CHALMERS
UNIVERSITY OF TECHNOLOGY

Management of Innovation Projects in a Unique Organizational context

Master's thesis in Management and Economics of Innovation

LINNEA BORGCRANTZ
FANNY VIKSTEN

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF SCIENCE, TECHNOLOGY AND SOCIETY

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2022
www.chalmers.se
Report No. E2021:141

Master's thesis 2021:141

Management of Innovation Projects in a Unique Organizational context

Linnea Borgcrantz
Fanny Viksten

CHALMERS
UNIVERSITY OF TECHNOLOGY

Department of Technology Management and Economics
Division of Science, Technology and Society
Chalmers University of Technology
Gothenburg, Sweden 2022

Management of Innovation Projects in a Unique Organizational Context

Supervisors: Erik Bohlin, Academic Supervisor, Department of Technology Management and Economics.
Patrick Moder, PhD Candidate at Kuhne Logistics University.
Examiner: Erik Bohlin, Professor,
Department of Technology Management and Economics.

Report no. E2021:141
Department of Technology Management and Economics
Chalmers University of Technology
SE-412 96 Gothenburg
Telephone +46 31 772 1000

Gothenburg, Sweden 2022

Management of Innovation Projects in a Unique Organizational Context
LINNEA BORGCRANTZ & FANNY VIKSTEN
Department of Technology Management and Economics
Chalmers University of Technology

Abstract

Today, firms must be innovative to stay competitive, but this does not only require investments in RD, but also a good understanding of what innovation is and careful strategies. Innovativeness is shaped by higher organizational levels, such as the organizational contexts; formal structures, informal structures, organizational culture and individuals. However, becoming innovative also require good knowledge management, as innovations are created by developing new knowledge or combining and transforming existing knowledge into something new. Finally, innovation must also be managed at a project level, as different types of projects require different strategies depending on whether it is of exploratory or exploitative character. The innovation topic is therefore highly complex and must be managed at several levels to maximize innovation output. In this master thesis, the organizational contexts of an innovation department at a semiconductor firm is mapped, and put in relation to certain innovation projects to identify managerial implications.

Keywords: Innovation, Innovation Management, Exploration, Exploitation, Ambidexterity, Supply Chain, Early Warnings

Acknowledgements

Many years at Chalmers have culminated in this master thesis and along the way, we have met great people enirching our experience and learning us new things, which we are very grateful of. However, the master thesis has been a big project with many new insights, learnings, experiences and perspectives and some have made a big impact in helping us acheive this report. First of all, we want to thank everyone who have helped us to finish this master thesis. A special thanks goes to our Patrick, who was our guiding light and supported us throughout the process. Moreover, big thanks to Hans and Elias as they have been of great support and have giving us new ideas and input along the way. We are very grateful for Hans and Patrick giving us the opportunity to conduct this master thesis project. We also want to give special thanks Erik Bohlin for his great feedback, support, ideas in how to proceed and all his efforts to help us finalize this thesis.

Linnea Borgcrantz and Fanny Viksten, Gothenburg, 2022

Contents

List of Figures

List of Tables

1
Introduction

Today, rapid technological development and increased globalization have made competition tougher than ever and firms must be innovative to stay competetive (Teece, 1996; Kim and Mauborgne, 2005). However, technological development is characterized by path dependencies, meaning that new technological achievements are likely to follow the same trajectory as before. To overcome path dependencies and become more innovative, firms might have to develop new technical capabilities, but this requires investments and sometimes also organizational changes (Teece, 1996). Management must therefore understand what innovation is, be aware of the challenges related to it and pursue clear strategies to overcome these.

Firstly, there are different types of innovation and these require different strategies (Tushman et al., 2010). One first, important distinction is the distinguishment between incremental innovations and radical or major innovations (Tushman et al., 2010; De Matos et al., 2019). Incremental innovations target existing capabilities and current trajectories, while radical or major innovation target new opportunities. As the latter is about exploration and finding new trajectories, this is characterized by uncertainty as the outcome of the exploration initially is unknown (Teece, 1996). This also means that the financial benefits are unknown, whereupon firms and departments might prioritize exploitation of existing resources and capabilities as this is more likely to provide short-term revenues. Another issue with radical or major innovations is that they might challenge existing structures and technology trajectories, something that can give rise to tensions and resistance (Tushman et al., 2010). However, to stay competitive, firms must pursue both exploration and exploitation, that is, being ambidextrous, but this gives rise to organizational challenges due to their different characteristics (Tushman et al., 2010). Innovation must therefore be managed at a higher organizational level, as the organizational design highly impact an exploratory behavior and hence also innovativeness (Tushman et al., 2010; Teece, 1996).

Secondly, innovations often spring from combining existing knowledge in new ways, or developing new capabilities (Santos et al., 2004). Extending current or developing new knowledge are hence one of the corner stones of innovation management, and adequate knowledge management can improve the probability of successful innovations (Wang and Wang, 2012; Santos et al., 2004). Knowledge management includes tools, processes, systems, structures, and cultures, and how these can be used to facilitate knowledge creation and knowledge sharing (De Long and Fahey, 2000). According to De Long and Fahey (2000), one of the most important aspects

of knowledge management is organizational culture. This gives innovation management a new dimension, considering not only the formal organizational structure but also the informal organizational structure. However, although managers often realize the importance of culture, assumptions and beliefs are often deeply rooted and difficult to challenge. One way to extend or challenge existing knowledge is to connect different individuals, departments, or to incorporate new, external knowledge into the organization (Santos et al., 2004). However, integrating new employees or managing external knowledge is not easy, and does not come without costs and risks (Argote, 2013).

Thirdly, although innovation must be managed at a higher levels, it is also important to manage innovation at project level (O'Connor, 2008). Projects can have different characteristics, and explorative projects require different strategies compared to exploitative projects (Chen, 2017). In fact, explorative projects might even benefit from being separated from the mainstream system and its processes (O'Connor, 2008). As exploration is more uncertain than exploitation, some of the explorative initiatives will fail, and it is therefore important to have incentive structures that promote and encourage experimentation (Chen, 2017). Another aspect is how projects are performed, and exploitative projects that are targeting well-defined problems might be more suitable for execution-oriented processes than the uncertain, explorative projects. Chen (2017) means that ambidexterity at project level differ from ambidexterity at higher levels in the organization, such as corporate level and business unit levels, and should hence be managed differently. The reason for this is that although innovation projects usually start off as explorative, they will eventually get a more exploitative character, if the innovations are perceived as valuable and are to be implemented into the organization.

Innovation must therefore be managed at several levels: organizationally and at project level. Innovation management therefore requires extensive knowledge about how organizational structure and informal organization impact innovativeness. As innovation is about knowledge, managers must also be careful to understand how this is created and shared to increase the probability of innovations. Lastly, innovation must also be managed at a project level, as different types of projects can have different characteristics, but distinguishing between an explorative project and an exploitative project is not always easy.

One example of the complexity of innovations is when projects aim to improve or complement existing systems, and what kind of strategies that would be suitable to maximize the innovation output. Due to the increased globalization supply chains have come to play a significant role in maintaining and establishing competitive advantages (Mousavi et al., 2019). Hence, firms are striving to stay innovative, not only in terms of technology development, but also improved supply chain performance. One important part of this is ensuring reliable order promises despite changing conditions or disruptions in the supply chain (Mousavi et al., 2019). To do so, firms must quickly identify disturbances or risks that might impact delivery reliability, to ensure that precautionary measures can be taken to mitigate or eliminate these

and their root causes (Mousavi et al., 2019). This can be achieved by early warning systems that triggers warnings when order promises cannot be fulfilled, whereupon the firm can act upon this information both reactively and proactively. However, due to the complexity of many supply chains, developing this kind of system is not an easy task, and it requires well-targeted innovation strategies.

1.1 Purpose

This case study aims to investigate how a certain organizational context can impact innovation projects, while also considering knowledge management and project management. For the case study, the researchers investigated how an innovation department at a global semiconductor firm has worked to develop and improve an early warning system for the past decade. Despite several development projects, the system is still not accurate and seems underutilized. While an early warning system is highly complex and involves many different levels of information, the projects have been performed at a structurally separated department dedicated for supply chain innovation. By mapping and analyzing projects related to early warnings, the researchers want to answer the following two questions:

1. In what organizational context have the Early Warning innovation projects been conducted?
2. What might be the managerial implications based upon these organizational contexts?

1.2 Delimitations

The study has restricted the sample size for the focus group to recent projects conducted in Early Warnings, in this case the last two years. This also limits the potential sample size. Moreover, the study is carried out at one case company in a specific setting. These things affect the transferability and generalizability of the study, as it is dependent on many contextual factors and the sample is not randomized. However, the study has an exploratory character, and the researchers hope to shed light on how to apply general literature related to innovation and innovation management in a setting different from those of the literature.

2
Methodology

This chapter describes the methods utilized to answer the research question. This is done by starting with describing the overall research strategy and what assumption the researchers have about the world. This is followed by a section detailing the research design and the quality criteria utilized and how these where followed. The next section is the research process, further detailing the different utilized methods, literature review, inspection of documents, interviews and some further details on the interviews, ethnography. After this follows a section detailing the analysis that has been done, the excel comparison done from the inspection of documents and the coding and clustering done with the interviews and observations.

2.1 Research Strategy

According to Bell et al. (2019), quantitative research takes objectivism as the ontological position, which means that it is assumed that the social phenomena exists independent of the observer. Furthermore, as "reality exists objectively and externally", social phenomena can be studied by direct observation or measured by e.g. surveys and hypothesis are framed and then tested. Qualitative research follows a constructionistic viewpoint, where knowledge has elements of subjectivity, and we assign meaning to social phenomena's when studying them. Social science is not the same as natural science, human action and meaning making constitutes reality, so instead of only trying to explain human behavior, we want to understand human behavior.

This study mostly makes the assumptions of the reality as qualitative research does. As the researchers has been embedded within the organization at the time of the study, they believe they cannot be external observers, and how they interpret the findings are also shaped by being embedded within the organization. The research questions in themselves are not only trying to explain the behaviors in the organization, but also to understand them.

2.2 Research Design

The study was conducted as a case study at a department of a large industrial company. One part of the data collection was analysis of documents within the Early Warnings and background interview with different permanent employed staff at the

company. For student thesis and project reports, this was documents produced between 2010 and 2021. For internal documents, it was the most the recent version, as older versions are usually not available. Another part of the data collection was focus group interviews, interviewing recent project participants were interviewed. The study has also had some ethnographic elements such as immersion. Some complementary observations are described from this.

The traditional quality criteria for research, reliability, replicability, validity, oftentimes used in quantitative research and sometimes adapted to be used in qualitative research (Bell et al., 2019) were first evaluated by the researchers, but after careful considerations other quality criteria was used. Guba and Lincoln (1994) in Bell et al. (2019) suggests trustworthiness and authenticity as alternative criteria for qualitative research. Trustworthiness can be accomplished through the criteria credibility, transferability, dependability, and confirmability (Bell et al., 2019). Authenticity has the criteria fairness, ontological authenticity, educative authenticity, catalytic authenticity, and tactical authenticity, whereas fairness is the most important one (Amin et al., 2020). As authenticity is less discussed in e.g. Bell et al. (2019), has no positivist equivalent (oftentimes qualitative research) and is less used Amin et al. (2020), only fairness will be further discussed by the researchers.

2.2.1 Credibility

With a constructionist viewpoint of the world, multiple interpretations and viewpoints of the reality can exist simultaneously, and the researcher must make sure that they make an accurate representation of what the participants meant (Bell et al., 2019). To establish credibility, researchers are preoccupied with follow good research practice and to present their findings from their participants viewpoint accordingly (Bell et al., 2019). The corresponding positivist quality criteria is internal validity (Bell et al., 2019; Amin et al., 2020). Some techniques used for this are respondent validation/member checking, triangulation (Bell et al., 2019; Amin et al., 2020) and prolonged engagement (Amin et al., 2020). Respondent validation, or sometimes called member checking, can be carried out in multiple ways, but involves letting the participant confirm and adjust the researcher's presentation of their account (Bell et al., 2019; Amin et al., 2020). According to Bell et al. (2019), triangulation is the usage of multiple data sources or methods in a social study. Amin et al. (2020) extends the concept of triangulation with different subcategories. Methodological triangulation is the usage of more than one method, data triangulation is to use data sources which e.g. may have a different time or context and a third method, theoretical triangulation is to look upon a data set with different theoretical frameworks or perspectives. Prolonged engagement is when researchers spend time in the environment the research is conducted which helps building trust with participants and understanding the culture, and although no time is specified as a recommendation as it is context specific, signs of spending enough time with prolonged engagement is e.g. when it is easy to build trust (Amin et al., 2020).

The researchers used respondent validation in different ways. To start with, some-

times follow up questions were asked to confirm interpretation of questions. With one expert interview, the expert was given the notes taken and some parts were clarified. After the interview, a further discussion about how the researchers interpreted what they were saying.

Methodological triangulation was followed as both documents were studied and two different interview rounds were held, and according to Amin et al. (2020), this can help compensate weaknesses from one method. Merely conducting interviews with a limited sample would give the researchers only the perspective from the participants that were deemed be able to have done their projects recent enough to give qualitative answers. Interviews with full time employees provided another perspective on the development of the system. Reading documents from previous projects would on the other hand gives a limited perspective on how the project process was. These two combined on the other hand provided both some depth and breadth. Data triangulation was to some extent used, as the project used different data sources with different time through the documents, but these were more limited in insights they provided.

Theoretical triangulation is by the researchers deemed particularly important for business research as it is according to Bell et al. (2019) is oftentimes based on case studies. This makes it more context specific and sensitive to changes. The well-cited article by Bower and Christensen (1995) about disruptive innovation is e.g. a case study from one industry. Hence a broad range of perspectives were brought in different literature sources and to some extent even literature not concluding the same things nor agreeing with the researchers' viewpoint.

Prolonged engagement was a third technique utilized by the researchers. To start with, one of the researchers already had some familiarity with department from previously and knew some old students from there. Both researchers spent two months before starting the thesis, working at the department, getting familiarized with the culture and the members. This was very helpful in building trust and getting an informal contact network. Although a majority of the interviews were held online the researchers perceived the atmosphere in all interviews as trusting and that topics could be freely discussed.

2.2.2 Transferability

Qualitative research is oftentimes focused on a small and specific group, which makes the findings context dependent (Bell et al., 2019). Transferability's equivalent in a positivist viewpoint is external validity, and for qualitative research the reader must interpret whether it can be transferable to other cases (Amin et al., 2020). Thick contextual description is a common technique to create transferability, and the researchers are providing information that will make it possible for the reader to judge whether it is possible to transfer the findings to another case (Amin et al., 2020). Hence, the researchers have provided a thick contextual description of all aspects that might have shaped the findings, such as the culture, the setting and

different unique factors.

2.2.3 Dependability

The equivalent to dependability is reliability and involves making the study repeatable and having consistent findings (Amin et al., 2020). Audit, including the audit trail is a suggested method for this quality criteria, which involves that the researchers document research process properly and leave these documents to be audited in the same manner as a fiscal audit (Amin et al., 2020). The researchers have therefore closely collaborated throughout the research process and taken notes from activities, to enable external audits from peer reviewers.

2.2.4 Confirmability

Objectivity from quantitative research parallels confirmability in qualitative research criteria, so this involves making sure the researchers have been neutral and not based their findings upon personal biases or motives (Amin et al., 2020). Audit, including audit trail and triangulation are common techniques for this. How the researchers have worked with triangulation and audit is already described in transferability and dependability. The researchers have used a wide range of sources for their research by utilizing different methods, data sources and theoretical frameworks, which gives them a chance to base their understanding of the setting and tackle the problem from a broader perspective. The audit trail strengthens the accountability in the researchers' assumptions. As the research has been conducted in group of two researchers, and also been critically reviewed by two supervisors from different settings, the revision of the work has been done based on this.

2.2.5 Authenticity

According to Lincoln and Guba (1985), research with a positivist viewpoint fail to capture pluralism, conflicts, different values, as the research is supposed to be objective and hence value-free. Authenticity quality criteria tries to respond to this critique. Fairness is one aspect of authenticity. In fairness, the researcher must try to represent different constructions of the world, different value systems, conflicting viewpoints. This as to not diminish or enhance a certain viewpoint, making the results not representing the reality. The researchers have tried their best to contrast different viewpoints, and to not diminish certain viewpoints. This is however not a simple task, but by even attempting to be fair in their representation of different viewpoints, the researchers believe they are closer to achieving fairness at least.

2.3 Research Process

Several different data collection methods were utilized to gather data for this study; literature review, interviews, analysis of internal documents and ethnographical observations. They did not follow a linear process, where one started first and another

followed when the first was finished, instead it was an iterative process. Findings from one method guided further research with other methods, however, some methods were utilized earlier than others such as literature review and background interviews started earlier than the focus group interviews. The literature review was used to create a theoretical framework to be used in the study. Background interviews and analysis of internal documents were used to form an understanding of the system and the organization. Interviews of a focus group was conducted to get further insights on the projects run within the Early Warnings field. Lastly, ethnographical elements complemented the other methods, which provides observations the researchers made by spending time in the organization. The analysis of internal documentation provides longitudinal insights, as it is inspecting documents from 2012 to 2021. Interviews provided more in-depth knowledge in present time by interviewing experts and participants from a focus group.

2.3.1 Literature Review

A literature review was conducted to explore current research, and find relevant concepts and frameworks, as well as to identify common research methods and research strategies within the field (Bell et al., 2019), which helped the researcher understand the environment they were in and how to shape the study. One smaller part of the literature review was towards Early Warnings and Early Warning systems, to understand the system the projects has been run in. The bigger part related to innovation management. Fundamental articles already know by the researchers were reviewed again to find which parts were relevant to this study and searching through Chalmers Library database to find peer reviewed articles and books also relevant to this study.

2.3.2 Inspection of Documents

Closely related to the literature review was reviewing internal documents. Documentation studied was produced between 2012 and 2021 and hence provides longitudinal insights. The studied documents can be divided into several categories; theses produced by students at the department, project reports produced by students at the department, internal documentation for e.g. processes, systems or organization and public information from the company.

The different sources have been treated differently. To start with, theses and project reports produced by students were in this project used to understand the internal systems and processes, what projects that have been run and some information about how they were run. They were not used for theoretical frameworks, but sometimes inspired further literature search. Internal documentation is regularly reviewed and updated within the company, and it is clear when the last update was done as well. As internal processes and systems are continuously reviewed, adjusted, and improved, older documents will represent how the processes and systems worked at that time, not necessarily the current the status. On several occasions, discrepancies between documentation were found and only comparing which date

they were produced was not sufficient. Public information from the company was annual and quarter reports and these were deemed trustworthy as they have gone through an audit process.

2.3.3 Interviews

A common research method in qualitative research is interviewing (Bell et al., 2019). Qualitative interviews seek to seeks to understand the interviewee's perspective and can depart from the standard if needed, as detailed answers are more important than easily coded answers (Bell et al., 2019). Prolonged engagement by the researchers within the organization made it easy for the researchers to reach out to participants and create a good interview setting.

The interviews can be split into two different categories, background interviews with experts and focus group interviews with students which have conducted Early Warning projects. The purpose of the two types of interviews varied and hence the strategies for them as well. The background interviews intended to understand the environment, the processes and to guide further research. The focus group interviews sought to understand the students' perspective of conducting innovative projects in the Early Warning field. Sampling, structuring, note taking, recording and transcription will be further explained in the following sections, and how this was done for the different interviews follows by which purpose they had.

2.3.3.1 Sample

For the first interview round with experts, the researchers found the participants by asking around in the organization and getting recommendations who were experts in the field. The experts were specialized in a specific field and were found by recommendations. A total of five experts was interviewed, whereas one was expert in Order Management and Early Warnings.

For the focus group interviews, the researchers wanted to get deeper insights in how the projects were run in the Early Warnings field from the students' perspective. Hence the available sample size was limited. A time limit was set to only investigate projects run in 2020 or 2021, in order get the most recent insights from students. This further limited the potential sample size.

The focus group participants were found by asking senior members of the department and by going through material from the department. In total, five interviewees were interviewed in the focus group.

2.3.3.2 Semi-structured Interviews and Interview Guide

With a specific scope of an interview, a semi-structured interview is often common as it allows the interviewee and interviewer cover a set of topics but depart from these if other interesting topics surface during the interview (Bell et al., 2019). Hence,

this strategy was followed for most interviews.

For background interviews, a set of questions were decided beforehand, and topics were followed up on when found interesting. These interviews were either held online or in face-to-face meetings.

For the focus group interviews, an interview guide was designed. This as Bell et al. (2019) suggests having some structure makes comparing easier. The interview guide was arranged by grouping questions into different themes, as this can help the flow of the interview (Bell et al., 2019). As the researchers had spent time in the organization beforehand, it was easy to create a trusting environment although many of the interviews were held online. This could partly be attributed to that within the organization, online meetings have been common since March 2020, online meetings are rather the common working way for many.

The interview guide followed the following structure:

1. Background - to the project such as previous knowledge and experiences and reason for participating in an Early Warning project
2. Information - availability, how and where it was found and how it was perceived
3. Challenges - what those where and how those were faced
4. Collaboration - with whom and how
5. Additional information - challenges, what was smooth or easy and any additional remarks.

For detailed interview guide, please see attachments at the end of the report.

2.3.3.3 Note Taking, Recording and Transcription

For expert interviews, no recordings were done, instead meticulous note taking was used. This as the researchers wanted to keep the atmosphere as informal, and the important aspect was to gain insights on the environment to further use for the study rather than noting down specific details.

For the second interview round, both note taking and recording and transcription were employed. Note taking as it was a back-up if any of the participants would not agree to recording of the interview or if any technology issue would arise where any of the recordings were lost. Before recording the interviews, the researchers asked the interviewees for permission and explained the purpose of the recordings and how the data would be stored, so that the interviewees could give their informed consent.

According to Bell et al. (2019), it is not only important what the interviewees say, but also how they answer a question. Therefore, recordings and transcriptions are a useful tool for qualitative researchers. The researchers made use of the recordings on several occasions when an answer was ambiguous, and this helped resolving the ambiguity. The researchers discussed using transcription software for this. However, as this would require giving a third-party access to the interviews and the researchers

could not assess how that data would be treated or stored, the confidentiality of the interviews would be at risk. This would severely damage the credibility of the researchers. Hence manual transcription was chosen as the method for transcription.

2.3.4 Ethnography

According to Bell et al. (2019), organizational ethnography is a common business research method. One way to achieve immersion in the organization is to find a working role (Bell et al., 2019). The researchers spent two months before the thesis started in the organization, mostly as supporting Regional Logistic Coordinators. This role's purpose is to optimize customer requests and escalations when there is tight supply for certain products. In this role, the researcher met and worked with different employees working within the Supply Chain, interfacing the order management system, such as Supply Chain Planners and Customer Logistics Managers, and members of the innovation department. As thesis workers, the researchers were also immersed within the organization and took part of activities. Most of the findings have been derived from interviews and analysis of documents, but some further observations which could not be found from the participants are mentioned in the results as the researchers' observations.

2.4 Analysis

After data was gathered, the researchers analyzed the data. This was done differently, depending on the data. Excel was used to analyze the data from inspection of documents, as the data was already grouped in different themes. The focus group interviews required further coding and clustering to present the data in a meaningful way.

2.4.1 Excel Comparison

The data from Early Warning documentation was gathered into an excel file, and the explanations by different sources for different parts of the system had been gathered in columns. The researchers compared different aspects of the system and how the information was explaining how these were functioning. This was also compared to what expert interviews had informed the researchers of the system.

Many different aspects of the Early Warnings were noted down from these documentations such as what triggers an Early Warning, whether it is manually accepted, if an Early Warning report is mentioned and what is mentioned about the report, types of Early Warnings, challenges with Early Warnings, purpose of Early Warnings and other noteworthy things. After this, some of these categories were chosen to be presented in the results chapters. The researchers decided to make a detailed comparison between what triggers of Early Warnings, if the Early Warnings must be accepted manually and what a report is being used for and analyze these differences. This as these are quite fundamental to how the system function, and as it is quite

easy to compare in a comprehensive way for the reader.

To keep the authors of the inspected documentation anonymous, several steps to anonymize the data has been taken. Firstly, the publication year or last update has been presented as a span of two years. This as it is only a few authors each year. Secondly, the specific name of the report and the responsible authors are not presented. Thirdly, type of documentation is categorized as student work or internal documentation. Student work refers to master and bachelor theses, project reports and colloquiums, recorded presentations to present findings from a project. Internal documentation refers to documentation of processes and systems and e-learnings, both regularly updated and with responsible persons available. Lastly, only one aspect of the system is compared in each table and no complete table is presented. By only comparing one aspect at a time, the researchers could clean and filter the data and only focus on the aspect being compared. For peer reviewer or supervisors, the information is still stored as less anonymized version to keep trustworthiness in the research. When all these steps were taken, the researchers noted that there were differences and trends in how the documentation on Early Warnings are explaining the system.

2.4.2 Coding and Clustering

The focus group interviews where first analyzed one by one. Directly after each interview, some discussions were done. As all interviews in this round were held in quite a short time span, the detailed coding and clustering were done after all interviews were held, based on the transcriptions. The interviews were coded by making notes resembling post it notes, which were arranged in a power point presentation and each interview had its' own color. This was done online and not on physical post it notes as the researchers could not meet in person due to covid restrictions.

After all interviews transcription notes had been gone through by the researchers, the notes were printed and clustered individually by the researchers. The researchers presented then how they had clustered the interviews to each other and had a lengthy discussion on how to present the clustering. The two different clustering made was similar with some differences, especially in what categories were called, and how the clusters were arranged in relation to each other. These clusters are used for the presentation of results and the discussion.

The researchers were considering several different ways of analyzing the findings and decided for this as it would provide the most anonymity for the interviewees. This as only smaller parts from each interview are presented at the same point. This method might have a higher chance of adding the researchers' interpretation of events, hence the researchers have reminded themselves of the quality criteria chosen, especially fairness, where different and contrasting viewpoints may be presented. Observations made from the researchers are clearly presented as this in the result chapter.

3
Theoretical Background

The research questions aim to frame a certain organizational context, and investigate what managerial impacts this setting might have. To answer these questions, it is important to understand what innovation is and what factors that might impact innovativeness and innovation output. This chapter will therefore first define innovation and innovation management. Secondly, the organizational structure forms the base for how the company works, and hence also for innovation. Secondly, innovation is about developing new knowledge or combining existing knowledge into something new. The chapter will therefore also cover knowledge management in terms of learning and knowledge transfer on both individual and organizational level. Finally, innovation must also be managed at project level as different types of projects require different types of management.

In Figure 3.1, the organizational context is illustrated as a pyramid with these different layers and factors - organizational structure, knowledge management and project management. However, it is important to note that none of these exist independently of one another, and hence, they also impact each other. After the general introduction of innovation, the pyramid also shows the structure of this chapter.

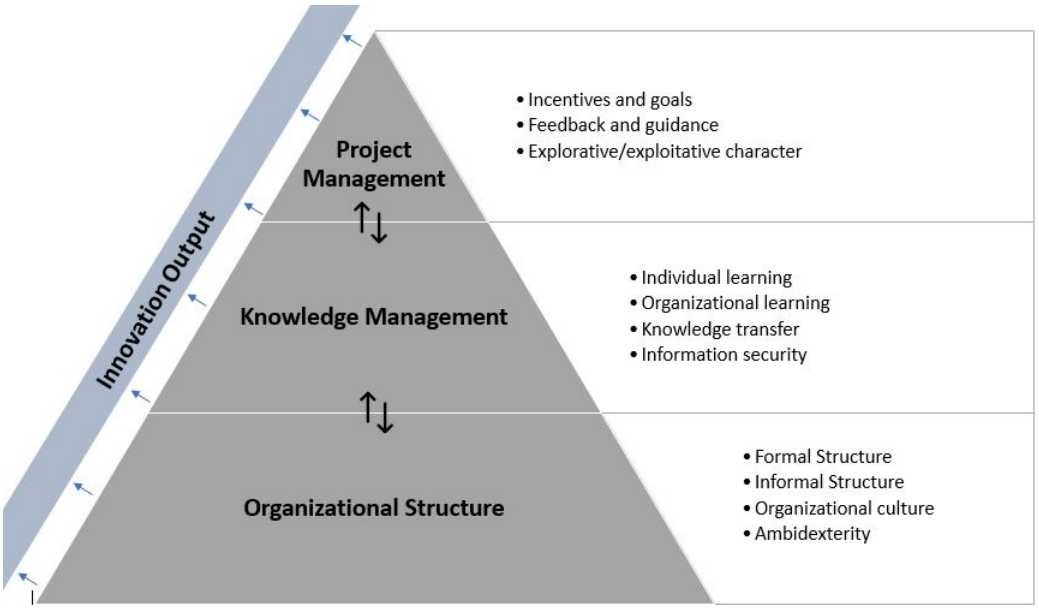

Figure 3.1: Different levels and factors that frame the organizational context and impacts innovativeness.

3.1 Innovation

Innovation has many different definitions, depending on what type and what is focused on (Assink, 2006). To start with, there is a difference between innovation and invention - Rogers (2003) defines invention as when an idea is created or discovered, whereas innovation is when this is adopted. Assink (2006) involves value for adopters in their used definition; "The process of creating something new that has significant value to the relevant unit of adoption". According to Jörnmark and Ramberg (2004), Schumpeter defined five innovation types, product, market, process, organizational and input. This has similarities to how Assink (2006) categorizes innovation on two different axes, technology/process/concept and market, with either new and existing as the two options (Assink, 2006). Incremental innovation is existing for both market and technology/process/concept, hence only incrementally changing. According to O'Connor (2008) incremental innovation holds less uncertainty than radical innovation, which Assink (2006) is categorizing as breakthrough innovation. Breakthrough innovation has both new market and new technology/process/concept which makes the projects high risk compared to the low-risk incremental innovation. O'Connor (2008) discusses three different kinds of innovations, incremental, really new innovations, and radical innovations. Radical innovation transforms markets, industries or is even creating new ones and has high levels of risk. Really new innovation can either discontinue market or technologies but not both. The last two forms of innovation, really new innovation and radical innovation, are by O'Connor (2008) categorized as major innovations, as they both hold higher levels of uncertainty.

3.1.1 Innovation Management

Tushman and Nadler (1986) specify three key elements of innovation management: the organizational arrangements, the informal organization, and individuals. The formal organization directs and motivates behavior by providing structure, systems, and procedures. Key dimensions of this are formal linking mechanisms, organizational design for venturing and entrepreneurship, incentives, joint evaluation, staffing and appraisal, job design, job rotation and careers, and education. The informal organization supplements the formal structure by connecting individuals that are otherwise separated, providing guidance, and stimulating creativity (Tushman and Nadler, 1986). Some of the most important elements are core values, norms, risk rewarding, communication networks, informal roles, and conflict resolution and problem-solving practices. However, as innovation usually starts at an individual level, the last pillar is built upon individual factors, such as diverse expertise, problem solving skills and team building skills.

3.2 Organizational Structure and Culture

The formal and informal organizational structure heavily impact the innovativeness of a firm (Teece, 1996). Mechanistic structures characterized by routines and formalization are good for exploitation as these structures facilitates coordination and increases efficiency, reliability, and effectiveness (Chen, 2017). However, hierarchical

structures and bureaucratic decision making tend to slow down innovation as these tend to reinforce existing capabilities (Teece, 1996). For exploration, Chen (2017) suggests a dynamic and organic structure with low levels of formalization and standardization as this increases experimentation and allows for new specializations and coordination to emerge.

The informal structure is shaped and formed by the organizational culture as the norms impact the behavior of individuals (Teece, 1996). As organizational learning is built upon individuals, it is very important to create a sense of purpose and autonomy; purpose for conceptualization and autonomy to give individuals the possibility to develop and absorb knowledge (Nonaka, 1994). To strengthen explorative behavior and hence increase innovativeness, the organizational culture must promote autonomy, allow trial and error, and cherish an open communication, both externally and internally (Teece, 1996). Furthermore, new innovations might also challenge some constituents, whereupon it might create tensions and resistance (Teece, 1996). Organizations must therefore encourage and support innovativeness by providing certain incentive structures. If business units are incentivized by improved business unit performance, they will be less likely to invest in innovations that might disrupt the current structure. Furthermore, if short-term profitability is prioritized, investments will most likely be made in exploitative initiatives as these are more certain than explorative projects. It is therefore important to create organizational structure and culture which support experimentation and promote entrepreneurship to achieve an innovative climate.

According to Teece (1996), a firm's technical capabilities lie within organizational systems and routines and are hence not easily captured by formal descriptions or instructions. Cross-functional and cross-departmental networks are hence very important as it increases knowledge sharing (Teece, 1996). This aligns with De Long and Fahey (2000), who states that individualistic thinking and accomplishments must be replaced by team-based performance and collective achievements. This would encouarge cross-functional sharing and collaborations, and hence increase knowledge sharing. Amabile et al. (2014) retells how ATT's patent office figured out what a successful group of employees had in common except having more patents than other employees. They were all regularly lunching with an employee, and this employee was great at asking good questions. Nonaka (1994) also emphasizes the importance of meaningful, face-to-face dialogues between individuals, as this extends concepts beyond the individual understanding and allows testing of hypotheses. For a dialogue to be meaningful, it must not be deterministic and single-faceted, individuals must be allowed to share their ideas freely, criticism must be constructive, and discussions should be encouraged.

In adddition to a collaborative climate, management must also promote a helping culture (Amabile et al., 2014). This is another important aspect of the informal organization as it is important for idea generation and development. To achieve this, management must not only encourage and inspire employees to increase team work and collaborations between individuals, teams and departments, but also actively

work to avoid colleagues considering themselves as competitors. However, this cannot be forced and when fostering help, this cannot be tied to bonus incentives as this in itself may foster more competitiveness (Amabile et al., 2014). Instead, Amabile et al. (2014) suggests giving space for crediting helpers as a useful incentive. In order for help to occur, employees must be available and hence they cannot have too many commitments - their must be leeway in employees schedules for help to occur. Amabile et al. (2014) conducted a study at an organization known for its fostering of helpfulness, and this study showed trust and accessibility was ranked as more important than competence when employees ranked these traits in their helpers. Competence was not unimportant, just less important than trust and accessibility. However, asking for help can be hard as it will open an individual up for showing weaknesses, and may come across as incompetent (Amabile et al., 2014). Employees must therefore feel safe enough to be able to ask for help.

3.2.1 Ambidexterity

As already stated, the organizational structure impacts innovativeness, and it is therefore important to organize for both efficiency and innovation (Teece, 1996). This requires the firm to choose adequate organizational structures (Teece, 1996) and becoming ambidextrous, that is, both explore and exploit (O'Reilly III and Tushman, 2011; Tushman et al., 2010). Exploitation is to further improve the current business by improving current products in current markets, and exploration is about discovering new markets and technologies. Firms that successfully manage both exploitation and exploration are called ambidextrous (Tushman et al., 2010; O'Reilly III and Tushman, 2011). While both exploration and exploitation are required for firms to stay competitive (O'Reilly III and Tushman, 2011; Tushman et al., 2010), being ambidextrous is not easy as these two modes often require different structures, strategies and processes (Chen, 2017). As mentioned by Teece (1996), mechanistic structures tend to promote exploitation, while exploration requires more flexibility and creativity.

Due to the different characteristics of exploitation and exploration, top management must therefore create a beneficial environment for both modes by providing accurate formal and informal structures, unifying visions and incentive structures (O'Reilly III and Tushman, 2011). Top management must also sometimes orchestrate conflicting routines and requirements as these two modes often compete for scarce resources (O'Reilly III and Tushman, 2011; Tushman et al., 2010). The tensions are further increased as present business opportunities often give revenues in short-term, while future business opportunities might be cannibalizing on the present (Chandy and Tellis, 1998). The reason is that new innovations might follow new technical trajectories which require different capabilities and resources than what the organization currently has, whereupon the current business model and the organization risk becoming obsolete. This might trigger resistance to exploration (Tushman et al., 2010).

There are three common strategies for an organization to become ambidextrous:

structural ambidexterity, contextual ambidexterity and sequential ambidexterity (Chen, 2017). Structural ambidexterity is when exploration and exploitation are separated into different units (Pregmark and Fredberg, 2018). The complexity of the issue is handled by senior management, as they have links between the units (Tushman et al., 2010). Although structural ambidexterity enables keeping different strategies and structures for explorative and exploitative departments, this is very time-consuming as it requires extensive coordination and planning from top management (Chen, 2017). Issues also usually appears when these innovations are to be integrated (Pregmark and Fredberg, 2018). It is therefore important to unite different units by providing a common goal, while at the same time keeping separate but complementary goals for the different units (Birkinshaw et al., 2016). Furthermore, separate, self-managing units increase the decentralization, whereupon the units can experiment and allocate resources more freely (ibid). However, despite the structural separation and decentralization, Birkinshaw et al. (2016) emphasize the importance of collaborative networks and internal collaborations as exploratory initiatives eventually must be integrated into the organization to form marketable products for mainstream businesses.

Contextual ambidexterity is when both exploration and exploitation are carried out in the same unit (Pregmark and Fredberg, 2018). Here the tension must be dealt with throughout the organization and requires an organization with a culture that can support this (Tushman et al., 2010; Birkinshaw et al., 2016). Although this form of ambidexterity puts more emphasis upon separate units, Birkinshaw et al. (2016) states that unifying visions and culture are important. They also emphasize cross-functional collaborations as showing the commercial viability of new innovations increases the possibility of a smooth integration. While contextual ambidexterity might work well if the exploratory initiatives are similar to existing capabilities, more radical initiatives might disbenefit due to its sometimes controversial nature (Chen, 2017).

The third form of ambidexterity is sequential ambidexterity, where the firm is altering between exploitation and exploration depending on contextual factors (Chen, 2017; Birkinshaw et al., 2016). Exploratory projects are initiated when the environment changes and more radical innovations are required, while exploitative projects are common when the environment is stable. Internal networks, clear visions and long-term focus are important to provide guidance and set direction for this form of ambidexterity (Birkinshaw et al., 2016). Different units and individuals often have different interests and objectives, and good collaborations and internal networks breed discussions and negotiations, whereupon the best way forward can be identified. However, as already mentioned, exploration and exploitation might require different strategies, structures, and processes Chen (2017). Altering between these two modes too often therefore risks damaging existing core capabilities and organizational performance, both in the long- and short-run.

Chen (2017) suggests a combination of all three types of ambidexterity, so called dynamic ambidexterity. Structural ambidexterity should be utilized at the corporate

level and different business units would focus on either exploitation or exploration. On business-unit level, he suggests contextual ambidexterity as this would allow employees to also explore, hence increasing the probability of explorative initiatives also in exploitative business-units. Lastly, sequential ambidexterity should be utilized at project level as exploratory projects can evolve into exploitative projects once a viable business model has been identified.

3.3 Knowledge Management

Today, knowledge is considered as one of the most important strategic resources for firms (Minu, 2003; De Long and Fahey, 2000), and the importance of knowledge and learning in innovation processes is often highlighted in research (Dasgupta and Gupta, 2009; Tushman and Nadler, 1986). According to Dasgupta and Gupta (2009), knowledge and learning are vital for innovation to occur, and effective and efficient knowledge management is hence crucial for innovation work. This aligns with Tushman and Nadler (1986), who describes innovative organizations as effective learning systems that collects and processes data about customers, competitors, and technology. Firms must however also be able to incorporate the knowledge into the organization to generate innovations (Tortoriello, 2018). This requires a deeper understanding of what knowledge is and how it can be created, shared, and used in the organization (Minu, 2003; De Long and Fahey, 2000).

3.3.1 The Concept of Knowledge

Knowledge is not data, nor information, but a product of reflection and experience, which can be at individual, group or organizational levels (De Long and Fahey, 2000). It can also be explicit or tacit; explicit knowledge is codifiable and more easily transmittable, while tacit knowledge is more personal and contextual, such as thinking processes, and hence more difficult to standardize and communicate (Nonaka, 1994). There are also several distinct types of knowledge, such as human knowledge, social knowledge and structured knowledge as mentioned by De Long and Fahey (2000). Human knowledge considers the individual aspects, such as skills or expertise, and can be both tacit and explicit. Social knowledge, on the other hand, is mainly tacit, and consists of collective knowledge within groups. Through effective knowledge sharing within the group, individual knowledge is combined to create a greater, collective knowledge. Structured knowledge considers organizational systems, processes, tools and routines and is explicit. Organizational knowledge considers all knowledge that is embedded in the firm; the knowledge and skills of the employees, processes, structures, firm specific knowledge (suppliers, customers) and industry specific knowledge (markets, competitors).

Knowledge can also be acquired from external sources (Tortoriello, 2018). Tortoriello (2018) distinguishes between industrial knowledge and scientific knowledge; industrial knowledge considers more practical issues within a specific industry, while scientific knowledge is broader, less practical and more likely to present new ideas. Gibbons et al. (1994), on the other hand, mean that traditional, academical re-

search are more linear in terms of knowledge production. Gibbons et al. (1994) also add one additional dimension to this and specify two different kinds of knowledge production in relation to academia:; Mode 1 and Mode 2. Mode 1 considers traditional academical research and is disconnected from the industry as such. In Mode 2, contextual specific knowledge is created by stakeholders in academia and industry combining empirical and theoretical components to target more context specific problems. However, although collaborations with external partners, such as universities, can be very beneficial for acquiring and developing new knowledge, Borjesson and Elmquist (2011) found that creating new knowledge networks was a key challenge (Borjesson and Elmquist, 2011). The new knowledge must first be identified, then new networks built, and new people involved. This gives rise to an issue known as the "not-invented-here syndrome".

3.3.2 Individual Learning

Both explicit and tacit knowledge are very important for the knowledge creation process. As tacit knowledge is not easily codifiable, observing experienced individuals has been shown to be more effective than training through lectures Nadler et al. (2003). It also gives the trainee the opportunity to acquire not only explicit and tacit knowledge (Nonaka, 1994), but also norms (Brown and Duguid, 1991). Another aspect of the formal descriptions of work is that these are abstractions detached from practice (Brown and Duguid, 1991). In fact, Brown and Duguid (1991) found that formal training programs and manuals often differ from actual practices. Hence, learning by only reading instructions and formal descriptions will not give a proper understanding of the system, and without this, processes cannot be engendered nor enhanced. Furthermore, by relying on only formal descriptions, the actual practices might be overlooked, and important implicit knowledge might be forgotten.

Studies have shown that early feedback has a positive impact upon learning (Diehl and sterman, 1995; Gibson, 2000), but that continuous high-feedback specificity hamper exploratory behavior (Goodman and Wood, 2004). In fact, by allowing individuals to act autonomously, an organization can achieve higher flexibility in acquiring, relating, and interpreting information, hence also increasing the possibility of discovering new possibilities and opportunities (Nonaka, 1994). High levels of autonomy, variety and individual involvement will increase intrinsic motivation, whereupon employees become more likely to experiment and be creative (Tushman and Nadler, 1986). Hence, with increased intrinsic motivation among employees, an exploratory behavior is strengthened (Nonaka, 1994).

3.3.3 Organizational Learning

A firm's ability to absorb knowledge and generate innovations does not only depend upon investments in R&D, but also internal knowledge sharing, both between individuals and business units (Tortoriello, 2018; Lei et al., 1999). Nonaka (1994) talks about organizational knowledge creation as a cycle, which is initiated by a socialization mode where knowledge is first shared between individuals, for example by

the creation of teams or fields. By achieving dialogues between the members, tacit knowledge becomes visible and can be communicated. Finally, data and external knowledge are incorporated into the concepts, and through coordination between different stakeholders and organizational levels, as well as documentation of existing knowledge, knowledge is spread throughout the organization. In this way, knowledge spreads from individuals to an organizational level. This knowledge sharing is especially important when data appears to be conflicting and confusing (Nonaka, 1994). Here, boundary spanning collaborations can be helpful in creating a shared understanding. Information asymmetries can also result in individuals not interacting on equal terms, whereupon the knowledge risks becoming one-faceted (Ibid).

Internal knowledge transfer is however not always frictionless and organizational structures and cultures can create barriers to knowledge transfer (Tortoriello, 2018). De Long and Fahey (2000) mention two reasons why individuals would not share knowledge with others. Firstly, individuals will be less likely to share knowledge if they suspect that this incurs a personal risk, and secondly, if they believe it would reduce power. As norms and values shape individual behavior, it is therefore very important to create a culture where conflicts are constructively managed and where different opinions embraced and respected. Furthermore, in addition to the formal structures, there are also informal networks. As informal community of social interaction can span different organizational levels and structures, as well as organizational boundaries, informal information sharing is very important for knowledge creation (Nonaka, 1994). However, although researchers often emphasize the importance of internal networks and collaborations between different knowledge domains, less is known about the social aspects of innovations and what makes individuals more innovative (Tortoriello, 2018).

Knowledge can however also depreciate, not only because of inefficient or faulty information transfer, but also by products and processes becoming obsolete (Argote, 2013). One cause of knowledge depreciation is when information gets lost or is hard to access. High personnel turnover can also cause knowledge depreciation if knowledge embedded in individuals goes lost when they leave the organization or group (Argote, 2013). Relationship-specific assets might also be lost when teams and networks are not complete. However, although individuals who have been at the same company for a long time often are very knowledgeable, they are not very likely to contribute to new knowledge (March, 1991). New employees, on the other hand, has often less knowledge but increases diversity. A higher turnover rate might therefore be beneficial when the task is complex and involves change and innovation, as new employees might bring new knowledge and skills (Argote, 2013).

The effect of a higher turnover rate depends however on the employees' ability to learn and the rate of "socialization of individuals" as mentioned by March (1991). This is defined as the process where new employees are integrated into the company and its organizational procedures and beliefs. When individuals quickly adopt and adapt to the organizational knowledge, the system does not have time to learn from the individual's personal beliefs and knowledge, hence reinforcing exploitation.

With slower learners, on the other hand, the system has time to learn from the new employee, which increases exploration. However, if the turnover rate is high and the new employees are slow learners, the result will be poor exploitation due to the lack of knowledge about the systems and processes.

The integration of new employees also comes with a cost and employing too many new employees might disrupt organizational performance, not only because of the risk of knowledge depreciation (Argote, 2013). Integrating new employees takes time and resources, and teams might have to reorganize when individual skills change. To mitigate the negative effects of high personnel turnover, firms should try to motivate employees to share their knowledge, to capture it in documentation and information system or embed the knowledge into organizational routines and structures (Argote, 2013). However, as previously mentioned, tacit knowledge is difficult to codify, whereupon this type of knowledge is more easily lost when individuals leave the organization (Dasgupta and Gupta, 2009).

3.3.4 Information Security

One important aspect of knowledge creation and knowledge sharing is information security. Innovation and information are interlinked, and important assets companies must protect. Innovation can be protected through several ways with intellectual property rights (IPR) trade secrets, patents, copyright, and design rights (Granstrand and Holgersson, 2015). Information can be related to business processes, customer data, production data or business know how to mention a few things. Apart from protecting a company's information and intellectual property through IPR's, information security strategy and procedures must also be in place (Daswani and Elbayadi, 2021). This as data breaches can be costly by losing reputation or through fines, or by benevolent actors getting ahold of information that might be used for other purposes (Daswani and Elbayadi, 2021). The Mueller report concluded that the outcome of the 2016 US presidential election may have been influenced by foreign actors using a data breach (Daswani and Elbayadi, 2021).

Employee compliance with the security policies in place is important as many of these only works if they are being followed (D'Arcy et al., 2014; Jeon et al., 2020). However, if these procedures are perceived as burdensome or slowing down the work, employees are less inclined to follow the procedures, e.g. if sharing a password with a colleague speeds the work up, they may be more inclined to do so (D'Arcy et al., 2014; Jeon et al., 2020). Moreover, stress caused by security procedures e.g. slowing down work may also cause employees to not comply with these procedures, as they morally detach from the burdens (D'Arcy et al., 2014). In other words, what employees are working with is being protected by information security, but if it is too burdensome, employees may not follow all of these, which is a threat. On the other hand, employee motivation through e.g. autonomy can contribute positively to an employee's inclination to follow procedures (Jeon et al., 2020).

3.4 Project Management

Engwall (2002) lists three common reasons to why innovation projects fail: faulty management (faulty planning, coordination, or technical solutions), environmental factors (prioritization issues, lack of resources, opposition), or unclear goals. The latter is one of the most critical factors as the goals define the project and guide all actions towards the goal. Project management should coordinate activities to ensure that the goal is reached. Initially, vague goals can unite otherwise separated stakeholders and align them towards a common goal. However, although vague goals can set the direction, it offers little guidance regarding required actions. If the goal is more clearly formulated, planning can be improved and knowledge about possibilities, necessary measures and what the project can achieve. However, all information is not known on beforehand, and goals should therefore be considered as guidance and non-linear, to allow the project to evolve as the understanding and knowledge increase.

Exploitative projects are often built upon existing information and capabilities, and intend to solve well-defined problems (Chen, 2017). In these cases, traditional execution processes such as the stage-gate process and waterfall process can be used to improve efficiency and effectiveness. In terms of customers and users, mainstream customers can guide the firm towards exploiting existing market demands. However, for exploratory projects, new information and capabilities are required, whereupon it is not possible to plan the process and define success criteria early on. Therefore, exploratory projects are more likely to benefit from search-oriented, incremental, and iterative processes, for example the learn startup method, design sprints and agile processes. Here, the search for new business models should be directed upon experimentation and continuous feedback from lead customers and users who are ahead of the mainstream customers in terms of exploring new markets. While exploitation might benefit from incentive structures based upon performance, exploration benefits from incentive structures based upon more long-term success and increased experimentation (Chen, 2017). As many of the exploratory projects fails, firms must accept, or even celebrate, early failures (Chen, 2017). This minimizes risk aversion to failures and increases the possibility of employees taking risks and being more experimentative.

Borjesson and Elmquist (2011) investigated a successful innovation project at Volvo that aimed to improve the organization's innovation capabilities. As exploratory activities and new ideas might encounter resistance from the core business, one of the key characteristics were involvement. The project team was quite small but invited and involved other employees in the organization, whereupon the knowledge base, as well as the understanding and support for the project, increased. Four important routes were identified in the project: clearly defined targets, defined technology pathways (identifying promising technologies for the future), experimenting with idea generation and product development, and small-scale market tests for learning. During the project, the team discovered that developing new competencies related to the second route was the most difficult one. This as it required influencing deci-

sion makers and developing new competencies without initial knowledge of how this could be achieved.

4

Case Description

This chapter will describe all aspects deemed relevant for the case. The chapter will first introduce the semiconductor industry and what makes the industry relevant. Secondly, the supply chain in the semiconductor industry is introduced. Lastly, the company and the department are introduced. As mentioned in the methodology chapter, transferability is one of the research criterias for qualitative studies. This involves determining what can be transferred to other studies. To do so, the reader must compare the contextual factors in different cases. In order to determine the transferability when reading a study, thick contextual description is a useful technique. However, as the company is anonymized, some details are kept vague, but nothing that matters is left out on purpose.

4.1 The Semiconductor Industry

In 1965, Gordon Moore, founder of Intel, predicted that for every 18 months, semiconductor components would double the capacity from a certain size of a chip, or that the cost of a certain chip would half the cost of that chip. This was intended as 10-year prognosis but has more or less held true since then. From 1950 onwards, the semiconductor has transformed and changed industry after industry by replacing mechanical parts with microprocessors in product such as mechanical calculators, watches, cameras and telecommunication and the industries supporting these products. This as Gordon Moore's prediction of incredible technological advancements has held true for much longer than the original 10 years. The long and fast development and advancement in semiconductors have however resulted in a highly competitive and fragmentized industry, long lead times and complex manufacturing. (Jörnmark and Ramberg, 2004)

The semiconductor industry was early on characterized by a fast-pace and competitiveness, which led the companies to find new markets and customers aggressively. Moreover, with the high pace of product development and lowered costs, large warehousing became something impossible from a competitiveness perspective, as even half a year of production in warehouse would be expensive with the ever-falling prices of semiconductors and affect the accounting value significantly. (Jörnmark and Ramberg, 2004)

The semiconductor industry has in the past years started to become more consolidated and economics of scale has come to another important aspect to compete

with customers (Burkacky et al., 2021). In 2020, production capacity was utilized to 88% and in the last two decades it has only twice been below 75%, and production capacity has in the last two decades increased with 179%, a yearly average of 4% (Burkacky et al., 2021). The semiconductor industry had a global revenue of US$437.713b, with three major manufacturers having at least 5% of the total market. Intel with US$76.2 has 16% of the market, Samsung with 56.9b 12% and SK Hynix 26.5b amounts to 5.6% (Case Company data). The 20 biggest companies have 74.4% of the market. The remaining 25.6% of the market is shared by 1 500 semiconductor companies, making the market very fragmented. However, the market is continuing to consolidate, and some recent acquisitions are currently under scrutiny by authorities. (Case Company data)

4.2 Supply Chain in the Semiconductor Industry

With these characteristics shaping the high-tech semiconductor industry, it is now characterized by complex production processes, short product life cycles, highly differentiated products and long lead-times (Burkacky et al., 2021). This makes upstream suppliers highly dependent upon accurate forecasts and predictable demand, as even small changes in downstream demand might result in large fluctuations of incoming orders for the suppliers (Sterman and Dogan, 2015). This phenomenon is called the bullwhip effect and heavily impacts supply chain performance as it complicates operational work and planning. One reason to the bullwhip effect is stressful or uncertain environments, as this leads to customers altering their buying behavior. This effect is particularly common in industries characterized by long and volatile lead-times, such as in the semiconductor industry. This complicates operational planning and forecasting, which not only impacts profitability, but also risks the firm's ability to fulfill the commitments to its customers. The bullwhip effect is further amplified by cyclical markets in terms of customer demand, something that is characteristic for the semiconductor industry [internal source]. Customers also demand high flexibility, such as the possibility to make short-term changes in order volumes [internal source]. Another aggravating factor is the "Just in Time" agreements between downstream customers, resulting in customers putting pressure upon semiconductor companies to deliver earlier than the actual lead time (Oner-Kozen and Ehm, 2018). The bullwhip effect is also amplified in uncertain or stressful environments as customers tend to place orders that are larger than the actual demand to create safety stocks, hence reinforcing potential shortages and further destabilizing the supply chain (Sterman and Dogan, 2015).

Due to the reasons mentioned above, semiconductor firms are striving to stay innovative, not only in terms of technology development, but also improved supply chain performance. Three important areas of the supply chains are nervousness (Mousavi et al., 2019), efficiency and resilience (Kumar and Pugazhendhi, 2012). One way to improve these areas is to reduce deviations. This can be achieved by implementing early warning systems that can identify risks, whereupon precautionary measures can be taken to eliminate or mitigate these (Garcia and Fearnley, 2012). An early warning system requires well-functioning and accurate monitoring

methods, forecasting models and effective communication networks. However, due to the complexity of the semiconductor supply chains, developing this kind of system is not an easy task.

To stay competitive and to reduce the impact of the bullwhip effect, semiconductor manufacturers must hence strive to improve the reliability and responsiveness of their supply chains , especially as a complex supply chain makes semiconductor manufacturers highly vulnerable to deviations and disturbances (Hendricks and Singhal, 2005). As this negatively impacts important KPIs such as delivery reliability (DR) and delivery performance (DP), it is of utter importance to reduce and bridge these deviations. Therefore, the supply chain of semiconductors has come to play a significant role in establishing competitive advantages, retaining market shares, and reaching new markets (Jörnmark and Ramberg, 2004).

4.3 The Case Company and Case Department

The case company where the study was conducted is a global semiconductor company. It has employees, production, customers and R&D facilities in various locations around the globe. The company has its own supply chain organization, taking care of several steps in the supply chain as well as developing it. English is widely used for communication within the company, however, positions involving e.g. production and customer contact may use local languages for communication as well.

The study was conducted at the Supply Chain Innovation department, structurally organized within the supply chain organization as a separate department and with connections to the main organization through management and different support tasks to other departments. Many responsibilities fall upon the department, whereas many can be categorized as focused on developing the Supply Chain and foster knowledge creation and dispersion. The department is located in Europe and consists of employees from many different countries, mainly European and other nearby countries. The main language for communication is English and for many of the employees, this is not their first language. The department has around 100 employees, whereas circa 10 of these are hired on long term contracts and the rest of the department consists of students doing internships, writing bachelor or master thesis, or working part time. Internship and thesis contracts are time restricted by maximum 6 months and working student contracts are restricted to that the student must live and study in the country of the department. Different contract types can be combined, but it is most common for a student employee to stay up to a year, as further studies or a full-time position somewhere else is often what happens next. Each month, it is common with 5 to 15 new employees as well as 5 to 15 employees leaving, which means that the department has a quite high employee turnover.

The innovation department is often conducting projects, which relate to other departments. This study has investigated projects in the Early Warnings system within order management. Order management has its own department and experts responsible for the system. The projects students from the innovation department has been

involved in improving the system, finding root causes to issues in the system, explaining the system or finding connections between different systems.
float

5
Results

This chapter will present the findings from the research. First, the unique organizational context of the innovation department is presented, with focus on knowledge sharing, culture and collaboration. The second part will first briefly give the history of Early Warnings, and then cover information about how Early Warnings Projects have been conducted at the innovation department. These results aim to answer the first research question, while the second research question will be responded to in the discussion.

The research questions this study is responding to were the following:

1. In what organizational contexts have the Early Warning projects been conducted?
2. What might be the managerial implications based upon these organizational contexts?

5.1 The Innovation Department

The innovation department is organized as a separate entity within Supply Chain Engineering, where the connection with other departments are mainly through management and support tasks different student members helps out with. The setup of this is most similar to structural ambidexterity. The majority of the employees at the department are students, and as the students usually do not stay for very long, the employee turnover rate is high. Every month, 5% to 15% of the student workers have left the department and similar numbers have joined. This means that within a year, many new members have joined and many have left. There are established ways of how new members are brought into the department and welcomed by peers, and further helped by supervisors. The students are encouraged to be curios and explore new things, to reach out to other members when needed, and to contribute to a positive and helpful culture themselves.

Knowledge sharing is perceived as highly important at the Supply Chain Innovation Department and there are several forums facilitating this. A few times every months, employees have a longer presentation on a topic they have been working on. This can be someone from another department or a student employee presenting their findings from their master thesis. All employees participate in a weekly meeting where the employees can share their progress during the week or reach out to their

colleagues if they need help. There are also biweekly meetings with the different subparts of the department for a more detailed knowledge sharing. As all meeting participants share some form of common knowledge ground and skills, the level of details is higher and they can exchange knowledge to each other directly. The department is also promoting the creation of informal networks. After the weekly meeting, employees are divided into smaller discussion groups and encouraged to talk about other things than work. The interviewees describe how other colleagues with different skills can join projects to form complementary teams. If there are good synergies between different projects at the department, the teams often collaborate.

In fact, the departmental work culture is described as helpful and collaborative throughout all interviews. Many of the interviewees says that they found good support in their colleagues and that they had a lot of colleagues to reach out to if necessary. One interviewee mentions how they supported another colleague in their work, and to ensure that they would be able to help when needed, they gave their private contacts. The helpful and positive environment was also evident for the researchers, and both colleagues and experts were very helpful. Experts contributed by explaining the topic thoroughly and the students in the focus group were generous with time and how they responded the questions. Sometimes experts were very busy, but despite this, they made their best to find time to help.

5.1.1 Informal and Formal Networks

The helpful and collaborative culture is built upon informal and formal networks. As the mentors and supervisors had good overview of the formal organization, they help students to get in contact with different experts and managers in the organization. They sometimes also help the students if external resources are needed, but not provided or prioritized outside the innovation department. The informal networks were created by employees socializing with other employees at the department, and then using their own contacts to find help and guidance. Two of the interviewees mention that collaborations happened by chance. In one of the cases, the interviewee asked a colleague nearby a question in another matter, whereupon they started talking and found out that they might benefit from each other's work. This led to a very beneficial collaboration that lasted for months. In the other case, the interviewee got a lot of help from a colleague that sat next to them, as the colleague turned out to have good knowledge of Early Warnings. Two interviewees had less contacts with knowledge in the topic but did not consider this as a problem as the people involved in the project knew whom to contact if help was needed. The researchers observed a pattern of which of the interviewees had collaborated more. Some of the students that are hired at the department are members of a talent network and already know people at the department and the company. Therefore, the creation of informal networks were initiated already before starting the internships. Furthermore, network events were also frequently organized at the company, whereupon participants were given the opportunity to meet employees from different parts of the company.

5.1.2 IT Security

As all major companies nowadays, the case company has strict information and IT protocols to protect one of their core assets, information. The IT department provides employees with securely configured laptops. Furthermore, all employees must go through security training regularly and additional training material is also provided. The basis for information security is that information is provided on a need to know basis. However, the administrative staff does grant access per default to some general, department specific folders. Many different folders are however provided on a need to know basis, and for new employees, it might be difficult to know that the folders even exists. In order to get access to cloud services, approved software, different local hard drives, reports and databases, each employee must apply for access and motivate why before it can get approved. Many of the databases, reports and software have different access levels, where the base level to be approved for is read access and write access to different parts requires further approval. If access can be justified, it is usually quite smooth to get the access.

There are no general rules prohibiting live collaboration software, such as software allowing multiple participants writing in the same document at the same time. However, such software is not on standard provided and it must be approved by IT before starting to use it. Therefore, live collaboration software is not widely used within the department. Regarding cloud services they must be both provided and approved in order to be allowed to work with. However, students coming to this department are oftentimes used to work with live software in projects, such as Google drive, Dropbox or Microsoft office 365 online, or live sharing of code with e.g. Eclipse. There is one example of a project at the department where team members must update their parts of an excel sheet each week, but as only one person at a time can edit the document, no one else can access that version until it is saved and closed. As they must update the document before a meeting, everyone is given a time slot to update their parts of the document. One way of overcoming this issue could be that employees start a phone call and the one editing in the document shares their screen. It is still only one person that can edit the document, but all participants can at least still see the same screen. The researcher do however perceive these workarounds as nonoptimal as it slows down and limits collaboration.

5.2 The Early Warning System

The Early Warning System is an important step in implementing a new pricing model, and the Early Warning topic is and has therefore been an important topic at the department for many years. During these years, the Early Warning system has undergone several changes as it has evolved to fit the needs of the business. The system is however still not fully utilized and more challenges are to be solved before it can be implemented. Since at least 2012, several projects have worked on solving the current issues of the system, which has evolved the system to the current version. The researchers have observed that there is a general awareness and understanding at the innovation department that the systems are hard to learn

and grasp, as they are complex. Full time employees are given years to learn the systems they are working with, and the students must grasp at least parts of the system with much shorter time.

According to two of the interviewees, Early Warnings are not well-known outside the Supply Chain Innovation Department. One of the interviewees says that when talking to a colleague at another department, the new colleague did not know about the topic. However, they found the project very interesting and concluded that it might be beneficial also for their department. This aligns with the perception of one of the other interviewees. They state that although Early Warnings are highly prioritized at the Supply Chain Innovation Department, "the awareness [of Early Warnings] is still very minimum" outside the department. The interviewee says that this might impact external departments' willingness to allocate resources for Early Warning projects. The interviewee does however emphasize that every department has its own objectives and limitations in resources.

5.2.1 The Early Warning Projects

The interviewees were students with different educational background, but with a common knowledge base in engineering. None of them had previous experiences in supply chain, order management or Early Warnings when they came to the company. As presented in Table 5.1, the students had not been at the company for a long time before joining Early Warning projects. Several of the interviewees describe the topic as complex and two of the interviewees found it difficult to understand the processes and struggled due to the lack of knowledge. One of the interviewees felt like the lack of experience and a long start-up phase slowed down the project. Another interviewee sees it from a different viewpoint and lifts the aspect of contributing with an "outsider perspective".

Table 5.1: Time at the company before joining Early Warning projects.

Interviewee	**Time**
Student 1	1-3 months
Student 2	1-3 months
Student 3	1-3 months
Student 4	6 months
Student 5	1 year

Although the system is complex, the interviewees seem highly motivated to learn and appreciate challenges. The degree of freedom in choosing the direction of the project can be divided into high and low degree of freedom. Three of the interviewees were assigned the projects by their supervisor, and for these interviewees, the degree of freedom in choosing projects is classified as low. For the two interviewees that had a higher degree of freedom, the interviewees were given the chance to find their own direction of the projects. The interviewees were first introduced to the topic by the supervisor, whereupon they could study the subject for some time. This arose inter-

est around the subject, and the interviewees could choose a project within this field. One of the interviewees said that although they had not been at the department for long, nor had a complete picture over the supply chain, studying this subject gave them a feeling of novelty and importance. Another interviewee had a similar experience, but expresses that they found the topic somewhat interesting, whereas the company was more eager to investigate the issue closer. However, although this interviewee was given the opportunity to find a direction that they found interesting, this was not the final project as the direction was changed during the project.

In the beginning of the projects, all projects had clearly formulated, overarching goals. For the three projects that were assigned to the interviewees, the overarching goals were formulated by the supervisor. For the other two, the main goals were set up in agreement by the supervisor and the interviewees. The overarching goals were then divided into smaller subgoals or altered as the project developed, and in this case four of the interviewees felt like they contributed to the goal setting. One of the interviewees said they found the leadership very good, as the supervisor provided guidance and support without pushing for certain directions. They also felt like the goals helped them keeping track of their progress. All interviewees were provided continuous feedback and guidance by their supervisors, and this was perceived this as helpful. However, one interviewee said that they were sometimes asked to add goals and dimensions that were not possible due to the time frame. In this case, the feedback was perceived as somewhat stressful, but the main perception of the interviewee is that the feedback was helpful most of the time, as seen in the quote below.

> "He always gives you an idea or something that helps you to proceed to another goal /. . . / I think he has a thousand things in his head, and you cannot do everything he says."

As the mentors and supervisors had good overview of the formal organization, they helped the employees to get in contact with different experts and managers in the organization. This was highly appreciated by all interviewees. One of the interviewees also lifts the benefits of having someone that was high in hierarchy and influential that promoted and supported the project. When the project ran into issues or needed resources, the manager strongly pushed for the project by also reaching outside the own department. The interviewee perceived this as very helpful, as they perceived it as students have very little influence outside the own department. Not all interviewees did however utilize the opportunity to reach out to managers. During one interview, they say that this might be due to cultural differences, as they were used to a more strict hierarchy where you do not reach out to the managers unless it is inevitable.

In addition to the support from supervisors and other colleagues at the department, several of the interviewees had contact with experts outside of the innovation department. The experts of Early Warnings are located at the Order Management Department and have to a varied degree giving guidance to the students working

on the projects. During the interviews, several of the interviewees state that this was very beneficial. However, some interviewees found it somewhat difficult to get in contact with experts outside the own department. One of the projects was also discarded as the reality differed from the written information. Several of the interviewees also state that is difficult to know what would be beneficial without having real connections to the business. One interviewee says that they cannot proceed with the project without help from experts, as the team lack some business related and domain related knowledge.

For all of the interviewees, knowledge was gathered through both formal and informal information and communication channels. The formal introduction to the area of research differs somewhat between the interviewees, but they have all studied formal introductions and documentations. The information needed for the projects is spread out on different format and platforms and how easily accessible the information has been perceived by the focus group varies. Three of the interviewees got a personal handover and introduction to the field as they joined or took over ongoing projects. This type of personal communication was highly appreciated by the interviewees as this gave them the possibility to ask questions about the system and previous projects. The other two interviewees mostly relied upon the formal documentation, such as iLearnings and internal training courses. When asked how the interviewees found the information, three of the interviewees answer that other colleagues or supervisors guided them or provided them with information. It becomes apparent that all information and documentation are not accessible from one single information channel, but that the information is spread at several different platforms. One of the interviewees states that it is somewhat scattered, but that they knew how to access it. Another interviewee who mainly accessed information through their colleagues, states that they still do not know where to find it. One interviewee said that they got inspired from previous projects in where to find information and that the public folders were an important source of information and inspiration for their own project.

One interviewee perceived current introductions and information as insufficient to give a proper understanding of the system. Another interviewee stated that processes behind the system are relatively unknown. When asked whether the documented information is up to date, two of the interviewees hesitate. One interviewee states that the reality differ from the documented information as the documented information only reflects the ideal. Another interviewee finds the information "more or less" up to date but concludes that completely accurate information is difficult to achieve as processes change continuously.

5.2.2 Inconsistencies in Available Information

When the researchers mapped and studied available information, they discovered that information was not consistent throughout the different sources. The differences could not be explained by the timeline of the development of the system. However, these inconsistencies were not mentioned during the interviews, and the

interviewees seemed quite unknowing about these differences. Some of the differences were also found in descriptions of fundamental concepts and definitions. It is however worth mentioning that some of the differences were not always distinct, but rather nuances of interrelated processes and some of the definitions were closely related. As for the example in table 5.2, almost all definitions are related to different types of confirmed dates, but these confirmations concerns different promises and can be found at different stages of the supply chain.

Table 5.2: Triggers of EW according to different internal sources

Year	Type of documentation	Trigger of EW
2020-2021	Student work	CDD cannot be met
2020-2021	Student work	Change of CMAD
2020-2021	Student work	Change of CMAD
2020-2021	Internal documentation	CRD not met
2020-2021	Student work	Change of CMAD
2020-2021	Student work	Change of CMAD
2018-2019	Student work	Change of CDD
2018-2019	Student work	Change of CMAD
2016-2017	Student work	Change of CDD
2014-2015	Internal documentation	Change in quantity and/or date
2014-2015	Student work	Change of date or quantity
2012-2013	Student work	Mismatch between supply and demand
2012-2013	Student work	Time mismatch or supply mismatch

CMAD (Confirmed Material Availability Date) is for example only for internal use and shows when the material will be available at the distribution centers. CDD (Confirmed Delivery Date), on the other hand, is the officially confirmed date and shows when the customer is promised to the receive the product. As only CMAD is the true trigger of Early Warnings, distinguishing between the different concepts and definitions is important to understand the correct functionality of the system. Although systems change and develop over the years, this is a fundamental functionality of the system which has been constant throughout the years.

The researchers also found differences in descriptions of how the systems was used. One example is whether the Early Warnings were manually or automatically accepted, as presented in table 5.3. In this case, the system has changed. Previously, Early Warnings had to be manually accepted before the change was confirmed in all systems. If an Early Warning was not accepted, there would be a mismatch between two interconnected systems, something that sometimes resulted in an over allocation of products. Therefore, the system was re-designed to automatically accept all Early Warnings. When this happened, the purpose and usage of the system changed. With manual acceptance, customer logistics managers (CLMs) had to control and accept Early Warnings daily. This change was confirmed when the researchers interviewed CLMs and experts in order management who claimed that it was not used, that they did not know about it, or that it was not a part of their daily work.

Table 5.3: Manual acceptance of Early Warnings

Year	Type of documentation	Manual acceptance
2020-2021	Student work	Yes
2018-2019	Internal documentation	Yes
2018-2019	Student work	No*
2016-2017	Student work	No*
2014-2015	Student work	Yes
2014-2015	Student work	No
2014-2015	Student work	Yes
2012-2013	Student work	Yes
2012-2013	Internal documentation	Yes
2012-2013	Student work	Yes

*This is not explicitly stated, but from reading the description in the report, it can be interpreted as there is no manual acceptance of Early Warnings.

There were also differences in how the system was perceived to be used, how often a report is created and what it contains. These differences are presented in table 5.4. Hence, internal documentation serving to explain the system for employees is seemingly on several occasions presenting outdated information and reporting an outdated version of the usage of the report.

Table 5.4: Usage of Early Warning report

Year	Type of documentation	Usage of report
2020-2021	Student work	Checked daily by CLM's.
2020-2021	Internal documentation	Daily EW report
2020-2021	Student work	A list generated with all EW's within the definied time
2020-2021	Student work	Weekly updated list containing that weeks EW's
2014-2015	Internal documentation	Daily handling by CLM's, find root cause/whether it is a fake nEW, resolve and eventually notify customer
2014-2015	Student work	Report documents occurrences of EW. Contains delivery quantities, lastly confirmed delivery, suggested adaptations
2014-2015	Student work	CLM duty to check the report daily and handle the EW's
2012-2013	Student work	CLMs can confirm them or try to find a solution
2012-2013	Student work	CLMs might not accept or will ignore the report

6
Discussion

In the results chapter, the organizational context for the Early Warning system's innovation activities has been thoroughly examined. In this chapter, innovation management theory, knowledge management theory and project management theory, will be used to analyze the organizational context, both as such, but also in relation to the innovation projects. By doing so, the researchers hope to identify possible managerial implications. Hence, the discussion chapter will discuss both of the research questions, which were as follows:

1. In what organizational context have the Early Warning innovation projects been conducted?
2. What might be the managerial implications based upon these organizational contexts?

The structure of this chapter follows the structure presented in figure 6.1. It starts with the organizational context; informal/formal structures, culture, ambidexterity and informal/formal networks. The following section will discuss Knowledge Management; learning, organizational learning and IT security in relation to this. Lastly, it will discuss project management, feedback and guidance within the projects.

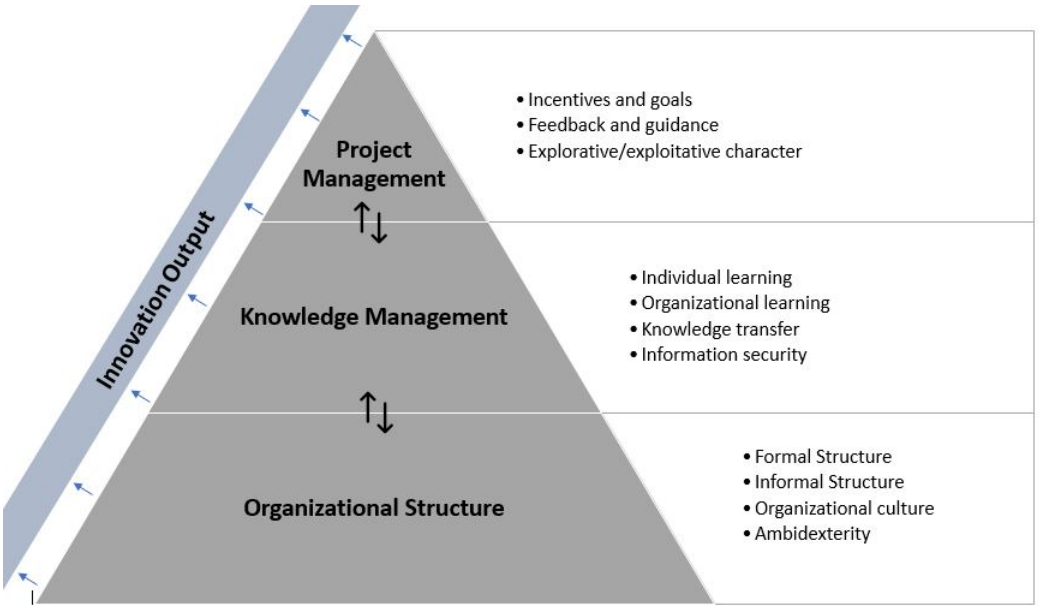

Figure 6.1: Different levels and factors that frame the organizational context and impacts innovativeness.

6.1 Organizational Context

This section starts with a discussion relating to the the organizational structure and ambidexterity and the related topics of exploration and exploitation. After this follows discussion of the the culture and informal and formal networks, which are a part of the organization.

6.1.1 Organizational Structure and Ambidexterity

Exploitation is about developing activities and strategies related to efficiency, optimization and implementation to improve performance in short-term. Exploration, on the other hand, is more about research and risks, and is characterized by uncertainties. Exploration strives to achieve new insights and directions in the long-term. Different strategies can be used to achieve an ambidexterity. One example is structural ambidexterity where exploratory activities are separated from the ordinary organization.

At the case company, the innovation department is partly separated from the rest of the organization and the setup is therefore similar to structural ambidexterity. During the research, some common issues with structural ambidexterity were identified. Firstly, an innovation project conducted at the department did not receive adequate help from the IT department when needed. The issue did not seem to have been prioritized by the IT department and they did not assist in this matter. Unfortunately, it was impossible to finalize the project without the expert help from internal developers at the IT department. Due to the differences between the two departments, it is unlikely that the requests got rejected due to internal competitiveness. Instead, the lack of assistance from the IT department might be due to one of the issues brought up by Smith's et al. (2010). Exploration and exploitation oftentimes compete for resources and as exploitation is in general more certain and acute, exploitation is often prioritized. As dismissing the requests of this project did not mean any direct impact upon current business, other, more acute projects might have been prioritized by the IT department. This is also related to the findings presented by Amabile et al. (2014), as a helping environment can only be fostered if employees and departments have enough time to help.

Another issue related to ambidexterity is that loose connections to other departments and real business situations might make it more difficult to eventually implement the innovation as the commercial viability would not be known outside the innovation department. This was however not the case for the early warning projects as they were not about to get implemented but rather in the development phase. Loose connection to other departments could however impact the helpfulness of external departments as they might have less understanding of the value of a proper early warning system, and hence not prioritize it. Two of the interviewees stated that early warnings were quite unknown outside the innovation department and order management department. This was also mentioned as one possible explanation to why the early warning project did not receive as much help as needed.

If there is weak connections to the external organization, this might indicate that there could be issues once the innovation is to be implemented, or when external help is required. Another aspect of this problem is if exploitative initiatives have weak connections to the external organization and in particular to the employees or departments that are about to use the innovation. Weaker connections might risk making exploitative initiatives less beneficial for the organization due to low knowledge about actual processes and needs. Several of the students felt like their lack of understanding or weak connections to the "real" organization made it difficult to know how to create value for the organization as they did not know about what challenges the company was facing. If the improvement and development of early warnings can be considered as incremental innovations and the projects of an exploitative character, this might risk the quality of the final results. Several differences were noted in the different projects, and this could be an effect of low knowledge or understanding of the systems. If this is the case, this might result in inadequate exploitation.

On the other hand, structural ambidexterity allows the students to focus on their explorative projects, without having to manage their time between these and exploitative projects with immediate needs. Moreover, in their day to day situations they do not have to deal with the conflicts of interest that is inherent between exploitation and exploration, the complexity of the issue is instead delegated to senior management.

One way of overcoming the difficulties with structural ambidexterity is to pursue contextual ambidexterity. In this case, the innovation department would conduct both explorative and exploitative projects. This would however require good knowledge about the businesses and systems, something that might be difficult due to the rapid personnel turnover. This is further amplified by the low initial knowledge about supply chains, order management and Early Warnings among the new recruits. Another aspect of this is that the innovation department is about pursuing exploration. In order to achieve contextual ambidexterity for the organization, the innovation department's tasks and employees would be integrated into other departments, such as the order management department, and the innovation department would no longer exist. This could be done by e.g. still employing student employees within the different departments, and some of the tasks of the students would be similar to these of the innovation department.

Contextual ambidexterity solves some issues and creates other issues. On the one hand, it helps resolving the problem of isolation, as the same persons dealing with the business day to day are also working with exploration of future opportunities. However, is also involves facing complex conflicts regularly. As aforementioned, there is a high employee turnover embedded in design of the department, as student workers are eventually finishing their education and internships and theses are time limited. Moreover, when interviewing student workers about their projects in Early Warnings, it became apparent that the task of learning the system is complicated and time-consuming, something some students struggles with. Combining a high

employee turnover, meaning that a single employee might not stay as long as year, and complicated system as a baseline in the systems, might be too much complexity already, and it is not ideal to add another complicated task.

For projects with explorative character, the organizational setup of the innovation department is not an issue and the general setup with structural ambidexterity can be kept. However, for projects with exploitative character where e.g. knowledge of specific system is useful, it is probably good to focus on strengthen the weaknesses of the organizational setup. This can be dealt with in several ways, such as defining a small scope for projects which would require less knowledge of the system or by utilizing strategic internships.

6.1.2 Organizational Culture

The culture at the company and the department is perceived as helpful, collaborative and inclusive. As stated by Amabile et al (2014), projects benefit from a helping culture. At the innovation department, employees are encouraged to help each other and reach out to colleagues when facing obstacles, something that is faciliated by management who directs the students to both colleagues and experts. Secondly, the management seems to have found a good balance in encouraging and directing employees towards becoming a part of the helpful culture, which is a difficult task. One aspect brought forward by Amabile et al. (2014), is trust. In fact, the study conducted by Amabile et al. (2014), showed that employees ranked trust together with accessibility as most important when receiving help. By fostering a helping environment in all levels, employees will be more likely to ask for help and less afraid to expose their weaknesses. The aspect of trust is considered as highly successful as all of the interviewees were very positive towards asking for help and also helping their colleagues. Considering the high employee turnover rate and the lack of experience and knowledge of supply chains and order management among the new employees, a helping climate might be even more important to improve the socialization rate. Another aspect of this is the accessibility, but at the moment, there are no persons using or working with the Early Warning systems at full time at the innovation department. Hence, there are no experts in the field at the department, and most of the individuals with knowledge about the system have the same background, that is, trying to improve a system they do not actively use in their daily work.

Another important aspect of achiveing a helping culture is that employees must not be overburdened with tasks, as accessibility is an important aspect when asking for help Amabile et al. (2014). During this research, the researchers got access to experts and received a lot of help from the colleagues at the innovation department, so from this perspective, employees do not seem to be overburdened. However, as previously mentioned, some projects experienced difficulties when trying to gain help from an external department. It is difficult to find a balance between workload and having the time to help, as it might only on occasions create value for projects with uncertainty. It is easier to prioritize tasks that are immediately value-creating, as usually is the case for exploitative projects. However, due to the nature of ex-

plorative projects, the outcome is more uncertain, but has potential in creating value, sometimes more than in exploitative projects. Herein lies the uncertainty of innovation, and the hard part to manage.

6.1.3 Informal and Formal Networks

The importance of formal networks and structures are mentioned by several interviewees. One of the interviewees stated that having a mentor in a "higher hierarchy" made it easier to get resources and accesses as students otherwise have very little influence. This also made the project more prioritized not only in the own department, but also in other departments.

As mentioned by Tsai (2002), informal lateral relations are important as knowledge sharing is a social process. Social interactions between individuals and departments increase trust and fosters collaborations, whereupon knowledge sharing is enhanced. These informal networks become apparent in several of the interviews. One of the interviewees talks about a "snowball effect", where they got redirected until they reached the right person. Another interviewee says that although they did not have a lot of connections to experts in the organization, the people involved in the project knew whom to contact if help was needed. For two or the projects, the interviewees met colleagues by chance, whereupon they started to collaborate as they realized that they could find synergies between their fields.

The researchers have observed that an informal network might be beneficial for students. However, it has been of varied degree the students have managed to create their own informal networks, especially for those rarely at the office or not knowing other members of the department beforehand. Although the department is providing some opportunities for getting informal networks through online gatherings, it might be beneficial too look into this further and provide more occasions for this. Another aspect of this is that it might be beneficial to also further utilize the network of previous student members of the department which are now working as full-time employees. They might be more likely to help the current students of the members, as they remember their own situation, and may be happy to stay in touch with old colleagues. This could be utilized by arranging further gatherings with both current and old members of the department.

6.2 Knowledge Management

Key to innovation is knowledge management, how the individuals and the organization learns and how the organization supports this by feedback and guidance. This section starts with outlining learning, followed by organizational learning and lastly feedback and guidance.

6.2.1 Individual Learning

According to Seely, Brown and Duguid, formal training and manuals might not be enough to learn a system as formal documentation often differs from reality and the actual practices. One reason mentioned by Argote (2013), is that processes and products can become obsolete. Another aspect mentioned is that implicit knowledge is not easily captured by formal descriptions. If a firm chooses to rely upon formal documentation for learning, they must ensure that this information is non-ambiguous and updated. However, when studying the available information, it became clear that the official information and the results from the projects differed. Some possible explanations to these differences might be outdated information sources, not updated documentation and ambiguous information. The discrepancies also risk affecting the trust in the information, as it difficult to validate trustworthiness. The consequences of inadequate or insufficient information depends on what the information will be used for. If it is to increase the understanding of the system in a broader sense, it will probably not matter. On the other hand, if the reader will use the information to develop the system, for example to find root causes of Early Warnings, there is a risk of misunderstandings and inadequate solutions. Using the wrong definition of the trigger will for example affect the hypotheses of root causes, whereupon the actual root causes are missed. However, as the system is highly complex and in some aspects relatively unknown, it is unclear whether this has impacted the results in previous projects.

Systems develop and change with time, and extensive resources might be required to keep it updated. The researchers therefore argue that a closer connection to experts in the field might reduce the risks related to outdated or ambiguous information. Some of the interviewees had close contacts with experts at other departments, while others lacked this collaboration or exchange of information. For the others, mainly formal documents were used for learning. Without previous knowledge it is difficult to know whether the information about existing systems is correct or up to date, and it is hence less likely that the students will question available information.

A closer connection to the organization would also facilitate tacit knowledge transfer and provide nuances or know-hows about the system that are not possible to capture with formal documentations. In addition to this, reducing the amount of new knowledge students must acquire before involving in projects might improve the outcome. Not having to learn everything from scratch would give the students more time to learn about relevant, actual processes. This could be achieved by recruiting students with background knowledge within supply chains, order management and Early Warnings. Although this might reduce the novelty of their ideas, it would also reduce the risk of inadequate exploitation due to lack of knowledge. The firm could also consider narrowing down the projects, whereupon the students can become experts in certain parts of the system, rather than engaging in the entire system.

A high employee turn-over also entails a risk of knowledge going lost once the students leave the department. This goes for both individual knowledge and social knowledge. Explicit knowledge can often be retained through formal documenta-

tions. Tacit knowledge is however not easily codifiable, and to reduce the risks of losing this kind of individual knowledge, the department should encourage knowledge sharing to increase the probability of organizational learning. Personal communication, such as personal handovers, has been proven to improve learning in terms of also tacit knowledge. This might also reduce the risks of reduced social knowledge when one team member is replaced with someone else.

6.2.2 Organizational Learning

All of the interviewees were students without prior knowledge about practical aspects of supply chains and Early Warnings but with strong connections to academia. Hence, incorporating them into the firm could result in new ideas given thought of the academical knowledge of the students. As mentioned by Tortoriello (2018), academia is less likely to be path dependent and more likely to present new knowledge. The students are neither indoctrinated nor familiar with current processes, or even the industry, whereupon they increase variation and can contribute with an "outsider perspective" as mentioned by one of the interviewees. Hence, by combining the industrial knowledge of the firm with the scientific knowledge of the students, more context specific problems can be targeted, such as Early Warnings. This could lead to increased organizational learning, if the organization embraces the diversity and learns from the students. Although the students are less knowledgeable than the existing employees, this could increase diversity and bring new skills and knowledge into the organization. According to March (1991), this might be particularly beneficial when the task is complex and requires innovative thinking, as like in the case with Early Warnings. In fact, the complexity of Early Warnings is the reason for many of the Early Warning projects. However, as students only stay for a shorter period of time, the rate of employee turn-over is high. Although new employees might bring new knowledge into the company, the high employee turn-over rate is also an aggravating factor, making it a threat to the projects run at the department. The reason is twofold; firstly, the students might not have time to develop a basic understanding of the system and secondly, the organization might not have time to learn from the students.

The first aspect becomes visible during the interviews as several interviewees describe Early Warnings as highly complex, and some interviewees say that they struggled due to the lack of understanding of the system. One of the interviewee also says that the project required a lot of new knowledge, and that the learning process slowed down the progress. If students fail to develop a basic understanding of the system, this might result in inadequate exploitation, limited value creation or even faulty solutions. To learn about and understand the system, all of the interviewees took part of the firm's structured knowledge, such as organizational systems, processes, tools and routines. As some of knowledge is explicit, it can be saved as formal introductions and documentations. However, although formal documentation might provide a good, first introduction to the task, relying too much on formal training tools and documents pose a risk. Firstly, tacit knowledge is not easily codifiable, whereupon important aspects of the system and practices might be overlooked. Sec-

ondly, written documentation is only a reflection of reality, and might differ from the real practices, as mentioned by Seely et al. (1991). This is also something that is brought up during the interviews. For the interviewee that did not get a personal hand-over, nor got in contact with a lot of experts, the initial project had to be discarded due to the differences between the formal descriptions and reality. Hence, not maintaining formal documentation and having weak connections to the actual practices, pose a risk of misunderstandings and skewed results. Another aspect of personal hand-overs and closer connection to experts and colleagues is that this also facilitates the socialization process. In this way, new employees not only acquire implicit knowledge, but also get familiar with the organizational culture and become part of formal and informal networks. Hence, by quickly integrating the student into the department, the student can also benefit from and contribute to the social knowledge. There is however a trade-off between organizational learning and fast learners. If a student is a fast learner, the student will quickly adopt and adapt to the organization, but there is a risk that this decreases the aspect of novelty and variation, which would reduce the chance of innovative thinking and organizational learning.

As the second aspect indicates, employees must stay long enough for the organization to learn from them, but many students do not stay for very long. It is therefore very important to encourage knowledge sharing and document achievements and insights in order to retain the knowledge in the organization and increase the probability of organizational learning. Knowledge sharing is highly encouraged at the department and achieved through several formal routines. When the students are still employed at the department, they participate in formal meetings where all participants share and discuss their progress, whereupon knowledge is diffused among the employees at the department. Employees can also share their findings through colloquiums, which are sent live, recorded and uploaded on the internal iShare. To save explicit knowledge, students are encouraged to keep non-classified achievements, insights and results in public folders that everyone at the department can access also after the student has left. These kind of folders served as inspiration for at least one of the interviewees. Reports and theses are also published at the internal web page, so that future students can access previous results. It is however not easy to codify tacit knowledge, hence, there is a risk of missing knowledge when the students leave. This can be tacit aspects of the human knowledge, such as individual skills and expertise. It can also be the the social knowledge, which is mainly tacit and hence very difficult to capture in formal documentations. This knowledge is the collective knowledge within groups, which might be affected when team member leaves.

Despite the risks of a rapid socialization process, the high employee turn-over rate makes it necessary as the students must form a basic understanding fast in order to create value for the organization. It is therefore important to facilitate the socialization process and quickly build a good knowledge base.

6.2.3 Collaboration and IT Security

Information security and IPR's are incredibly important to protect a company's core assets. However, innovation often requires collaborations, and this should hence be facilitated by the management. This is perceived as especially important when more of the work is done remotely, such as in the case of home office. As close collaborations are encouraged by management, adequate methods to collaborate must also be made available for the employees. In one of the cases, the interviewee stated that the lack of adequate live collaboration tools hampered collaborations during the project. Live collaboration tools might however entail a risk of IT leakage, and this security aspect must of course be considered. Due to the increasing usage of live collaboration tools, the students might be used to use certain types of tools. If the company does not offer adequate live collaboration tools, there is a risk of employees using external tools to facilitate collaboration, which would increase the risk of data leakage. However, not offering any live collaboration tools or implementing non-user-friendly live collaboration tools would impede collaborations. Employees might therefore break information security rules to achieve efficient collaboration. As found by D'arcy, Herath and Shoss (2014), too burdensome procedures make employees more inclined to not comply with the security procedures. To reduce the risks of inefficient collaborations or data leakage, it might be a good idea to look into further ways to improve collaboration.

The security aspect is also valid for accessing information. At the moment, the firm provides information on a need-to-know-basis, but without previous knowledge about the organization or department, it might be difficult to know where to find the information, whom to ask for access, or even that it exists. The internal information is quite open for the employees at the innovation department, as a lot of the research is published internally. However, although the information might be available, the new employees must be aware of its existence and know where to find it. During the research, the researchers identified one risk. As some of the information is provided upon a need-to-know basis, the new employees must actively ask for permission to access this information. If the new employees do not know that this information exists, they will not ask for it and hence not get access to the information. This might result in reduced knowledge and understanding. Senior members should be aware of this gap, and help bridging this, which they are already doing by providing guidance in terms of where and how to find information, as well as connecting the students with relevant people. This is especially important as the employee turnover rate is high, and new employees require more intial guidance. It might therefore also be beficial to try to retain employees somewhat longer as they will develop their knowledge about the department, organization and its systems. They can also help introducing new employees to the current setup, such as show where information can be found and what information that is available.

6.3 Project Management

As the Early Warning system is based upon current systems and is to improve current supply chain, as well as provide increased knowledge and understanding of deviations in order confirmations, it could be argued that Early Warning projects are more of an exploitative character, rather than explorative.

As the system is highly complex and several of the Early Warning projects aim to increase the understanding of the system, or to improve existing processes, extensive knowledge about the system is required. However, the students often lack previous knowledge about supply chain, order management and Early Warnings, and several of the students mention that their lack of knowledge impacted the development of the project. If the Early Warning projects can be said to be more exploitative, this initial lack of knowledge might result in inadequate exploitation. It would therefore be very important to facilitate the socialization process and to ensure quick learning and increased understanding of the system among the students. This would however also risk the innovativeness among the students, as they would quickly get indoctrinated and possibly also impacted by eventual current path dependencies. According to the researchers, this risk is however outweighed by the benefits from a faster socialization process. As stated in the results, the researchers found discrepancies in the available information, which entails a risk of confusion and inadequate solutions. This risk is also assumed to be amplified if the individuals have limited knowledge and understanding of the system, as the probability of them questioning the information would be lower.

The researchers also suggest keeping the projects clearly defined and niche, so that the students have time to acquire enough knowledge about certain parts of the systems. These kinds of projects might also require more extensive guidance and support than more explorative projects where the outcome or objectives often are more unclear and undefined, and hence gives more room for interpretations, innovativeness, and creativity.

For exploratory projects, less focus should be put upon formalizations and standardizations, and instead, more emphasis should be put upon research and trial and error. To strengthen explorative behavior and increase innovativeness, the supervisors must provide autonomy and promote open communication. This was the case for most of the interviewees, and there were signs of intrinsic motivation, such as a desire to learn, challenges and novelty. However, although the students are willing to learn, the researchers suggest cross-functional work or collaborations with other employees if the student lack basic knowledge or skills in certain areas. For example, one of the students had to learn an entire new programming language to achieve their task. Due to the high employee turn-over, this kind of basic learning might hamper the development of the project. Instead, students should be involved in projects related to their field of expertise, to ensure that the external knowledge can be utilized. Another aspect of the exploratory projects is to evaluate whether close connections with the organization is necessary. As some innovations might be con-

troversial, structural separation might reduce the risk of individuals or departments trying to counteract the new initiatives. However, as the Early Warning system is not controversial but would rather improve and enforce existing systems, this is not perceived as necessary. The researchers therefore recommend spreading awareness of the Early Warning projects also externally, as this might increase the possibility of other departments providing their resources. Currently, there is a low awareness of the projects outside the innovation department, and some of the interviewees state that this might be one of the reasons why their requests were not prioritized by another department. By increasing transparency and improving collaborations with other departments, the Early Warning projects might gain more acknowledgement also outside the innovation department.

The department already sometimes offer internships split between different departments and cooperates with other departments in several ways. This is something that could be further utilized strategically for innovative projects with an exploitative character. This by having students at other departments where exploitative innovative projects are to be run. Either by letting a student worker spend all their time at a specific department first, or by splitting their time between the relevant department and the innovation department. For the Early Warning projects this is relevant both to the IT department and the order management department. This would allow the student to learn of the environment they are in and get further contacts at the relevant department. This solution would still keep the structural ambidexterity setup of the innovation department, but strengthen some weaknesses related to the department setup.

6.3.1 Feedback and Guidance

The interviewees in the focus groups seems to all have some degree of autonomy in their projects and been given some degree of guidance or direction. Herein lies a tricky balance. The literature seems to in general encourage autonomy for individuals, as this is important for instrinsic motivation. However, the right amount of feedback must be given at the right stage of a project. Early on in projects, feedback pointing out direction is beneficial, and later on, less guiding feedback is beneficial. It cannot be concluded from the interviews whether the received feedback has followed this pattern. For one of the cases, the purpose and the intent of the projects have been clearly defined. There could be a slight tendency that this project had clear feedback and guidance in the beginning, and that this held true for the entire process. In another case, there was some degree of guidance of the direction in beginning but still autonomy, and in the later on the autonomy was kept as the guidance was not defining the direction. A suggestion for management and supervisors to try and experiment with hence is to give clear direction in the beginning, and more open feedback later on, and to evaluate and discuss with the students if this is helpful or not.

It is however questionable whether the theory of feedback is applicable in this environment, given thought of the combination of a high employee turnover rate and lack

of related knowledge among new employees. Several employees also state that they found it difficult to know how to create value for the company. It might therefore be so that continuous feedback plays a bigger role in guiding the students towards the goals, to ensure that they will not go astray. However, it is also true that explorative projects require new, innovative thinking and with too strict guidance, this aspect might be lost. If this is the case, the main idea of incorporating new employees into the organization.

7
Conclusion

In this chapter, the researchers will present their conclusions and answer to the two research questions:

1. In what organizational context have the Early Warning innovation projects been conducted?
2. What might be the managerial implications based upon these organizational contexts?

The organizational context for the researched projects of the department were somewhat limited connections to the main organization and experts, limited knowledge about supply chain, Order Management and Early Warnings among the new recruits and high employee turn-over. The limited connection to the rest of the organization might be because of the structural separation, which the researchers argue reminds about strucutral ambidexterity. This might strengthen an explorative behavior and improve innovation output as it makes the department more independent from the other departments. However, in the case with early warnings, a closer connection to the main organization might be beneficial as Early Warnings are closely related to the existing systems.

The organizational culture was helpful and collaborative, and helped mitigating some of the issues with a high employee turn-over as the students could help, learn from and support each other. This positive effect was further amplified because of the formal and informal networks at the department. For the formal networks, the supervisors helped the students to find information, get help both internally and externally, get resources or get in contact with epxerts. The latter was particularly important due to the intially limited knowledge about Supply Chains, Order Management and Early Warnings among new employees. The department also provided good possibilities for knowledge sharing, and encouraged students to share their knowledge and progress with the others. In this way, individual knowledge could be secured and reduce the risk of knowledge going lost when employees leave. Good, formal communication channels also strengthened the informal networks, as the students got an overview of the other students, such as what their expertise was and what they were working with. Informal networks were also created by chance when colleagues met at the office, something that speaks in favor of working at the office and not remotely. Because of these informal networks, the students could approach relevant colleagues if they needed help or wanted a collaboration. Another important part of the networks was getting access to information. In this matter, both

the supervisors and other students were helpful in directing and informing about information sources, hence furhter improving knowledge sharing.

Innovativeness is in the end about developing new capabilities and knowledge, and incorporating this into the organization. Knowledge management is therefore extra important in environments with high employee turnover, as this requires good strategies to both create, share and save knowledge.

There were both positive and negative aspects of the high employee turnover. One positive aspect with the fast employee turn-over rate was that the company could acquire external knowledge and get a closer connection to academia. However, for the organization to learn, the individuals must stay long enough for the company to learn from them. It is also important that the students do not adapt too fast, as this could mean that they would not transfer their existing knowledge but rather learn how this organization works. In that case, the existing structures would be reinforced. However, due to the fairly short employments, the researchers conclude that the benefits of a fast socialization rate outweighs the negative aspects. To reduce the start-up phase, the company could therefore hire students with some previous experience within supply chain, Order Management or Early Warnings. Another option could be to strategically place the students at relevant departments. By doing so, the department would also get access to some external knowledge from other departments, and create informal networks that reaches also outside the own department. This would help mitigating the negative aspects of the structural ambidexterity. External departments might also get a better understanding of Early Warnings, see the value of it and start prioritizing it.

Another aspect of the high employee turn-over rate is that knowledge might get lost when the individuals leave the department. To reduce the risk of knowledge depreciation, the company must ensure that the knowledge is documented and stored before the individual leaves. Although there is a good system for this, some of the knowledge might get lost anyway as all knowledge cannot be codified and saved as formal documents. There is also a risk of misunderstandings if the information is unclear or ambigious. During the research, the researchers found differences in existing information. One possible reason is that tacit knowledge cannot easily be saved in formal documents. Another explanation could be that the information is outdated, or limited understanding of the system. The researchers conclude that it can be a combination of both. Firstly, limited understanding of the system makes it less likely that new recruits will question the information. The combination of high employee turn-over, limited initial knowledge about systems and processes, and a complex system increase this risk. This is further amplified by weak connections to experts, as these will not confirm, neither reject the information. This means that the students must rely upon the formal documents, without being able to control or know whether it is up to date, or if they have misunderstood something. Hence, if the company relies upon formal documentation, they must ensure that it is up-to-date and non-ambiguous. Another possible way to mitigate these risks would be closer connections to experts which can bridge the gap between documentation and reality.

Furthermore, this gap can be further reduced by eliminating time gap in between connected projects. This enabels personal handovers and tacit knowledge sharing. Finally, the company could try to keep students connected longer at the department, as this could further help knowledge sharing by utilizing informal networks.

The Early Warning projects have both explorative and exploitative elements. Supervisors embraced autonomy, creativity and trial and error, hence giving the projects an explorative character. Explorative projects might benefit from a high employee turnover as it might result in acquiring new knowledge. It might also benefit from the structural separation if the project has controversial aspects. However, as the projects targeted existing systems, this indicates a more exploitative character of the project. There is a risk of inadequate exploitation if a a exploitative project is performed in an environment characterized by high employee turn-over, limited knowledge among the new recruits and limited connections to the main organization and experts.

Hence, the researchers conclude that in a high-turn over environment, the organization must have good strategies and routines to ensure good knowledge sharing and knowledge storing. Formal and informal networks are important to increase knowledge transfer and connect new individuals with other employees. Managers and project leaders must evaluate the projects and decide whether they are of explorative or exploitative character, as these require different strategies. To maximize the output of an exploitative innovation project, good connections to the ones that will use the innovation and involved departments are important, while an explorative project might benefit from less connections. If a firm relies upon formal documentations, it must be non-ambigous and up-to-date, something that is difficult when the systems or solutions are highly complex. In this case, closer connection and continous collaborations with experts will reduce the risk of misunderstandings or non-optimal solutions.

Bibliography

Amabile, T., Fisher, C. M., and Pillemer, J. (2014). Ideo's culture of helping. *Harvard Business Review*, 92(1/2):54 – 61.

Amin, M., Nørgaard, L., Cavaco, A., Witry, M., Hillman, L., Cernasev, A., and Desselle, S. (2020). Establishing trustworthiness and authenticity in qualitative pharmacy research. *Research in Social and Administrative Pharmacy*, 16:1472–1482.

Argote, L. (2013). *Organizational Learning. [electronic resource] : Creating, Retaining and Transferring Knowledge.* Springer US.

Assink, M. (2006). Inhibitors of disruptive innovation capability: A conceptual model. *European Journal of Innovation Management*, 9(2):215–233.

Bell, E., Bryman, A., Bryman, A., and Harley, B. (2019). *Business research methods.* Oxford University Press.

Birkinshaw, J., Zimmermann, A., and Raisch, S. (2016). How do firms adapt to discontinuous change?. *California Management Review*, 58(4):36 – 58.

Borjesson, S. and Elmquist, M. (2011). Developing innovation capabilities: A longitudinal study of a project at volvo cars. *Creativity and Innovation Management*, 20(3):171.

Bower, J. L. and Christensen, C. M. (1995). Disruptive technologies: Catching the wave. *Journal of Product Innovation Management*, 1:75–76.

Brown, J. S. and Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovating. *Organization Science*, 2(1):40 – 57.

Burkacky, O., Lingemann, S., and Pototzky, K. (2021). Coping with the auto-semiconductor shortage: Strategies for success.

Chandy, R. K. and Tellis, G. J. (1998). Organizing for radical product innovation: The overlooked role of willingness to cannibalize. *Journal of Marketing Research (JMR)*, 35(4):474 – 487.

Chen, Y. (2017). Dynamic ambidexterity: How innovators manage exploration and exploitation. *Business Horizons*, 60(3):385 – 394.

D'Arcy, J., Herath, T., and Shoss, M. K. (2014). Understanding employee responses to stressful information security requirements: A coping perspective. *Journal of Management Information Systems*, 31(2):285 – 318.

Dasgupta, M. and Gupta, R. (2009). Innovation in organizations. *Global Business Review*, 10(2):203 – 224.

Daswani, N. and Elbayadi, M. (2021). *Big Breaches ; Cybersecurity Lessons for Everyone.* Apress.

De Long, D. W. and Fahey, L. (2000). Diagnosing cultural barriers to knowledge management. *Academy of Management Executive*, 14(4):113 – 127.

De Matos, H., Dias, A., and Bagno, R. (2019). Incremental and 'radical' innovation in an emergent country automotive subsidiary: is there any organisational ambidexterity there?. *International Journal of Automotive Technology and Management*, 19(3-4):206–228.

Diehl, E. and sterman, J. D. (1995). Effects of feedback complexity on dynamic decision making. *Organizational Behavior Human Decision Processes*, 62(2):198.

Engwall, M. (2002). The futile dream of the perfect goal. *Beyond Project Management: New Perspectives on the Temporary Permanent Dilemma*, pages 261–277.

Garcia, C. . . . and Fearnley, C.J. (2, . . (2012). Evaluating critical links in early warning systems for natural hazards. *Environmental Hazards*, 11(2):123–137.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., and Trow, M. (1994). *The New Production of Knowledge : The Dynamics of Science and Research in Contemporary Societies.* SAGE Publications.

Gibson, F. (2000). Feedback delays: How can decision makers learn not to buy a new car every time the garage is empty?. *Organizational Behavior and Human Decision Processes*, 83(1):141–166.

Goodman, J. S. and Wood, R. E. (2004). Feedback specificity, learning opportunities, and learning. *Journal of Applied Psychology*, 89(5):809 – 821.

Granstrand, O. and Holgersson, M. (2015). *The Wiley Blackwell Encyclopedia of Consumption and Consumer Studies.* John Wiley Sons, Ltd.

Hendricks, K. and Singhal, V. (2005). An empirical analysis of the effect of supply chain disruptions on long-run stock price performance and equity risk of the firm. *Production and Operations Management*, 14:35 – 52.

Jeon, S., Son, I., and Han, J. (2020). Exploring the role of intrinsic motivation in issp compliance: enterprise digital rights management system case. *Information Technology People.*

Jörnmark, J. and Ramberg, L. (2004). *Globala förkastningar : en historia om råolja, mikrochips och bolaget Altitun.* Studentlitteratur.

Kim, W. and Mauborgne, R. (2005). *Blue Ocean Strategy.* Harvard Business School Press, Boston.

Kumar, R. and Pugazhendhi, S. (2012). Information sharing in supply chains: An overview. *Procedia Engineering*, 38:2147–2154.

Lei, D., Slocum, J. W., and Pitts, R. A. (1999). Designing organizations for competitive advantage: The power of unlearning and learning. *Organizational Dynamics*, 27(3):24.

Lincoln, Y. S. and Guba, E. G. (1985). *Naturalistic inquiry.* Sage Publications.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1):71 – 87.

Minu, I. (2003). Knowledge sharing in organizations: A conceptual framework. *Human Resource Development Review*, 2(4):337 – 359.

Mousavi, B. A., Azzouz, R., Heavey, C., and Ehm, H. (2019). Simulation-based analysis of the nervousness within semiconductors supply chain planning: Insight from a case study. *2019 Winter Simulation Conference (WSC), Winter Simulation Conference (WSC), 2019*, pages 2396 – 2407.

Nadler, J., Thompson, L., and Van Boven, L. (2003). Learning negotiation skills: four models of knowledge creation and transfer. *Management Science*, 49(4):529.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1):14 – 37.

O'Connor, G. C. (2008). Major innovation as a dynamic capability: A systems approach. *Journal of Product Innovation Management*, 25(4):313 – 330.

Oner-Kozen, M. and Ehm, H. (2018). Dynamic price and lead time quotation under semiconductor industry related challenges. *2018 Winter Simulation Conference (WSC), Winter Simulation Conference (WSC), 2018*, pages 3386 – 3396.

O'Reilly III, C. A. and Tushman, M. L. (2011). Organizational ambidexterity in action: How managers explore and exploit. *California Management Review*, 53(4):5 – 22.

Pregmark, J. and Fredberg, T. (2018). Organizational renewal: When the seed changes the soil. *Research on Organization Change and Development*, 26.

Rogers, E. M. (2003). *Diffusion of innovations.* Free press.

Santos, J., Doz, Y., and Williamson, P. (2004). Is your innovation process global? by sourcing and integrating knowledge from dispersed geographic locations, companies can generate more innovations of higher value and lower cost. *MIT Sloan Management Review*, 45(4):31.

Sterman, J. D. and Dogan, G. (2015). "i'm not hoarding, i'm just stocking up before the hoarders get here.": Behavioral causes of phantom ordering in supply chains. *Journal of Operations Management*, 39-40:6 – 22.

Teece, D. J. (1996). Firm organization, industrial structure, and technological innovation. *Journal of Economic Behavior Organization*, 31(2):193–224.

Tortoriello, M. (2018). *Innovation in Organizations : Informal Networks, Knowledge Sharing, and the Development of Firms' Innovative Capabilities.* Bocconi University Press.

Tushman, M. and Nadler, D. (1986). Organizing for innovation. *California Management Review*, 28(3):74 – 92.

Tushman, M., Smith, W. K., Wood, R. C., Westerman, G., and O'Reilly, C. (2010). Organizational designs and innovation streams. *Industrial Corporate Change*, 19(5):1331 – 1366.

Wang, Z. and Wang, N. (2012). Knowledge sharing, innovation and firm performance. *Expert Systems With Applications*, 39(10):8899.

A

Interview Questions to focus group

1. How long had you been at the company before starting the EW project?
2. Did you have any experience of EW projects or order management before?
3. Why did you start a project related to EW's?
4. Was there a goal, purpose or clearly defined objectives for you in the project? Who set up the goals?

5. How did you get information about the system?
6. How did you know where to find the information?
7. How easy was it to find the information you needed?
8. Was the information easy to understand and up-to-date?

9. What challenges did you face? Did you have to change direction?
10. When facing issues, did you know who to seek advise from?
11. What support did you get during the project?
12. How was the feedback during the project?

13. Did you collaborate with anyone during the project?
14. Do you know what happened with your project afterwards?

15. What was most difficult?
16. What went smooth or was easy?
17. Is there anything you want to add or ask?