a part of everyday operations of the plant. The term is repeated in many occasions as a part of the base of the operations.

To summarize the safety culture statements of the licensees, this investigation has showed that the licensees use the term a lot in their communications in several occasions. The term is used in plans and strategies but also in more general statements and policies to show the organizational work principles. The way the term is used in the

public documentation shows that the need for a safety culture is acknowledged and both licensees find it a core value. The sound of the use of the term refers to individuals' responsibility to commit to safety. The licensees' understanding of the phenomenon relies on the approach that safety culture has to be embedded in everything.

The public documentation of the licensees does not refer to managerial responsibility to enhance safety culture with the same sound as the requirements of STUK. The requirements are written on a managerial base, and licensees' documentation highlights individual responsibility. It is good to acknowledge, however, that the purpose of these documentations is fundamentally different, and the difference of the style of the text can be explained by the audience the text is meant for. Nevertheless, these dissimilarities might indicate differences in the perceptions of safety culture enhancement. In the next section, the primary data of the study is introduced to reflect these findings on the middle managers' experiences.

4.3. MIDDLE MANAGEMENT INTERVIEWS

In this section, the middle managers' interviews are analyzed and the findings are introduced. The interviews are analyzed under three subheadings to relate the findings directly to the research questions. The analysis includes important findings regarding the research questions together with interesting perspectives and perceptions that arose in the interviews. The focus of the analysis is, however, on the themes that answer the research questions.

4.3.1 THE CONCEPT OF SAFETY CULTURE

In the beginning of the interviews, the middle managers were asked to tell if their organizations had defined the term safety culture collectively in the organization. Most of the interviewees said that they do not know any official definition to the concept and that it is something that people understand in different ways through their own work.

The fact that their organizations have defined and opened up the term was unrecognized by most of the participants. This question gathered very different answers, and because the question is important in our attempt to understand middle managers' experiences of the phenomena, the answers to this underlying question are analyzed in more detail. Six of the interviewees did not know that the term had been defined at all.

> *"I guess that there is not a common definition to the term. At least I have not heard it. No, no one is spreading around definitions of what the concept actually means."*

> *"We have had safety culture surveys but to be honest, I don't really know if the term has been defined in a sentence or two by anyone."*

> *"We all grow to it, to think about safety. I don't know if there is a definition to that [safety culture], but we value safety and keep it high."*

Other two of the interviewees recognized that the term is in use in their organizations and particularly at the top management level but they hesitated on stating the definition of the term and opening up what the concept of safety culture means in their organization.

> *"I might have heard our organization's official definition but I don't remember it… It means different things to different people, depending on how they connect it [to their work]. It is not a common term, which we would all understand in the same way."*

> *"Probably you can find it from the company's manuals but for us it is built in our operations. In our function, it is not in our own procedures… At least I don't know that it would be."*

Three interviewees approached the concept of safety culture directly from the perspective of safety significance.

"Our company's definition is that things get a proper treatment according to their safety significance. That is safety culture. We recognize the things that have a high safety significance from those which do not have and focus correctly."

"Yes we do have an official definition. What is it? I have to say that I looked it up before coming to this interview. But the idea is that it is formed like any other culture from the attitudes of the community, which affect all employees. Another important factor in the definition is the safety significance approach, meaning that things get the importance which they have according to the safety significance. That is how I interpret it."

"The definition is that things are ranked through the safety significance that they have."

One of the twelve interviewees recognized the theoretical background of the definition determined by their organization without hesitation:

"The common definition comes from the safety guides of IAEA. It is used as a base to our own."

This interviewee had worked with the phenomenon closer than the others in his work tasks. The diversity in the answers was fruitful for the discussion and for the study, as it indicates clear diversity among the interviewees and gives reliability to the investigation.

The answers show that the official definitions that the licensee organizations have are not commonly known in the middle management. The question of the definition of the concept was very useful in the beginning of the interview. The interviewees understood the concept of safety culture through their own background and experiences, regardless

of the fact that the term is used commonly in the industry and academic research studies safety culture in the industry closely.

When discussing about the concept through examples of their everyday work, it was fundamentally shown how middle managers valued safety in their own work as well as in the actions of their employees. They just did not know, if how they understood the term was commonly recognized within the organization or of it was just their own perception of the phenomenon. This hesitation seemed to spring from their perception that safety culture as a term is something used at the top management level, not in practice.

> *"The term safety culture is used at the upper level and top management brings it up. At our level, it is included in the procedures and approaches. Of course, we understand that it affects safety culture but as the term is so abstract, it is easier to divide it into the instructions and procedures. Everyone knows that we aim at doing everything safely."*

As the quote shows, the concept was recognized but the interviewees in general were more interested in the practices than the theoretical definition. The fact that most of the interviewees did not have in mind a shared definition of the concept offered a great opportunity to investigate how they understood the concept by themselves.

After asking for the organization's common definition of the concept, the interviewees were asked to define what the term meant for them and in their work. The picture of safety culture was manifold and showed that safety culture has been discussed in the organizations over time.

> *"Organizational culture influences the safety culture greatly. How people relate to safety and have attitudes towards it. It is safety culture that people follow instructions and how they act when the cameras are not on… Safety culture is the common way to act so that people respect the safety significance of their work tasks."*

"I would highlight the importance of attitudes, they determine safety culture. Peoples' attitudes reform the culture and in here, they have to be safety oriented. A community of people builds culture but individuals are the ones who bring their attitudes to it."

"Culture is the way we act. When we combine safety into it, it means that in our practices and decisions safety is recognized. So that we always remember safety in our actions."

"Safety culture is not an easy thing to define. It has something to do with safety and occupational safety and [safety] climate, openness. It is integrated into our activities. It is automatized into all we do… The way I understand it is that people are open to tell things, tell about their perceptions, intervene and tell about their own mistakes, too. People do not cover things up and the organization supports the openness."

The answers show that the interviewees have an understanding of the phenomenon as many aspects of safety culture, including attitudes, practices and activities as components that affect the culture, were brought up. The attitudes of the employees were recognized as an essential element of safety culture by several middle managers. This perception is essential as the practical view of culture easily focuses mostly on the actions taken. The view of safety culture is practical and in most cases, the interviewer had to ask several related questions to get an answer to description of safety culture. These definitions made by the middle managers are thorough and deeper than was expected as they felt that there was not a common definition.

The practical implications the interviewees brought up while discussing about how they understand the concept were examples of their basic work tasks, but also indicated some shortcomings on the understanding of the abstract term. These expressions are investigated in the following quotes. The middle managers started to talk directly about the work practices that enhance safety in the nuclear power plants. They all underlined

the importance of safety as well as the importance of following the instructions. These two walked hand in hand in the interviews one after another.

> *"Safety culture means that we work in the nuclear power plant… we have rules and we follow them."*

> *"It is a broad term and all, but let's say that it is about following the approved guidelines and procedures."*

The interviews showed strongly that the importance of safety culture relates to following the instructions. Talking about safety culture as following the rules was the first approach many of the interviewees took to process the phenomenon. The culture is a major component of an employee's willingness to follow instructions and therefore it is important that the interviewees recognized the connection.

In addition to discussions of following the instructions, the interviewees highlighted the importance of embedding safety-oriented thinking into their work. The attitudes that safety is in everything they do were highlighted strongly.

> *"Safety culture comes through events in here. We discuss about events if they affect nuclear safety. It is always in our minds. We do not discuss about safety culture as a separate thing."*

> *"I think that safety culture is built in our practices. My own actions serve safety culture. I mean that my actions serve safety. I don't really know about the culture-word. However, it means the spirit [of working safely]."*

From these quotes, it can be concluded that middle managers understand the importance of safety as their core value, and following the instructions is seen as the most important activity to act safely. The interviewees also mentioned events regularly as a point when they discuss about safety issues. Events mean situations when even a small, unplanned

event has occurred in the power plant. The interviewees showed strongly that safety-oriented thinking was embedded into their practices during these situations.

The interviews included some straight questions about the work environment, but mostly the practices that relate to safety culture arose in the examples the interviewees gave about the work in their teams.

> *"It is in our everyday practices. You cannot see it. We have built these operations so that we follow safety culture practices in our normal routines. To give an example, if a modification has to be made, the first thing that is thought of is the safety significance the system has… And what it said in the instructions."*

> *"You can see safety culture in how people make choices in here. In every decision, people have to make a choice so that it is conservative enough for safety... For me safety culture means that people have enough time to make good decisions and that the decisions are conservative enough. But the word is also like a curse. It has been mixed to wrong places and because of that, some [other] tasks are left undone or postponed without a reason."*

> *"We have our rules and guidelines. It starts by following them."*

These expressions speak for the assumption that "a good safety culture" is understood as following instructions and making conservative choices to maintain safety in operations. The interviews indicated that safety culture would be something they try to follow in their work, not so much that it would be something that their own team would build for themselves. The discussions showed that the interviewees had not been thinking about the concept too much and it was hard for them to come up with their definitions. They were, however, well aware of the situations affecting nuclear plant safety. Defining safety culture was a hard question but the themes affecting it arose in every interview through other questions.

The interviews indicated that the use of the term is challenging and calls for theoretical understanding. Some interviewees did not respect the use of the term and felt that it brings more harm than help to their attempts to understand the phenomenon. According to the interviewees, the term is used mostly at the top management level and in the operations they talk mostly about the themes behind the term.

> *"Safety culture can be understood on different levels. When you talk with people about safety culture, you always have to tune your speech to the level of the counterparty. How they see it and understand it. Sometimes you face these problems."*

> *"I have not used the term safety culture with my team. I don't think that it is the correct way to enhance it, anyhow. To collect everyone together and say that let's talk about safety culture. It sounds really fake. Mostly we talk about the issues behind the term, about the small errors, for example; if someone recognizes an error, they should be encouraged to bring them up. These are the things that need to be discussed, not safety culture as itself."*

The challenge with the abstract term has affected the use of the word so that the managers used the term safety culture almost as a synonym to an order to highlight safety. The managers talked mostly about their attempts to make the employees remember to follow safety culture as if it would be one of the work instructions instead of a part of the organizational culture.

> *"Safety culture comes up in conversations sometimes. It is questioned if the operations are in accordance with safety culture."*

> *"It is good to highlight the importance of safety culture in communication. So that the employees do not work against it."*

The comments are based on an understanding where safety culture is a set objective and the employees should work according to the culture, which is determined by the top

management. This problematic twist can be recognized from several interviews. The underlying logic that safety-critical practices are desired but the term safety culture is used to measure if the practices pursue the prescribed safety culture, as if it would be an objective or an order that needed to be followed.

The middle managers' experiences of the concept of safety culture show that they understand the phenomenon and the need to enhance safety as a core value, while the term safety culture is seen as challenging and too abstract. The concept of safety culture is challenging to define but as it is widely used in the industry, middle managers face it in their work as top management's core value and in their organizational policy statements. Regardless of the hesitation on defining the term, middle managers showed understanding towards the need for a good safety culture in a clear manner. Their expressions and examples showed that safety is valued among the employees on a deep level.

4.3.2 MIDDLE MANAGERS' POSITION ON ENHANCING SAFETY CULTURE

This study was planned on an underlying assumption that the middle managers would enhance safety culture in their teams actively as one of their work tasks. During the interviews, it was clearly indicated that they did not share the underlying idea that it would be their task to do so. The middle managers understood their position as team leaders and as safety guards but the aspect of enhancing safety culture beneath the visible level of artifacts was not recognized without hesitation. The interviewees clearly did enhance safety culture as they worked as team leaders but they did not recognize those elements as part of "safety culture enhancement" systematically. This was a surprise and changed the section of investigating middle managers' "best practices" into investigating their position and experiences in safety culture enhancement. The assumption of middle managers' awareness towards safety culture enhancement was based on the literature reviewed for the study. As discussed in the literature review of this study, safety cultures' effect on the nuclear safety is underlined in research, and cultural studies emphasize the important position of different levels of management in cultural development.

None of the interviewees indicated without asking directly that enhancing safety culture would be their task. As mentioned before, they valued safety but they did not connect enhancing safety in their function to enhancing safety culture even when they clearly did that in their work practices. Their examples showed clear managerial attempts to enhance safety also on cultural level.

> *"Safety culture is not a task on my worklist, there is no challenge in it. I don't know who should enhance it. As a manager I try to make sure that our operations follow the requirements and that we do not do anything stupid. But it does not mean that it would be a core task or anything. As I said before, we don't have that kind of training or point in the regular meeting agenda. So if no one asks to talk about safety culture, we do not talk a word about it during the year. It is shown in the decisions then, if they are made as good or bad decisions. It is present in the thoughts and so it shifts to others as well, the good decisions."*

The comment quoted above contains perfectly the atmosphere that was present in many of the interviews. It is an answer to a question whether the interviewee enhances safety culture as a managerial task. The answer shows that the manager values safety and sees that the task of the manager is to promote safe operations. Safety culture, however, is seen as too abstract to be a task of a manager to enhance and therefore the interviewees did not connect their attempts to enhance safety to safety culture.

The interviewees were asked whether they had been guided to cultural enhancement as they work as managers or whether leadership thinking had been developed for them from somewhere else. The theme was not discussed in all interviews, but the interviewees brought it up on several occasions. The answers showed that the managers felt that they had developed their safety culture understanding by themselves.

> *"No one has said that enhancing safety culture would be my job... We get reminders about the importance of the regulations and all that but it is not said*

that it would be team leader's task to enhance safety culture. Of course the importance of safety is marketed but there is no training where especially managers would be adjusted to enhance safety culture."

"I think that it is part of the job. But it has not been told to me that it would be… The instructions and practices of the function are my responsibility and safety culture consists of all of these. But I have not thought that it would have been told to me that I should look after the safety culture."

These statements indicate how confusing the concept of safety culture is on the lower organizational level in the nuclear power plants. The official statements talk about safety culture but it is not used in practice. Regulations and top management use the term safety culture but in practice these middle managers (1) see safety culture as something that is embedded in everything they do and (2) see safety culture as something that they do not do at all.

The findings of the middle managers' experience of their own position in enhancing safety culture show clearly that the interviewed middle managers in general did not connect safety management and safety culture management together. The notice that safety culture was not recognized as a phenomenon that managers should enhance should not be mixed with the safety culture enhancement practices, which they still perform. Many of the interviewees showed that their underlying values did cultivate safety culture enhancement without saying it aloud.

4.3.3 METHODS TO ENHANCE SAFETY

When discussing about methods of enhancing safety culture, middle managers gave a lot of examples from their everyday practices. In the beginning of this section, these examples are introduced. Moreover, middle managers' experiences in developing safety culture in their organizations are discussed in this section.

Middle managers gave a lot of attention to leading by example. They addressed effectively their need to follow the guidelines themselves and to show to others the model of how they should work and cultivate desired work practices.

> *"It is about leading by example. We have to show that things get done as agreed and when we have settled rules we also follow them. It is not always financially the most effective way but that is what we have to do. Showing example is important. We have to act as agreed at all times."*

> *"It is important that the manager does not slip from following the rules. It easily affects the others if the manager jokes about safety or makes decisions which are in the gray area. It is easy for the employees to interpret that these issues are not important if the manager does so. The manager needs to show example."*

> *"It is important how much we talk openly about our decisions. It is important that if an employee is unsure of the work task, he or she does not guess what to do but asks. It is important to show example and make sure, that employees can bring up questions if they are unsure."*

Leading by example is shown strongly in the interview sample, and the managers clearly understand their role in developing the work culture even if they do not recognize that it is what they do by leading by example. Managers showed a deep understanding on the power of leading by example in their interpretations and examples. They even stated different methods to lead by example and editing employees' work routines without giving them a hint that it was happening.

Another task the interviewees saw important was supervising the work of their team members. Many interviewees brought up the importance of controlling the quality of their employees' work and saw the quality controlling as a way to keep up safety culture.

"Manager has to make sure that everyone knows what they are doing and knows their responsibilities. The manager also supervises that the instructions are followed and the work tasks are prioritized correctly."

"It is about keeping up the conservative attitude and giving time to the employees to consider their decisions even when we are late from the time schedules."

Among being an example and supervising that the employees follow the procedures, the interviewees indicated several methods to enhance safety culture and develop it in their organizations.

"With small movements it [safety culture] gets better. It is good to enhance new things positively... When the boys are included in the development, it is easier to sell them new ideas and instructions. And that way they also participate in the development brainstorming. By involving people in the development."

"It is important to be active in the development programs we have here at the plant. When it is seen that something is not on the level where it should be, we have to be active in the development and push forward and that develops the safety culture also. When people realize that issues are addressed and we are trying to fix them."

The interviewees addressed the importance of including employees in the development processes to be one of the key elements of enhancing work practices. They also highlighted the need to show to the employees that development projects are important and issues in working practices are evaluated and developed. The importance is in being open and showing that the necessary developments are in process as well as explaining why some developments are needed.

Besides the attempts to enhance safety culture, some managers indicated that safety culture has been developed already to the advanced level where it needs to be. Two of

the interviewees said that they have not thought about developing safety culture as they think that it is on the correct level already. These answers indicated that the managerial task is maintaining the level, not enhancing it further.

> *"Well... I have not come up with any sections of safety culture where we would be bad at... so it is hard to say where we should develop our activities. At least in our function, the level of safety culture is good already."*

The interviewee had earlier explained the same processes of leading by example and controlling the work quality. The comment shows that the middle manager's work indicates efforts to be headed in maintaining the level of safety culture and reminding the employees of the importance of safety as well as watching over that the new employees adapt the work culture.

Together with middle managers' daily practices, one part of the interviews concerned the organizational methods to enhance safety culture and the challenges middle managers had faced in safety culture development in their organizations. Next, the methods used along with the day-to-day enhancement are introduced.

An important theme that was actively discussed in many interviews was the difference between enhancing safety culture among the employees who already had experience of working in the plant and enhancing safety culture by recruiting the right people and training them correctly. Training was raised into the discussion also as a way to enhance all employees' understanding of the phenomenon but especially it was discussed as a way to improve managers' abilities to cultivate safety culture enhancement. The importance of safety culture training was also highlighted strongly in the new employees' orientation process.

The interviewees frequently called after safety culture training that helps them to understand what the safety culture requirements mean in their work practices. Some of the interviewees recognized that they have had trainings in their organizations, which helped them to process and recognize the importance of safety culture. Most of the

trainings mentioned in the interviews referred to the human performance development tools used in the industry. However, the mutual understanding seemed to be that the term safety culture was not used in the trainings that much, since it refers to such an abstract phenomenon.

> *"The term safety culture is not used in trainings. We talk about technical issues, processes..."*

The middle manager level generally felt that talking about safety culture as such would be too vague and unhelpful for their work, if the objective would be to enhance safety culture by saying that safety culture should be enhanced. The interviewees did not mention, however, that the term would have been discussed much in their trainings. The interpretation is that if the training did not explicitly state that safety culture would be the theme of the training, the interviewees did not connect it with safety culture training as the question asked in the interviews were whether the interviewees had received some training regarding safety culture. One interviewee mentioned that participation in a seminar concerning safety culture had advanced the knowledge of the phenomenon.

> *"I participated in a Safety culture seminar organized by STUK some five years ago. From there I gained some understanding about it. Otherwise, I think that I have just grown to understand it."*

This interviewee showed understanding towards the concept of safety culture as an element that is recognized widely in the industry. By this interviewee sample, the safety culture seminar seemed to affect fundamentally the understanding of the phenomenon.

Together with discussing trainings that help the middle managers to understand safety culture and its importance to the nuclear safety, trainings that concern middle managers' ability to enhance safety culture in their work position through leadership were discussed in the interviews.

"Leadership has an effect that the employees know what they are expected to do. When a person knows what is expected, he or she has better acquirements to feel good about the job… It might be that we have not been trained for leadership but my personal opinion is that it is highly important in this job."

The question of leadership did not come up in all interviews, but in the ones it was brought up the middle managers expressed that they have not had training in leadership thinking and in safety culture enhancement as leaders. This is an important finding explaining the interviewees' hesitation in naming their position in safety culture enhancement.

Together with the theme of training, a challenge brought up by the interviewees was recruitment. The theme that was not considered before the interviews but became an important topic during the interviews was the recruitment process and the importance of finding the right people to work in the plant. The managers felt that it was fundamentally harder to try to change the culture afterwards when the employees have settled into the scene. This theme got attention from plenty of managers and they addressed many issues concerning new recruitments as influencers of safety culture. Firstly, the importance of recruiting the right people was emphasized and secondly, the orientation process for the new employees was brought up in many interviews.

The managers brought up recruitment in several interviews while discussing the development of organization's safety culture. It is essential to recruit people who value safety and are ready to prioritize it above other values in an industry like nuclear business. This task was seen as a fundamental challenge for maintaining and developing safety culture to the desired direction.

"It is really important how we select new employees in here."

"We monitor already in the recruitment process that we get the right persons... We cannot take any fumblers. The process makes sure that they are careful and exact."

The interviewees valued accurate recruitment processes and the ability of the processes to select persons who are already exact before entering the plant. Hazards in the recruitment process were seen problematic. They also emphasized that the development of safety culture relies on the persona and their ability to stay strong with their safety values and spreading it to develop the culture regardless of variables in other employees' attitudes.

> *"New employees learn the culture from the colleagues sitting next to them. If the person in the next desk respects safety, the new employee will respect it too. Otherwise, the new employee would not learn to respect safety. You cannot go to get it from somewhere... If they don't find it from the next desk, they don't find it at all."*

> *"The practices and attitudes transfer fast to the new employee. When a new guy comes in, it does not take more than two months until he even walks just like the others."*

> *"Safety culture is also built in the welcome-training. But it is all in the beginning when a new employee comes, safety culture is not the first thing in your mind when you just want to learn how to find the cafeteria in the building."*

> *"One thing is to train the employees well. We have to teach them why these things are important. Well-trained employees understand why some aspects are more important than other ones."*

These comments emphasize the importance of the colleagues and the team in the safety orientation process of a new employee. The interviewees did not mention managerial role in embedding desired safety attitudes in new employees' orientation but they showed understanding towards the culture, which shifts the employees' perceptions rapidly after entering the workplace.

The interviewees actively emphasized the importance of recruiting people with high safety standards, but some of them also recognized the challenges in these new recruitments and embedding them into the community and culture.

> *"New ones easily adapt to the existing culture. Even if they had higher safety standards themselves, it would not take long for them to fall to the same level that the others have. If the person had fundamentally higher safety standards, it would be really hard to keep them. Maybe in the long term they could affect positively the safety culture, or then we should be able to recruit a group of these people at the same time to make a difference. Otherwise, the new ones with higher standards just fall to the level of others."*

This is a great concern in enhancing safety culture, and it is essential to recognize the cultural effect described by the interviewee. Enhancing safety culture is, therefore, not met just by recruiting people with high safety standards and effort has to be directed on cultivating the culture systematically in the desired direction among the employees.

The importance of the team member's attitudes was also emphasized from the other direction as one person's influence to decrease the safety culture in the work team.

> *"The climate affects the safety attitudes mostly. If there is even one in the group who questions the need for safety or does not respect the instructions, it will slowly affect others' attitudes, as well."*

These comments indicate that it would be easier to affect the culture negatively rather than to develop it into a desired direction. The managers, however, highlighted that among the employees who have been working in the plant for a long period, it is extremely hard to affect their culture at all. The task is easier among new employees, but as they get their orientation from their colleagues, the culture shifts easily.

The middle managers' view on developing safety culture along the day-to-day activities centralized around training and recruitment of new employees. Together with the need

to train all employees, training middle managers to understand how they can enhance safety culture was discussed in the interviews. The middle managers highlighted the importance of new employees' introduction as a way to maintain the level of safety culture and enhance it further. Middle managers experienced that new employees are more easily adjusted to enhance safety culture in the organization than the experienced workers are. These findings are important to acknowledge as they show how middle managers in practice find it possible to enhance safety culture as a managerial task.

4.4. SUMMARY OF THE FINDINGS

This chapter started with investigating the regulations and requirements regarding safety culture in the Finnish context and continued to the practitioners' perceptions of the phenomenon and study of their expressions of the concept. The chapter analyzed the findings of the middle manager interviews and related the findings to the research questions by naming the subheadings according to the research questions and reconstructing the themes analyzed under the headings.

The study shows that the safety culture regulations and requirements and licensees' safety culture statements had a different approach to the safety culture enhancement. The interviewees hesitated on defining their role in safety culture enhancement and the licensees' documentation of safety culture refers to embedding a good safety culture into all doing and into everyone's responsibility in contrast to the style of the requirements, which refer more to the managerial approach to cultivate safety culture. This is an important finding to be studied more, as also the safety culture characteristics of IAEA (2009) highlight the importance of clear leadership in safety culture development.

The main findings of the interviews relate to middle managers' experiences of enhancing safety as a cultural manner. They acknowledged good safety culture through work practices that ensure safety. Their examples showed that they do enhance invisible

parts of culture through leadership methods but these practices were not recognized as safety culture enhancement as actively as in the level of visual artifacts.

The study was based on an underlying assumption that the interviewees would be concerned to enhance safety culture as their work task but the interviews showed that they systematically enhance safety in their functions without recognizing it as safety culture enhancement. The concept of safety culture is too abstract in nature to relate to and even when the interviewees showed by their examples that they do enhance safety culture in practice, they in general did not seem to think about it that way by themselves. The term safety culture is used a lot in academic literature but it was clear that in practice the top management level of nuclear power plants uses the term and at lower levels already the middle managers discuss in other terms about safety. The concept of safety and culture together seemed to confuse the interviewees, and they used other styles to talk about employees' effects on safety.

In their daily work, middle managers enhanced safety by various ways. They listed leading by example, reminding of the importance of the work instructions, supervising the work of the employees and integrating employees into development projects as effective practices to enhance safety. The methods include both control and commitment-based examples of safety enhancement. The methods listed by the interviewees include examples which focus explicitly on safety culture as well as on other aspects like behavior modification where safety culture develops as a side product, parallel to what Viitanen found in his study (Oedewald at al.,2015).

The middle managers interviewed highlighted training and recruitment as essential elements of developing safety culture together with the daily enhancement. The middle managers felt that they had not been trained to enhance safety culture systematically in their teams, which explains their hesitation in stating their position in the safety culture enhancement. Above other things, the importance of new employees' recruitment process and introduction to work were highlighted continuously as a development practice. The interviewees recognized that the desired safety culture is easier to cultivate among new employees. The views on safety culture development that the middle

managers had indicate that they understand the fundamental effect of the surrounding organizational culture on the activities of a new employee.

The next tables collect the main findings of the study together to summarize the perspectives analyzed in this chapter. The summary consists of the safety culture regulations, requirements, and licensee organizations' safety culture statements together with middle managers' experiences.

Theme	**Finding**
Safety culture regulations and requirements	▪ A good safety culture is required by the regulation STUK Y/1/2016 and specified in the YVL guides ▪ The decision of the implementation practices is left to the licensees ▪ The requirements refer to managerial responsibility to enhance safety culture ▪ Most of the middle managers were not aware of the content of the safety culture requirements
Safety culture statements of the licensees	▪ Licensees use the term safety culture continuously in the official communication ▪ The importance of safety culture is highlighted frequently and in many occasions on the strategy level ▪ The licensees had a different amount of documentation available publicly ▪ The secondary data of the licensees refer to safety culture as something that is embedded into all doing

Table 1. Summary of the findings of the secondary data

Theme	Finding
The concept of safety culture	▪ The interviews indicated that the term safety culture was used as a target state and as a desired objective of actions ▪ The official definitions of safety culture were not familiar to the interviewees in general ▪ Experiences were that everyone understood the need for a safety culture differently in their organizations ▪ A good safety culture was seen primarily as employees' willingness to act as expected ▪ The term is in use mostly on top management level
Middle managers' position in enhancing safety culture	▪ Middle managers expressed numerous ways of enhancing safety in their work but hesitated in calling it safety culture enhancement ▪ They did not experience that enhancing safety culture would be addressed as their task ▪ Middle managers experienced that the methods to ensure a good safety culture were embedded into all practices and were everyone's responsibility
Methods to enhance safety	▪ Leading by example, supervising employees' work, reminding about the importance of work instructions and involving employees in development activities ▪ Training to develop the managers' awareness and abilities to enhance safety culture systematically ▪ Recruitment and orientation of the new employees were seen as essential elements to develop safety culture

Table 2. Summary of the findings of the interviews

5. CONCLUSIONS

This thesis examines middle managers' experience of enhancing safety culture in Finnish nuclear industry. The study is constructed of scientific literature review of middle managers, safety & culture and qualitative empirical research of middle managers' experiences as well as practitioners' documentation about the phenomenon.

Safety culture is a phenomenon which has developed in the nuclear industry, and it has become a mantra (Silbey, 2009) that is repeated to enhance safety in nuclear power plants. A good safety culture is required from the nuclear licensee organizations by national and international regulations but as culture is a unique phenomenon, it is up to the licensees to determine how they ensure fulfillment of these requirements. Middle managers are in central position as they work between the abstract-level requirements as well as organizational policies and enhance safety culture in practice.

This study examines their experiences by investigating (1) how middle managers understand the concept of safety culture, (2) how they experience their own position in safety enhancement and (3) how they experience methods to enhance safety culture. The academic literature research shows that in organizational culture studies, middle managers are seen as fundamental influencers of organizational culture. As safety culture is understood as part of organizational culture, it affects safety in this study, middle managers' role in enhancing safety culture is essential.

The empirical study consists of 12 middle manager interviews, involving managers who work in operating Finnish nuclear plants. The interviewees were gathered from different functions of the organizations to form a coherent picture from different viewpoints. The analysis investigates official documentation of safety culture in the nuclear industry together with the findings of the interviews. It is essential to understand what has been said about the phenomenon in the requirements of the regulatory bodies as well as in the strategies and policies of the nuclear power companies. By examining how practitioners

use the term in the industry, the study forms a review of the environment where middle managers navigate on enhancing safety culture.

The main findings of the study are reflected on academic literature in the next section to connect the study to previous literature. After that, managerial implications of the study are discussed. Finally, ideas for further research are introduced to cultivate interest in further studies of the phenomena. This study has found some interesting angles of the phenomenon of safety culture as an exploratory study, and suggestions for further research are expressed to complement the study from other focus areas.

5.1. DISCUSSION OF THE MAIN FINDINGS

The objective of this explorative study was to complement previous research by examining how middle managers experience and enhance safety culture. The study investigated the official definitions and statements of safety culture together with middle manager interviews to form a coherent picture of the phenomenon and the field where middle managers work in the Finnish nuclear industry.

The literature review formed a firm base for the investigation as it helped to concentrate in managerial issues that might rise up in the interviews. The middle managers' positions in the organizations were not in the center of the study, but the effects of the position and possibilities that the central position in organization offers were one of the key principles of the study. The analysis of the empirical study showed that the understanding of middle managers' position was essential for the study and their perceptions differed from the official documentation of the organizations. The theoretical framework of the study combines managerial studies and middle management perspective with safety science and with safety culture studies in the nuclear industry.

The main findings contribute to the previous research in the field of safety culture studies by investigating the dilemma from a managerial perspective. The discussion of

the main findings starts with perceptions of safety & culture, and concludes in discussion about middle managers. The chapter is structured in this way to show the reader the connections of the study to culture and the specialties of the industry and finally to tie it to the main purpose, to study middle management.

The starting point of the understanding of organizational culture could be the difference between whether culture is seen as something that an organization is or something that an organization has (Smircich, 1998). The middle manager interviews showed both perspectives, while some of the interviewees indicated that culture of the organization is what it is and there is no point on trying to change it. These perceptions were based on a belief that the level of safety culture is on a good level already. Some of the interviewees indicated that culture is a reforming construction which restructures in their interactions. These views showed understanding towards the managers' own role in cultural enhancement. As Reason (1998) pointed out, the approach which sees culture as something an organization has refers to a view where attempts to enhance culture are seen as realistic possibilities to reform the culture and therefore useful for the managerial viewpoint. The viewpoint where culture is seen as something that the organization is refers to the approach where middle managers found it difficult to discuss about culture as a separate phenomenon of the existence of the organization.

The perspective to study culture can also be divided into a culture as a shared consensus, subcultural consensus or inconsistent in nature (Meyerson & Martin, 1987). In the middle manager interviews, their views of the nature of culture were seen as a shared consensus as they talked strictly about their organizations as one unit, but in their perceptions they also indicated that different teams work differently, which refers to subcultural consensus. The difference between these approaches was that middle managers viewed culture as a shared consensus when they talked about their organization's respect towards safety and safety as a core value of the organizations. The shared consensus referred to basic values that the organizations share. The viewpoint of subcultural consensus, instead, referred to practices of the teams. The middle managers saw culture as a subcultural consensus when they talked about the methods and artifacts they use to maintain and develop safety culture.

To investigate middle managers' perceptions of organizational culture further, a model by Edgar Schein is in use in this thesis to understand the abstract levels of culture. He structures culture through three levels to consist of artifacts, espoused values and basic underlying assumptions (Schein, 1985). The basic underlying assumptions and safety as a core value were seen as a shared consensus of the organization. From the levels of culture, the interviewees referred mostly to the artifacts and espoused values. These two are the parts of culture which are easier to identify than the basic underlying assumptions. Their examples of safety culture were practice-oriented and related to manners they rehearse in daily work. Artifacts are the only level of culture that is visual (Schein, 1985), and the findings of the study show that the managers understood the effects of artifacts on the culture actively.

The managers, according to the findings of the study, also enhanced the essence of culture, the embedded invisible parts of the culture. The difference is that these levels showed in the interviews through the examples, but were not indicated directly by the managers. The middle managers enhanced the invisible levels of safety culture in their work as they had deduced themselves that it was something they needed to do. In general, the interviewees did not recognize that it would have been their task as safety culture developers, as they did not emphasize that they would embed safety culture in the invisible level through these practices. In other words, they saw the practices they reduce as attempts to increase safety, not safety culture.

The finding is relevant to the ongoing discussion of the use of the term in the industry. As in the literature (eg. Glendon et al., 2006; Silbey, 2009) also, practitioners hesitated on defining the abstract phenomenon of safety culture. The middle managers related safety culture strongly towards safety and safety enhancement. The cultural aspects of the concept were harder to define. They stated, that they did enhance safety in their work but did not call it culture.

In addition, official practitioners' definitions of safety culture relate strongly towards the prioritizing of safety, too. The essence is that safety would be embedded in the

organizational culture and would be recognized as a core value. This has been highlighted in the industry by the official bodies as well as by the licensee organizations.

The interviews showed that the middle managers were actively acting towards safe operations and referred to the importance of responsible behavior. The importance of employees' responsible activities has been highlighted in previous safety culture studies (García-Herrero et al., 2013), and the interviews indicated middle managers' active style to embed safety. Also Mengolini & Debarberis (2007) highlighted the importance of management commitment in their study of safety culture enhancement.

Referring to the previous safety culture studies in the nuclear industry, the main findings of the study concern the reflection of the middle managers' experiences on safety culture measurement studies as well as on the studies of methods to enhance safety culture. The DISC model (Reiman et al., 2012) introduced in the literature review describes different aspects of a good safety culture. The elements of good safety help to form a bigger picture of the middle managers' experiences present in the power plants. Organizations' understanding of safety as a genuine value were highly present in the interviews. The middle managers understood the meaning of safety and continuously argued upon the essence of safety in the industry. Moreover, the interviews showed that the middle managers were well aware of the characteristics affecting safety culture through their work practices regardless of their hesitation on calling it safety culture. The safety culture characteristics (IAEA, 2009) and the DISC model highlight the importance of management and leadership and in the following paragraphs, the managerial viewpoint is analyzed in more detail.

The managerial aspects of the study combine managerial studies and middle managers' position with managerial safety culture enhancement studies. Firstly, middle managers' central positions in the strategy implementing process (e.g. Wooldridge et al., 2008) were clearly shown in the study where top-management level abstract objectives of safety culture were unfamiliar to the middle management in their practical work tasks. The strategic role of middle management has been under discussion in academia

(Rouleau & Balogun, 2011) and this study repeats the conclusion that middle managers' understanding of the strategic goals would be essential in implementing the strategy. The findings of the interviews show that the middle managers see top-management level safety culture talk as abstract discourse of a phenomenon that is not manageable. They pursued practices to enhance safety but were not on the same level with the abstract safety culture talk in their perceptions about the effect of their activities.

Barling and Hutchinson (2000) investigated the differences of control-based and commitment-based approaches to enhance occupational safety in their study. This thesis has clear findings that both approaches are actively in use to enhance nuclear safety. The middle managers used both methods to enhance safety as in the interviews several methods that they use in practice were discussed. It is essential to note that both of these approaches are in use. Control-based approaches to safety culture enhancement were clearly the first impression of the interviews. The importance of procedures and instructions are in great role in the industry. The interviews indicated that the commitment-based approach was experienced as a personal choice of the manager to pursue.

Many interviewees stated that they want to include their team members in decision-making and development because they have learned in practice that these elements increase the commitment, and therefore, the quality of the work. These themes have been studied in the academic research as being essential elements of performance (e.g. Stoker, 2006). The interviewees also emphasized the importance of increasing employee commitment to mutual goals by training and work orientation. These were seen as essential elements on enhancing safety culture.

Moreover, middle managers' central position and influence in the organization have been highlighted in literature (Burgelman, 1998; Mantere, 2008). This influential position and the possibilities it enables were not brought up by the interviewees systematically. Some of them mentioned the challenging position between top management and the shop-floor workers but the fundamental effect that they have towards the decision-making and attitudes were emphasized. These activities and the

importance of leadership have been studied also in the nuclear industry. Martínez-Córcoles et al. (2013) stated that the managements' effect on the employees' safety attitudes is fundamentally important.

The strategic role of middle managers, which has been studied a lot (Rouleau & Balogun, 2011), was not actively recognized as an element of the position of the interviewees as they were focused towards ensuring safe operations at the plant. The contribution of middle managers that has been brought up in literature (Wooldridge et al., 2008) was not emphasized by the managers themselves. Hale at al. (2010) studied the successful interventions to highlight safety and stated that training and motivating managers was one of the most essential patterns to manage safety. These together with the perceptions that the leadership status of the interviewees was not discussed in the organizations widely indicate that the managers focused on their managerial role above the possibilities to affect the performance as leaders. To collect the main managerial perspectives from these findings, the next section will focus on the managerial implications of the study.

5.2. MANAGERIAL IMPLICATIONS

This section is dedicated to the managerial implications of the study. This thesis has focused on the academic impact of the investigation but, moreover, some implications to practitioners can be made. In this chapter, the final thoughts of managerial implications are summarized.

First, the term safety culture is challenging. Many researches alert that the term is challenging to determine and it shows strongly in the study that the term is vague to be used in practice. The study shows that middle managers have difficulties in defining the term and find it better to talk about the issues behind it than the term itself. In the industry, practitioners should pay attention closely to what they want to emphasize when the term is used. Some of the interviewees debated safety culture as a fixed goal of the top management. The safety culture discussion makes it difficult for the managers

to focus on what is actually meant by using the term and some of the interviewees indicated that the trend of talking about safety culture has been mixed to areas where something different is meant.

Second, middle managers had difficulties in stating the managerial perspective to enhance safety culture in the licensee organizations precisely. The interviewees did not recall that safety culture enhancement would be their task, or that they would have been trained to enhance cultural aspects. As previous research indicates, middle managers have fundamental role in developing organizational culture, and therefore, they should recognize their essential position. This is essential especially in nuclear industry where cultural aspects have been recognized as fundamentally important safety requirements.

Furthermore, together with helping the managers to recognize their position to enhance safety culture, the methods that the managers can utilize to enhance safety culture systematically in their daily activities could be included in their training program. In this study, the training program or methods were not investigated but the interviews indicate what the managers remember of the trainings that they possibly have had and shows that some adjustment should be looked for. Trainings were not mentioned in discussion about the managerial possibilities and position to systematically enhance safety culture on different levels of culture.

Lastly, middle managers brought up recruitment process and new employees' introduction to the work systematically in the interviews. They summarized that among experienced employees, the safety culture enhancement was mostly about maintaining the level that has been reached before, but among new employees, the level of safety culture was easier to develop. This perception might also arise from the experience that the middle managers felt that they had developed leadership skills mostly by themselves and the task to enhance safety culture among experienced employees calls for strong leadership mentality. Among new employees, the task to enhance safety culture might be easier to be adjusted. Many interviewees discussed the importance of focusing on the new employees and of making sure that as they start to form their own practices, they would form them around the desired safety level. The examples brought up in the

interviews formed a picture that in the moment the new employees' introduction would lie mainly in the formal trainings, and otherwise the work practices are formed by learning from others. This phenomenon should be studied further to form a precise picture of the new employees' introduction process outside the official trainings.

5.3. SUGGESTIONS FOR FURTHER RESEARCH

The focus of this thesis has been on the middle managers' experiences of safety culture enhancement in the operating nuclear power plants in Finland. The study was formed this way to complement previous safety science studies of safety culture with a managerial perspective. The managerial perspective could have been studied, just as well, from the top management level or from the operational team leaders' perspectives. Both of these perspectives would be an interesting complement to this investigation.

This study investigates the use of the term among the practitioners as a part to understand the environment where the managers work. Nevertheless, the practitioners' perceptions of safety culture could be studied with a wider range by focusing the study on the definition and use of the term, instead of mixing it together with the middle managers' perceptions. The term is used widely both in academia and by practitioners, and investigating the correlation of the use of the term would be an interesting study alone.

Furthermore, the findings of the study suggest some new ideas for further research. Firstly, the effectiveness of control-based approach to enhance safety culture versus commitment-based approach should be studied in the industry. Barling & Hutchinson (2000) investigated the phenomenon in the field of workplace safety, and as the middle manager interviews brought up that both of these methods were used in the industry to enhance safety culture, a study should be focused on those practices. Another theme that arose from the interviews is the implementation chain of the safety culture principles in the licensee organizations. A study should be conducted to investigate how top management safety culture statements are executed in the field. The middle managers of

this study were not familiar with the official safety culture objectives of the licensees, and the researcher was left with the question of how the objectives are executed and how the management system around safety culture objectives works in practice.

Nevertheless, this study investigated middle managers' experiences and perceptions of safety culture enhancement. A complement study should be conducted to investigate the practices of the phenomenon. It would be fascinating to complement this thesis with a practice-oriented view and to study how these middle managers' perceptions are shown in practice. All in all, previous safety culture studies should be complemented with research which focuses on people and practices. Many studies can be found defining safety culture and advancing evaluation theories of the levels of safety culture. Further studies should be focused on investigating the effectiveness of safety culture practices as licensee organizations use plenty of resources to enhance safety culture.

6. REFERENCES

Alasuutari, P. (1995). Researching culture: Qualitative method and cultural studies. Great Britain: Sage Publications Ltd.

Alasuutari, P. (1999). Laadullinen tutkimus. Tampere: Vastapaino.

Antonsen, S. (2009). Safety culture and the issue of power. *Safety Science*, 47(2), 183-191.

Balogun, J. (2003). From blaming the middle to harnessing its potential: Creating change intermediaries. *British journal of Management*, 14(1), 69-83.

Barling, J., & Hutchinson, I. (2000). Commitment vs. Control-based Safety Practices, Safety Réputation, and Perceived Safety Climate. *Canadian Journal of Administrative Sciences*, 17(1), 76-84.

Bate, P. (1984). The impact of organizational culture on approaches to organizational problem-solving. *Organization Studies*, 5(1), 43-66.

Bloom, M. (1999). The performance effects of pay dispersion on individuals and organizations. *Academy of Management Journal*, 42(1), 25-40.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.

Brayboy, B. M., & Deyhle, D. (2000). Insider-outsider: researchers in American Indian communities. *Theory into practice*, 39(3), 163-169.

Burgelman, R. A. (1983). A process model of internal corporate venturing in the diversified major firm. *Administrative Science Quarterly*, 223-244.

Cameron, K. S., Freeman, S. J., & Mishra, A. K. (1991). Best practices in white-collar downsizing: Managing contradictions. *The Executive*, 5(3), 57-73.

Carroll, J. S. (1998). Organizational learning activities in high-hazard industries: the logics underlying self-analysis. *Journal of Management studies*, 35(6), 699-717.

Clarke, S. (2000). Safety culture: under-specified and overrated?. *International Journal of Management Reviews*, 2(1), 65-90.

Cox, S., & Flin, R. (1998). Safety culture: philosopher's stone or man of straw?. *Work & stress*, 12(3), 189-201.

Currie, G., & Procter, S. J. (2005). The antecedents of middle managers' strategic contribution: The case of a professional bureaucracy. *Journal of management studies*, *42*(7), 1325-1356.

Danermark, B., Ekstrom, M., & Jakobsen, L. (2001). Explaining society: an introduction to critical realism in the social sciences. London and New York: Routledge.

Dutton, J. E., & Ashford, S. J. (1993). Selling issues to top management. *Academy of management review*, 18(3), 397-428.

Dutton, J. E., Ashford, S. J., O'Neill, R. M., & Lawrence, K. A. (2001). Moves that matter: Issue selling and organizational change. *Academy of Management Journal*, 44(4), 716-736.

Edwards, P. K., O'Mahoney, J., & Vincent, S. (Eds.). (2014). Studying organizations using critical realism: A practical guide (Vol. 17). Oxford: Oxford University Press.

Ellinger, A. D., Ellinger, A. E., & Keller, S. B. (2003). Supervisory coaching behavior, employee satisfaction, and warehouse employee performance: A dyadic perspective in the distribution industry. *Human resource development quarterly*, 14(4), 435-458.

Eriksson, P. & Kovalainen, A. (2008) Qualitative methods in business research. London: Sage Publication Ltd

Eskola, J., & Suoranta, J. (1998). Johdatus laadulliseen tutkimukseen. Tampere: Vastapaino.

Flin, R., Mearns, K., O'Connor, P., & Bryden, R. (2000). Measuring safety climate: identifying the common features. *Safety science*, 34(1), 177-192.

Floyd, S. W., & Wooldridge, B. (1994). Dinosaurs or dynamos? Recognizing middle management's strategic role. *The Academy of Management Executive*, 8(4), 47-57.

Floyd, S. W., & Wooldridge, B. (1997). Middle management's strategic influence and organizational performance. *Journal of Management Studies*, 34(3), 465-485.

Floyd, S. W., & Wooldridge, B. (2000). Building strategy from the middle: Reconceptualizing strategy process. California: Sage Publications Inc.

Frost, P. J., Moore, L., Louis, M., Lundberg, C., & Martin, J. 1991. Reframing organizational culture. California: Saga Publications Inc.

Fruhen, L. S., Mearns, K. J., Flin, R. H., & Kirwan, B. (2013). From the surface to the underlying meaning-an analysis of senior managers' safety culture perceptions. *Safety science*, 57, 326-334.

García-Herrero, S., Mariscal, M. A., Gutiérrez, J. M., & Toca-Otero, A. (2013). Bayesian network analysis of safety culture and organizational culture in a nuclear power plant. *Safety science*, 53, 82-95.

Ghauri, P. N., & Grønhaug, K. (2005). Research methods in business studies: A practical guide. Pearson Education.

Gherardi, S., & Nicolini, D. (2002). Learning the trade: A culture of safety in practice. *Organization*, 9(2), 191-223.

Glendon, A. I., Clarke, S., & McKenna, E. (2006). Human safety and risk management. Boca Raton: CRC Press.

Glendon, A. I., & Stanton, N. A. (2000). Perspectives on safety culture. *Safety Science*, 34(1), 193-214.

Glick, W. H. (1985). Conceptualizing and measuring organizational and psychological climate: Pitfalls in multilevel research. *Academy of management review*, 10(3), 601-616.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report*, 8(4), 597-606.

Gotcheva, N., Oedewald, P., Wahlström, M., Macchi, L., Osvalder, A. L., & Alm, H. (2016). Cultural features of design and shared learning for safety: A Nordic nuclear industry perspective. *Safety science*, *81*, 90-98.

Grote, G., & Künzler, C. (2000). Diagnosis of safety culture in safety management audits. *Safety Science*, 34(1), 131-150.

Guldenmund, F. W. (2000). The nature of safety culture: a review of theory and research. *Safety science*, 34(1), 215-257.

Hale, A. R., Guldenmund, F. W., Van Loenhout, P. L. C. H., & Oh, J. I. H. (2010). Evaluating safety management and culture interventions to improve safety: Effective intervention strategies. *Safety Science*, *48*(8), 1026-1035.

Haukelid, K. (2008). Theories of (safety) culture revisited—An anthropological approach. *Safety Science*, 46(3), 413-426.

Hirsjärvi, S., & Hurme, H. (2008). Tutkimushaastattelu: teemahaastattelun teoria ja käytäntö. Helsinki: Gaudeamus Helsinki University Press.

Hoon, C. (2007). Committees as strategic practice: The role of strategic conversation in a public administration. *Human Relations*, 60(6), 921-952.

Huselid, M. A. (1995). The impact of human resource management practices on turnover, productivity, and corporate financial performance. *Academy of management journal*, 38(3), 635-672.

IAEA Safety Standards. (2009). Safety Report on Safety Culture. Safety Guide No. GS-G-3.5, International Atomic Energy Agency, Vienna.

International Nuclear Safety Advisory Group. (1986). Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident, Safety Series No. 75-INSAG-I, International Atomic Energy Agency, Vienna.

International Nuclear Safety Advisory Group. (1991). Safety Report on Safety Culture. Safety Series No. 75-INSAG-4, International Atomic Energy Agency, Vienna.

Konovsky, M. A., & Pugh, S. D. (1994). Citizenship behavior and social exchange. *Academy of management journal*, 37(3), 656-669.

Lee, T. (1998). Assessment of safety culture at a nuclear reprocessing plant. *Work & Stress*, 12(3), 217-237.

Mantere, S. (2008). Role expectations and middle manager strategic agency. *Journal of Management Studies*, 45(2), 294-316.

Mantere, S., & Vaara, E. (2008). On the problem of participation in strategy: A critical discursive perspective. *Organization Science*, 19(2), 341-358.

Mariscal, M. A., Herrero, S. G., & Otero, A. T. (2012). Assessing safety culture in the Spanish nuclear industry through the use of working groups. *Safety science*, 50(5), 1237-1246.

Martínez-Córcoles, M., Gracia, F. J., Tomás, I., Peiró, J. M., & Schöbel, M. (2013). Empowering team leadership and safety performance in nuclear power plants: A multilevel approach. *Safety science*, 51(1), 293-301.

McAllister, D. J. (1995). Affect-and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of management journal*, 38(1), 24-59.

Mearns, K., Whitaker, S. M., & Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety science*, 41(8), 641-680.

Mengolini, A., & Debarberis, L. (2007). Safety culture enhancement through the implementation of IAEA guidelines. *Reliability Engineering & System Safety*, 92(4), 520-529.

Mengolini, A., & Debarberis, L. (2008). Effectiveness evaluation methodology for safety processes to enhance organisational culture in hazardous installations. *Journal of hazardous materials*, 155(1), 243-252.

Meyerson, D., & Martin, J. (1987). Cultural change: an integration of three different views. *Journal of management studies*, 24(6), 623-647.

Mintzberg, H. (1978). Patterns in strategy formation. *Management science*, 24(9), 934-948.

Morrow, S. L., Koves, G. K., & Barnes, V. E. (2014). Exploring the relationship between safety culture and safety performance in US nuclear power operations. *Safety Science*, *69*, 37-47.

Nonaka, I., & Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. New York: Oxford university press.

Oedewald, P., Gotcheva, N., Viitanen, K. & Wahlström, M. (2015). Safety culture and organisational resilience in the nuclear industry throughout the different lifecycle phases. VTT Technology 222.

Perrow, C. (1984). Normal accidents: Living with high risk systems. New York: Basic books.

Pilbeam, C., Doherty, N., Davidson, R., & Denyer, D. (2016). Safety leadership practices for organizational safety compliance: Developing a research agenda from a review of the literature. *Safety science*, 86, 110-121.

Reason, J. (1998). Achieving a safe culture: theory and practice. *Work & Stress*, 12(3), 293-306.

Reiman, T., Oedewald, P., & Rollenhagen, C. (2005). Characteristics of organizational culture at the maintenance units of two Nordic nuclear power plants. *Reliability Engineering & System Safety*, 89(3), 331-345.

Reiman, T., Pietikäinen, E., Oedewald, P., & Gotcheva, N. (2012). System modeling with the DISC framework: evidence from safety-critical domains. *Work*, 41, 3018-3025.

Rogovin, M. (1980). Three Mile Island: A Report to the Commission and to the Public. The Commission.

Rouleau, L. (2005). Micro-practices of strategic sensemaking and sensegiving: how middle managers interpret and sell change every day. *Journal of Management studies*, 42(7), 1413-1441.

Rouleau, L., & Balogun, J. (2011). Middle managers, strategic sensemaking, and discursive competence. *Journal of Management Studies*, 48(5), 953-983.

Schein, E. H. (1985). Organizational culture and leadership. San Francisco: Jossey-Bass.

Schein, E. H. (1996). Three cultures of management: The key to organizational learning. *MIT Sloan Management Review*, 38(1), 9.

Schein, E. H. (2004). Organizational culture and leadership. Third ed. San Francisco: Jossey-Bass.

Schilit, W. K. (1987). An examination of the influence of middle-level managers in formulating and implementing strategic decisions. *Journal of Management Studies*, 24(3), 271-293.

Silbey, S. S. (2009). Taming Prometheus: Talk about safety and culture. *Annual Review of Sociology*, 35, 341-369.

Smircich, L. (1983). Concepts of Culture and Organizational Analysis. *Administrative Science Quarterly*, 28(3), 339-358.

Sorensen, J. N. (2002). Safety culture: a survey of the state-of-the-art. *Reliability Engineering & System Safety*, 76(2), 189-204.

Staehle, W., & Schirmer, F. (1992). Lower-level and middle-level managers as the recipients and actors of human-resource management. *International Studies of Management & Organization*, 22(1), 67-89.

Stoker, J. I. (2006). Leading middle management: consequences of organisational changes for tasks and behaviours of middle managers. *Journal of general management*, 32(1), 31.

Vinodkumar, M. N., & Bhasi, M. (2010). Safety management practices and safety behaviour: Assessing the mediating role of safety knowledge and motivation. *Accident Analysis & Prevention*, 42(6), 2082-2093.

Välikangas, L. (2010). The resilient organization: How adaptive cultures thrive even when strategy fails. McGraw Hill Professional.

Weick, K. E. (1990). The vulnerable system: An analysis of the Tenerife air disaster. *Journal of management*, 16(3), 571-593.

Westley, F. R. (1990). Middle managers and strategy: Microdynamics of inclusion. *Strategic Management Journal*, 11(5), 337-351.

Wooldridge, B., & Floyd, S. W. (1990). The strategy process, middle management involvement, and organizational performance. *Strategic management journal*, 11(3), 231-241.

Wooldridge, B., Schmid, T., & Floyd, S. W. (2008). The middle management perspective on strategy process: Contributions, synthesis, and future research. *Journal of management*, *34*(6), 1190-1221.

7. APPENDIX: INTERVIEW OUTLINE

Master's Thesis
Jenni Haavisto
Aalto University School of Business
Management & International Business

Interview outline
April, 2016

Aloituskysymyksiä

- Kertoisitko vähän taustastasi?
- Kauanko olet ollut täällä töissä?
- Millaisia työtehtäviä sinulla on ollut?

1. **Keskijohdon työ**
    a. Kertoisitko vähän omista työtehtävistä?
    b. Mikä on sinun vetämäsi ryhmän merkitys teidän laitokselle?

2. **Turvallisuuskulttuurin määritelmä**
    a. Onko organisaatiossa annettu jokin virallinen määritelmä turvallisuuskulttuurin käsitteelle? Mikä se on?
    b. Mitä turvallisuuskulttuuri ilmiönä tarkoittaa sinun oman työsi näkökulmasta?
    c. Mistä uskot oman käsityksesi turvallisuuskulttuurista pohjautuvan?

3. **Turvallisuuskulttuurin johtaminen**
    a. Mikä sinun tehtäväsi käytännössä esimiehenä on turvallisuuskulttuurin ylläpitämisessä ja kehittämisessä?
        b. Käytännön esimerkkejä molemmista? Miksi?

c. Miten turvallisuuskulttuurin tulisi teillä kehittyä tulevaisuudessa / mihin pyrit toiminnallasi? Miksi? Mihin perustuu, mitä taustalla?
d. Minkälaisia haasteita koet turvallisuuskulttuurin kehittämisessä?
e. Millä keinoilla yleisesti keskijohto voi mielestäsi kehittää turvallisuuskulttuuria?

4. Strategia ja määräykset (kytkentä laajempaan kontekstiin)

a. Minkälaiset tekijät/tahot/toimijat/tapahtumat ovat teidän laitoksella eniten vaikuttaneet siihen, millaiseksi turvallisuuskulttuuri on muotoutunut?
b. Millainen merkitys yhtiön strategialla on laitoksen turvallisuuskulttuuriin?
c. Entä STUKin vaatimuksilla, millainen merkitys turvallisuuskulttuuriin laitoksilla?
d. Miten turvallisuuskulttuuria voisi kehittää vielä paremmin sinun näkökulmastasi?

Lopetuskysymyksiä

- Käsittelivätkö kysymykseni oikeita asioita?
- Mitä muuta haluaisit vielä kertoa?