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MARKKU KUUSISTO

EFFECTS OF DIGITALIZATION ON ORGANIZATIONS

Master of Science thesis

Examiner: prof. Hannu Jaakkola and reseach manager Jari Soini
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ABSTRACT

MARKKU KUUSISTO: Effects of Digitalization on Organizations
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This thesis examines the organizational effects of digitalization. Barriers and facilitators of digitalization are studied as well. The thesis is divided into two parts: a literature review of the subject and an empirical study. The empirical study consists of codification of qualitative data collected by dr. Pertti Aaltonen as well as development of a G-Accelerate tool prototype. This thesis is a part of Need 4 Speed SRIA programs G-Accelerate project.

Literature review presents findings of extant literature from different aspects of how digitalization affects organizations. Themes found in the literature are organizations size and shape, agility, digital innovations along with organizational learning and business ecosystems. Literature isolates organizational inertia and lack of understanding between top management and IT departments as barriers for digitalization. Main facilitators are top management support and competent IT departments.

During the empirical research 13 categories were segregated from the data collected by dr. Aaltonen. The research was done using *grounded theory* methodology. Final categories are: customer understanding, cooperation, ecosystems, business model design, capabilities and competences, culture, performance indicators, leadership capabilities, customer's customer, new business areas, management systems, organizational structures and process orientation. These categories were validated by having two researchers agree on the limits.

G-Accelerate tool prototype was created based on the categories from the raw data. G-Accelerate tool is a psychometric questionnaire designed to find out organizational capabilities, structures and processes regarding digitalization. Based on the answers it's possible to offer guiding insights for management to support organizations efforts to digitalize.

TIIVISTELMÄ

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Avainsanat: digitalisaatio, organisaatio, ankkuroitu teoria

Tämä diplomityö tarkastelee digitalisaation vaikutuksia organisaatioihin sekä sen etenemisen esteitä ja mahdollistajia organisaatioissa. Työ jakaantuu kahteen osaan: kirjallisuuskatsaus aihepiiriin sekä empiirinen tutkimus. Tutkimus koostuu FT Pertti Aaltosen kokoaman kvalitatiivisen haastatteludatan luokittelun ja kvantitatiivisen kyselyn kehittämisestä osana Need 4 Speed SHOK-hankkeen G-Accelerate -projektia.

Kirjallisuuskatsaus esittelee olemassa olevan kirjallisuuden löydöksiä digitalisaation vaikutuksista organisaatioihin. Kirjallisuuskatsauksen teemoja ovat organisaation muotoon, hierarkkisuuteen ja ketteryyteen liittyvät seikat sekä digitalisaation vaikutus innovointiin, organisaation oppimiseen ja liiketoiminnan ekosysteemien kehitykseen. Digitalisaation esteiksi olemassa oleva kirjallisuus esittää organisationaalisen inertian sekä johdon ja IT-osastojen riittämättömän kommunikoinnin.

Työn empiirisessä osuudessa haastattelumateriaalista eristettiin *ankkuroidun teorian* metodologian mukaan 13 luokkaa, jotka ovat kiinnostavia digitalisaation etenemisen kannalta. Eristetyt kategoriat ovat: asiakkaan ymmärtäminen, yhteistyö, ekosysteemit, liiketoimintamallit, kyvykkyydet, kulttuuri, toiminnan mittarit, johtaminen, asiakkaan asiakkaan ymmärtäminen, uudet liiketoiminta-alueet, johtamisjärjestelmät, organisaatiorakenteet sekä prosessisuuntautuneisuus. Löydetyt luokat validoitiin kahden tutkijan ristiintulkinnalla.

Luokkien pohjalta luotiin G-Accelerate työkalun prototyyppi. G-Accelerate on pelkistetysti kyselylomake, jolla pyritään selvittämään organisaation kyvykkyyksiä, rakenteita ja prosesseja digitalisaatioon liittyen. Saatujen vastausten perusteella voidaan myös antaa ohjausta tarpeellisista muutoksista, joilla digitalisaation kehitystä organisaatiossa voidaan johdon toimesta parhaiten tukea.

PREFACE

This thesis was made as a part of G-Accelerate project by VIA Group. I wish to express my gratitude to be able to take part in this wonderful project. I'd especially like to thank dr. Pertti Aaltonen for the invaluable insights during the creation process along with commentary of the thesis. I want to thank my supervisors, prof. Hannu Jaakkola and research manager Jari Soini for enduring all the unannounced visits with questions during the writing process and the comments made on various stages of the work.

I also want to thank the folks at home, Sanna and Kirsti, for tolerating what felt like nonsensical ramblings on the effects of digitalization as the only topic of discussion during the final crunch-phase of the work with good humour. I might have been a bit over-focused for few weeks.

Pori, November 2015

Markku Kuusisto

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LIST OF SYMBOLS AND ABBREVIATIONS

IT	Information Technologies
CEO	Chief Executive Officer
N4S	Need for Speed SRIA
SRIA	Strategic Research and Innovation Agenda
ITC	Information Technologies and Communication devices
BI	Business Intelligence system
RBV	Resource Based View
IOT	Internet of Things
TAM	Technology Acceptance Model
UTAUT	The Unified Theory of Acceptance and Use of Technology
TOE	Technology-Organization-Environment framework
IS	Information Systems
CIO	Chief Information Officer
KPI	Key Performance Indicator

1. INTRODUCTION

This section introduces the area of this thesis. It also sets the scope and research questions. Finally, the structure for the rest of this thesis is described in this section.

Digitalization

Effects of the information technologies (IT) or digitalization on organizations have been studied since they began appearing in 1960'ies. From business organizations perspective one of the key issues was if the investments were justified. Are we getting our money's worth while investing into IT? In the 1960's the effect was clear with the introduction of the mainframes. However, these questions received notable amount of studies during the eighties and nineties (e.g. Brynjolfsson et al., 1994; Brynjolfsson and Hitt, 1998; Real et al., 2006; Sambamurthy et al., 2003). At first the results were ambiguous – there was a long debate on an issue called productivity paradox. It consisted of trying to find out if the IT really increases productivity and if so, where does the value from increased productivity flow to. The debate was initiated as some studies could not identify any benefit from IT investments. Finally it was settled with the consensus being that digitalization in itself does not provide value. Still, it is an important portion of value chain – it needs to be utilized in a sensible manner. In other words, value of investments in digitalization is mediated by organizational capacities and processes. Today digitalization has spread to virtually every organization – in fact it is hard to imagine a world or an organization without digital assets. Recently studies have shifted the question from "does digitalization provide value" to "how does digitalization provide value" – the mechanisms are yet sometimes unclear.

The ways of working have remained similar to pre-digitalization in many fields. Some Chief Executive Officers (CEO) and researchers have declared that the way we work is about to be changed. Indeed, some of the interviewees in this research echoed this view. Digitalization will give most efficiency when the working habits and processes associated are changed to accommodate the improved efficiency enabled by digitalization. Just shifting the same processes from paper-based to digital-based doesn't actually improve the overall efficiency all that much. Some fields, such as music industry have already undergone tremendous changes due to digitalization. Nonownership of music, for instance, has provoked a revolution in the business model of the whole industry. Customers are not buying albums anymore – they're paying from usage of music.

This study is made as part of Need 4 Speed (N4S) strategic research and innovation agenda (SRIA) program. N4S program set out to create foundation for the Finnish soft-

ware intensive businesses in the new digital economy. N4S consortium consists of 13 large industrial organizations, 16 SMEs and 11 research institutes and universities (Digile, 2015). VIA Group commenced G-Accelerate-project as a part of N4S program. G-Accelerate project aims at finding ways to help organizations pinpoint the steps they need to take in order to succeed in digitalizing their businesses. This thesis is created as part of the ongoing G-Accelerate project.

Scope and Research questions

This research sets out to find what effects digitalization has had on organizations and how organizations can be managed to increase the speed of digital adoption.

The research questions are formulated as follows:

- *What effects has the digitalization had in organizations so far?*
- *What are the barriers and facilitators of adopting digitalization in organization?*

First question has been studied from many sides in the past, so the aim of this research is merely to gather the available information and present it in a sound form at the literature review. Second question has scarce extant literature available. This study seeks to contribute to the present literature by adding some new knowledge on the topics of the question.

G-Accelerate project is a large body of work; this thesis is only a part of it. The project will create a tool to be used with companies to assess their weak and strong suites in digitalization front. The scope of this thesis ends at the assembly of prototype questionnaire for the tool. Its validation, refinements and results from usage are left for continuation research.

Structure of the study

Figure 1 presents a flowchart of the study. The research was initialized by dr. Aaltonen while this thesis begins with the literature review which was fully done by author. Original theoretical background for the interviews is combined from books of Adner (2012), Schein (1992) and Kauppinen (2013) and an article by Zott et al. (2011). Methodology for literature review is presented in sub-section 2.2 and the results are shown in section 3. Data codification was jointly done by both researchers involved. Codification into categories took several iterations before authors proposal was finally accepted as the final one. Dr. Aaltonen then created the initial set of questions from the categorized data while author assessed different options for Likert scale's form. The questions were commented by author – a few modifications were made due to these comments. Final product in the scope of this thesis is the G-Accelerate tool prototype.

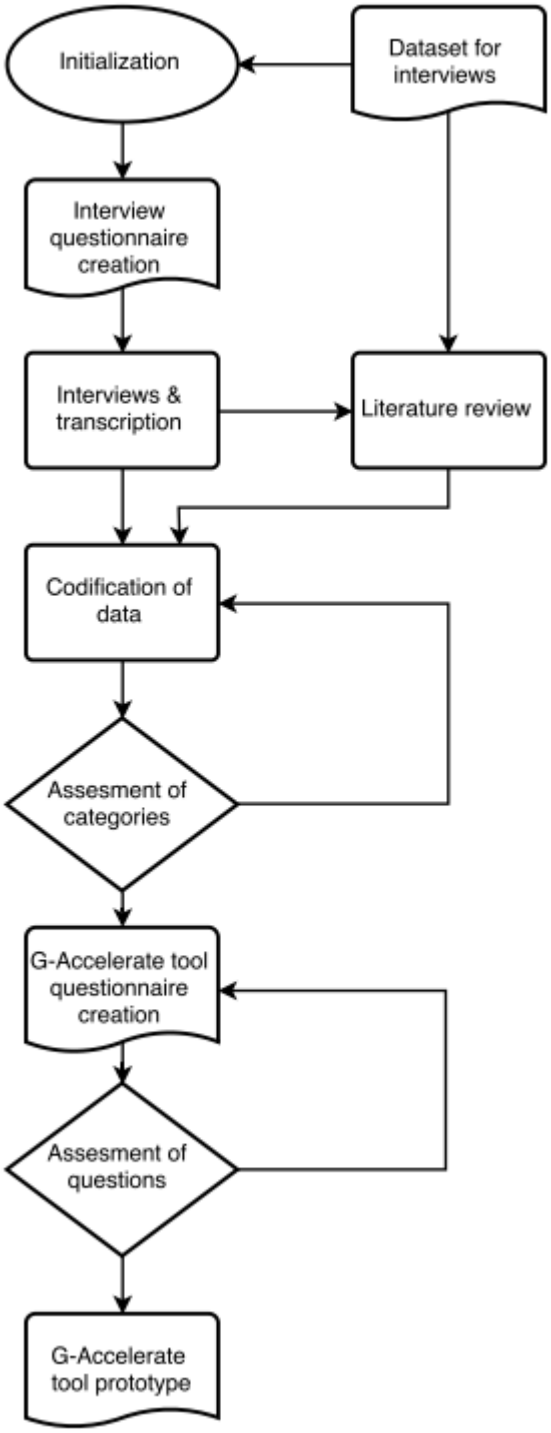

Figure 1. *Flowchart of the research (by Author)*

Section two of this thesis consists of a presentation of methodologies used in this research as well as the motivation for choosing these exact methodologies. The approach selected for data processing is grounded theory methodology. Questionnaire formulation is based on Likert-scale design literature. Requirements for validity and reliability are also considered in section two.

Section three of the thesis presents a literature review of the facets of the digitalization's effects on organization. Following topics are presented in this section: *organization's size and shape*, *organization's learning capabilities* and *organizational agility* are each discussed in their own sub-sections. Final themes are digitalizations effect on *innovating capabilities of organizations*, development of *business ecosystems* and last but not least, *facilitators and barriers of digitalization*.

Section four is a presentation of empirical research made in cooperation with dr. Aaltonen from VIA Group. First sub-section highlights how G-Accelerate project is situated in the context of N4S program. Second sub-section illuminates the actual methodologies used as well as responsibilities in each of them. Sub-section three describes the final categorization and discusses how the categories were achieved. G-Accelerate tool prototype is presented sub-section four. Finally thoughts of how the research meets the set requirements for validity and reliability are discussed.

Section five concludes the thesis. It highlights the research findings and proceeds to discuss about the success of the research. Limitations of the research and future research opportunities are presented in section five as well.

2. RESEARCH METHODOLOGY

Approach selected for eliciting results from the interviews was grounded theory methodology. This is by necessity, as a gap in the extant literature was found covering the second research question. A positivist theory to be tested couldn't be formed. Literature review was chosen to be conducted along the lines of Creswell (2012) as it was seen as a clear methodology for the review. G-Accelerate tool is basically a psychometric questionnaire used to gauge digital readiness of a company. Likert-scale questionnaires are widely used standard for psychometric scales and were chosen for this tool as well. Finally this section introduces requirements for validity and reliability for this research. There is novelty in the research so validity and reliability need to be assessed.

2.1 Theoretical background of the grounded theory methodology

Grounded theory methodology differs quite much from other qualitative methodologies. It was developed by Glaser and Strauss in the 1960's. The starting point of grounded theory is considered to be their books "Awareness for dying" (Glaser and Strauss, 1965) and "Time for Dying" (Glaser and Strauss, 1968). Their third book, "The Discovery of Grounded theory" (Glaser and Strauss, 1967) explained the methodology that is used in the other two. In grounded theory methodology a theory is generated from the data. Starting point for the theory is usually based on existing literature, yielding understanding of the phenomenon to be researched. Theory then gets iteratively more and more accurate as more data are gathered during the research based on the findings on the initial data (McCann and Clark, 2003). This is the main difference of grounded theory methodology from positivist qualitative research methodologies. Positivist methodologies develop the theory first, formulate hypotheses based on the theory and finally test those hypotheses against data to verify the theory.

When applying grounded theory methodology, a researcher first formulates his or her research questions. Based on these questions, he or she then decides what is the data needed to answer these questions. The topics of the initial interviews are based on pre-existing understanding of the phenomenon in question. After gathering the data, the researcher searches for conceptual models emerging from the data. After first round, these concepts are "fuzzy" – not very well defined. Researcher then iterates the process of data gathering and inspection until a saturation point is reached. Data is considered to be saturated when incoming data verifies the concepts and doesn't offer any new insights to the phenomenon. Conceptualization of data is meant to "lift" the data into a

slightly higher level of abstraction than it is in its original form. As Suddaby (2006) puts it: "The movement from relatively superficial observations to more abstract theoretical categories is achieved by the constant interplay between data collection and analysis that constitutes the constant comparative method"

According to McCann and Clark (2003) there are seven key characteristics in grounded theory: Theoretical sensitivity, theoretical sampling, constant comparative analysis, coding and categorizing the data, theoretical memos and diagrams, literature as a source of data and integration of theory. Each item will be discussed below.

Theoretical sensitivity is needed to give researcher valuable insights from the data. Without theoretical sensitivity it would not be possible to detach relevant information from irrelevant noise in the data. Theoretical sensitivity may be obtained through experience of the researched field or from review of extant literature (McCann and Clark, 2003).

At the beginning of the research decision of the initial subjects and participants are made. After the initial data is analyzed and initial conceptualizations are made, new participants and subjects are selected based on the arising concepts. The final aim is to create a theory (Ghezeljeh and Emami, 2009). *Theoretical sampling* takes phase when researcher collects a subsequent set of data and uses it to compare to and to evolve the concepts created from previous data (McCann and Clark, 2003). In other words: "process of data collection where the analyst collects codes and analyzes the data and decides what data to collect next and where to find them based on the emergent theory" (Mello and Flint, 2009). Sampling continues until theoretical saturation has been reached (Ghezeljeh and Emami, 2009). McCann and Clark (2003) state that theoretical saturation "occurs when no new data emerge relevant to particular categories and subcategories, categories have conceptual density, and all variations in categories can be explained. The links between categories must also be clearly explicated and validated"

Constant comparative analysis means simply that data is analyzed simultaneously while being gathered. Comparisons with new and older data are used to find out what similarities, differences, trends and patterns does the data hold (Manuj and Pohlen, 2012). Glaser and Strauss (1967) highlight four stages in this process: Comparing findings applicable to each category, integrating categories and their properties, delimiting the theory and writing the theory.

Coding refers to treatment of the data that has been gathered. During coding process the data is split into smaller fragments and sorted into categories, each given an appropriate code. Coding is the first step towards development of theory (McCann and Clark, 2003). Coding has two phases: initial open coding, during which all lines or findings are coded. It is followed by focused phase when findings are grouped together to synthesize and integrate the data into an emerging theory (Ghezeljeh and Emami, 2009).

Diagrams are drawn to represent the relationships of concepts within the emerging theory. (McCann and Clark, 2003). *Memo* writing is a tool for the researcher to clarify the data. Ghezeljeh and Emami (2009) state that memo writing is essentially a reflective process for the researchers, providing them with opportunity to remember, question, analyze and generate meaning from the data. Memos are capturing researcher's internal dialogues with the data at the point of writing them (McCann and Clark, 2003).

Literature review is an integral part of grounded theory. Even though Glaser and Strauss made a distinction between substantive theory, or a theory generated from extant literature, and grounded theory, they still held high value for substantive theory as a starting point for grounded theory (Glaser and Strauss, 1967). If the researchers review the extant literature and find a gap with no substantive theory in place to begin with, a grounded theory methodology is natural choice for process (Manuj and Pohlen, 2012).

Finally all the prequisite steps will have been taken and the theory is ready to be formulated. McCann and Clark find three strategies to add density to the theory: Category reduction – a large number of categories that was produced earlier is mulled through and some of the categories are united while others are completely erased. Selective sampling of the literature forms another source of data which can be integrated into the emerging theory. Selective sampling of the data is a third way to add density to the emergent theory. Selective sampling of data means refers to the gathering of data from the field to validate the categories as the theory being is developed (McCann and Clark, 2003).

2.2 Literature review methodology

According to Creswell (2012) a literature review consists of five stages. In stage one the relevant keywords are selected. In stage two the relevant articles are searched from different locations. In stage three the articles selected in previous stages are evaluated and relevant ones are kept while the rest are discarded. In fourth stage the literature is organized and finally in fifth stage a summary of the literature is made.

In this research the first articles were acquired from dr. Aaltonen, who had selected ten articles which were relevant for the G-Accelerate project that had been running already for some time. These articles support his original background literature of Adner (2012), Schein (1992), Kauppinen (2013) and Zott et al. (2011). A mindmap, shown here in Figure 2, was created based on these articles. It highlights the different areas of digitalization's effects on organization identified from the articles. Quite few of the effects are second order – not directly connected to the central idea, but rather they are resulting effects from first order of effects.

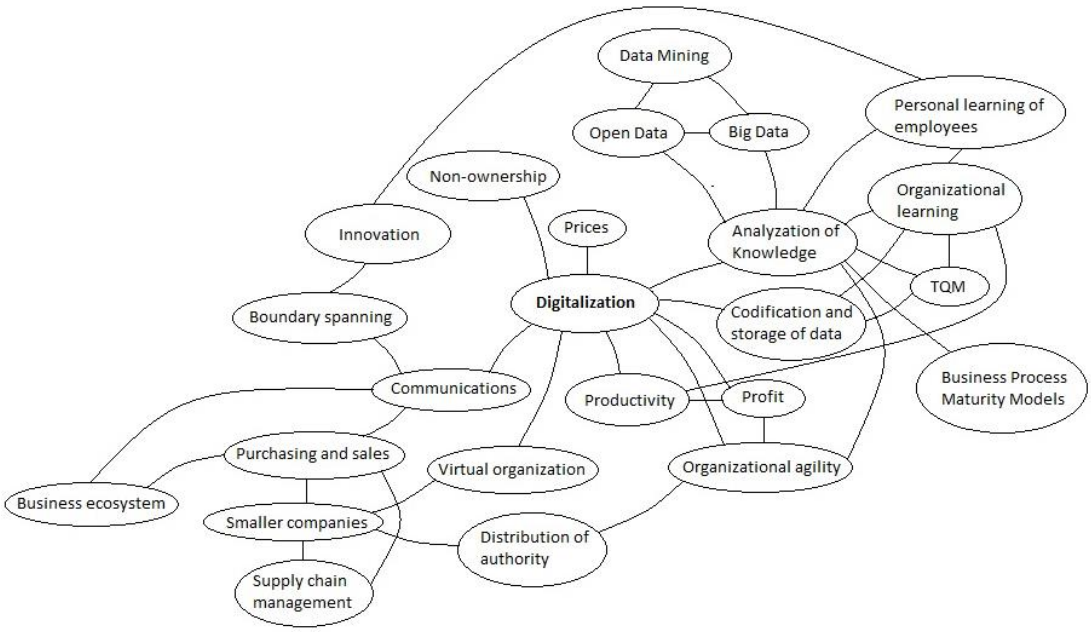

Figure 2. *Mindmap of digitalizations effects (by Author)*

All of the items in Figure 2 were not considered to be important enough to form a full topic in the review. Some, such as data-mining, open and big data, were discarded totally. Many were joined together to form more substantial bodies. Finally some bubbles were considered to be influencing multiple different topics selected so far and thus split between them. The resulting bodies of knowledge are presented as the topics of the literature review in this thesis.

After the topics were discovered and decided a standard literature review according to methodology from Creswell (2012) was conducted from each of the selected topics individually. For example, in the literature review on agility the keywords used in the search for articles were “organizational agility” and “digitalization agility”. Search was conducted in google, google scholar and in a combined search from several article databases, including EBSCO, Ex Libris and Science magazine. After finding the relevant articles with these searches a forward search from articles citing these articles was made along with backward search from the references. This was repeated with all the new articles until no new articles surfaced. All together the procedure usually yielded around ten to twenty articles for each topic. Five to ten of these articles are eventually cited in this thesis as some of the information was overlapping.

2.3 Likert scale design methodology

Likert scale was chosen for the G-Accelerate tool as it is the most commonly used psychometric scale for the issues that require self-reporting (Wakita et al., 2012). Likert-scale will be used in G-Accelerate tool to measure how the respondents feel about the

questions. It was developed in thirties by Rensis Likert for measuring attitudes (Likert, 1932). Original Likert-scale was a 1-5 point equal-interval scale where the respondent would check each item stating his or hers feelings towards the issue asked. After all the questions were answered, points would be added up for a total score. While single items could be worded both positively and negatively, highest points were always associated with positive attitude. Figure 3 shows two example questions from the original scale from the article of Likert (1932). These particular questions were chosen at random from the pattern to represent the look of the scale.

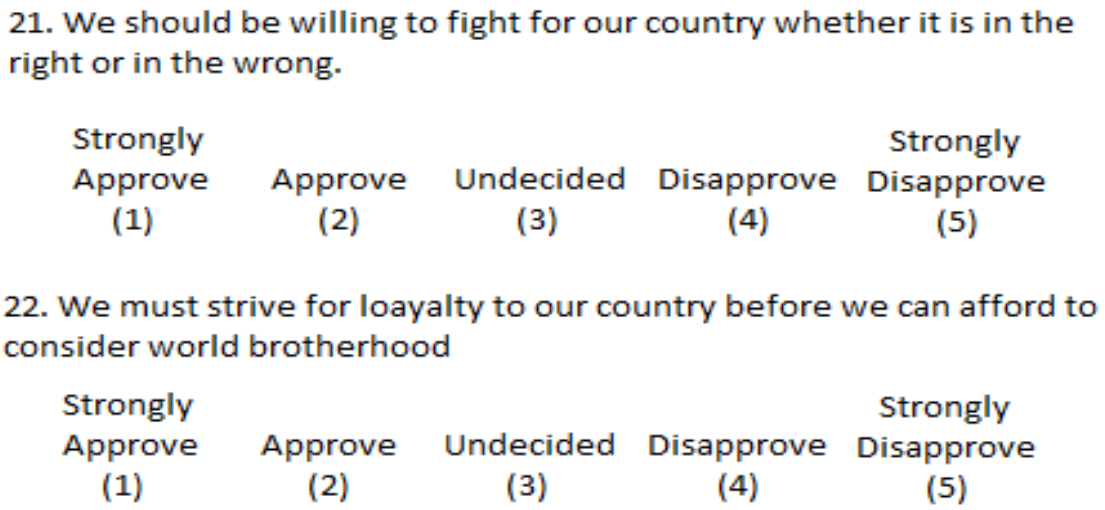

Figure 3. *Questions from original Likert-scale (Likert, 1932)*

Since then the scale has been dubbed "Likert-scale" and it has been variated in several different ways while being adapted to many different applications. Number of choices for each item has been differentiated between 2 and 100. Some scales have tried out a model where the choice has been a slider instead of discrete choice. There have been scales with even and odd number of choices, even ones forcing the respondent to have at least some opinion on the matter. Some scales have had their center point being zero (eg. -2, -1, 0, 1, 2). Some scales have had the numerical definition of each choice omitted totally. Sometimes the verbal labels are only positioned above the extreme positions on either side and the wording of the labels may change as appropriate for the study in question (Hartley and Betts, 2010). Even a fuzzy scale has been suggested for better grained information (Li, 2013).

Hartley and Betts (2010) studied if there is difference in answers to otherwise similar scales due to different order of labels and different order of scale. They manage to show that: "The scales that started with a positive label and had the highest numerical rating on the left produced significantly higher rankings compared with the three other versions." In other words, all the questions should be asked in positive way to ensure that the higher scores are on left.

Number of options for each question has been widely studied in the past (Wakita et al., 2012; Lee and Paek, 2014; Churchill and Peter, 1984). The results from these studies are mixed with no clear consensus for single number of choices. Wakita et al. (2012) studied the psychological distance between answer options with different numbers of answer options for question. They found four options to be optimal with five being only marginally worse. Seven options showed much more differences in category widths. Lee and Paek (2014) set out to establish optimal number of options and came up with an optimal range – between 4 and 6. They establish that fewer options are sufficient if there are enough questions for each dimension. More than four options should be used if there are very few questions from each dimension. However, in their meta-analysis of 108 studies, Churchill and Peter (1984) contradict the previous studies by finding support for their hypothesis that number of options increases the reliability of the scale. Other notable result from this study is that increasing the number of items on a scale increases its reliability. This is due to the fact that greater number of items in the scale increases the proportion of systematic variance to total variance in the measure.

The question of odd vs. even number of options seems to be omitted in most studies. It is not seen as important factor regarding the validity or reliability of the scale. Wakita et al. (2012) express their thoughts on the matter in following fashion: "Most Likert scales include four to seven categories. An odd number of options is used when researchers need a neutral anchor, such as "Neither agree or disagree," whereas an even number of options is used when researchers intend to elicit participants' opinions or attitudes through answers such as "Agree" or "Disagree"". Churchill and Peter (1984) find no evidence of increased reliability due to having a neutral option in the scale.

2.4 Validity and reliability

Validity measures how closely the research is studying the subject it sets out to study. (Eskola, 1960) In example, in case of IQ test, the test might be created in a way that it studies education level instead of intelligence. Valid IQ test would measure exactly persons IQ and nothing else. Reliability measures the amount of randomness in the results. Randomness in results is all but inevitable and thus measures to reduce the amount to be as small as possible should be taken. This is where the set rigorous methodologies step in – they are, in essence a set of principles assuring that the results will be valid and can be repeated by someone else following the same methodology.

Terms validity and reliability originate from quantitative research where there are concrete mathematical ways to evaluate the validity and reliability of research. In qualitative study, however, the terms are a bit fuzzy and there has been some debate about the relevance of the terms (Yu et al., 2011). Räsänen et al. (2005) state that qualitative study is always performed in a bit different way defined by the objectives of the study – no single methodology can encompass all the areas that can be researched. Tuomi and Sarajärvi (2009) criticize the usage of validity and reliability on qualitative studies due to

the fact that these terms are developed for and fulfill the needs of quantitative studies. The idea behind the terms is still valid in qualitative study, even if they can't be mathematically approached in the same way quantitative study does. In qualitative study there are other ways to assure the reader of the validity and reliability of research. In her collection of discussion around the issues of reliability and validity in qualitative study, Golafshani (2003) re-conceptualizes the terms in qualitative research as trustworthiness, rigor and quality of qualitative paradigm. She also notes that the way to achieve validity and reliability are to eliminate biases and increase the researches truthfulness of a proposition about the phenomenon to be explained using triangulation. Triangulation is defined as "a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study" (Creswell & Miller, 2000).

Manuj and Pohlen (2012) suggest that for grounded theory methodology the reliability of the data gathered is directly influenced by how well the first samples are chosen. The sources of samples should: "Fit in context, have visibility over the entire phenomenon, be knowledgeable, willing to participate and be experienced and engaged with the phenomenon". They also state that the path for the theory creation must be clearly explained from the initial categories to the final rich theory that is grounded in the data. Glaser (1998), one of the original creators of grounded theory, states that "fit" could act as a substitute word for validity in grounded theory. Fit in this context refers to the extent the concepts generated from the data actually describe the patterns in the data. Fitness is continuously improved throughout the research process of grounded theory methodology by comparing data with the categories created. Relevance is another term to be used in grounded theory context. Categories and concepts created during the research are relevant if they are important to the practitioners and if they can instantly "grab" the contexts. In his mind the theory is never wrong per say – it is just constantly modified while the understanding of the phenomenon increases (Glaser, 1998). Tuomi and Sarajärvi (2009) mention an additional technique to strongly enhance validity and reliability of any qualitative study. If the data can be cross-checked by two or more researchers and validated this way, it's a very good way to reinforce both the reliability and the validity of the study. They consider an agreement percentage of 80 to be suitable for "good fit" of data.

3. LITERATURE REVIEW

This section consists of literature review carried out on different aspects of the digitalization's effects on organizations that were identified as seminal from the original articles. Each aspect is discussed in separate sub-section. Several of the topics are interlinked – one enables another or they share some common ground. In these situations dividing the topics is made by using common sense, occasionally including some references to both topics. The aspects that were chosen are: Organization's size and shape, Organizational learning, Organizational agility, Digital innovations, Business Ecosystems and Facilitators and barriers of digitalization.

3.1 Organization's size and shape

When the first waves of IT's were introduced to the world, their effects for business were studied mostly by their impacts on business performance. Another early subject was the size of companies. For a long time, IT's effect on business performance was debated – so called productivity paradox existed for decades in the academic literature (Sriram and Stump, 2004). Some studies found evidence of increased IT spending increasing organizations profits, others were totally contradicting these studies. As a result, many mediating effects were studied. Eventually productivity paradox was more or less settled with the result that the IT does provide value, but the value might occasionally be captured by some other party than the one investing in IT (Brynjolfsson and Hitt, 1998). Organizations were found to be shrinking in size measured by number of employees (Brynjolfsson et al., 1994; Snow et al., 1999). This was partly attributed to IT simply doing away with manual tasks such as the middle managements data collection and processing. Main reason for the smaller company sizes was found to be decoupling of business (Sambamurthy et al., 2003). One clear effect of early IT's was lower costs of transactions and coordination. Due to this effect it was more profitable to, for example, buy tires to a car factory from supplier than to produce the said tires within the company. A smaller company was better with focus in producing tires and achieving economies of scale by being supplier for multiple car companies. (Brynjolfsson et al., 1994)

Virtual organization as a term was coined in 1990's. Snow et al. (1999) defined that virtual organization means any organization that is multisite, multi-organizational, and dynamic. Since then the definition has been broadened to encompass "organizations whose business processes are driven by e-commercial activities and whose members are geographically apart, usually working by computer email and groupware while appear-

ing to others in the form of website to be a single, unified organization with a real physical location" (Mohammad, 2009). Virtual organization is fully made possible by IT. As Priego-Roche et al. (2015) state: "this integration is possible throughout the layout of an information system infrastructure to satisfy customer's requirements, or to seize a business opportunity without having to form a new legal entity". Some forms of virtual organizations benefit from increased agility – teams form to solve an issue and disband after, only using up relevant workforce who can contribute to the task at hand (Snow et al., 1999). Sometimes virtual organizations are set up so that there is constant flow of work to a certain task by having different groups work in different time zones to establish an effective 24h continuous work cycle. As virtual organizations are growing more and more common, it is harder to draw a line between single virtual organization and business ecosystem.

Major impact of digitalization on organizations is that the information is more accessible and transparent. ITC's (Information Technologies and Communication devices) have made it much easier – even possible – to have information available for all personnel, who previously have been working with very limited knowledge of the big picture of the company. This allows for employees to make more informed decisions at lower levels of the organization – something previously available only for the top tier management. Corporate information systems and Business Intelligence (BI) programs are made to analyze and compress relevant data for top management – a task previously done manually by middle management. These together assist in modern organizations being flatter with fewer hierarchies than before (Dewett and Jones, 2001). Contemporary managers and team leaders usually have some active duties on top of their managerial roles.

Knowledge silo in organization is an organizational unit that is very good at what it does, but is unable to share information effectively or perform other tasks than those it is good at (O'Reilly et al., 2012). Knowledge silos usually consist of deep trained specialists on one field. These silos are being brought down by the organizational changes driven by digitalization. This is a direct result from knowledge being distributed more and more efficiently – and the need for lean and agile organizations that are able to perform different actions in quick succession. In these contemporary organizations information sharing and more general knowledge on each employee is considered the key to success. This is enforced via different platforms enabling employers to gain knowledge of the status of company – online screens, intra-nets and more recently social media are among the ways companies keep their staff up to date. Enterprise 2.0, more fully discussed in sub-section 3.3 of this thesis, explains the phenomenon behind the fall of organizational silos quite well (MacAfee, 2006).

3.2 Organizational learning

Organizational learning is important for companies because it enables innovation and process effectiveness (Joshi et al., 2010). Organizational Learning is an ambiguous term that has several meanings depending on the context. It may mean the process of learning in organization or the results of learning processes (Real et al., 2006). Real et al. (2006) define organizational learning as "a dynamic process of knowledge creation generated at the heart of the organization via its individuals and groups, directed at the generation and development of distinctive competencies that enable the organization to improve its performance and results." In their study, Fernandez-Mesa et al. (2013) differentiate between internal learning and external learning. In their view, internal learning refers to all knowledge create within the company itself – mainly through R&D and implementation of best practices. External learning is considered as all the knowledge company gains from outside world. This includes environment and other companies working in the same field. In this thesis organizational learning is seen through the lens of digitalization effect and is thus focused on the processes enabled by digitalization rather than the results of the processes.

Digitalization effects internal organizational learning by enabling codification and improved analysis of knowledge. Quality management tools are a good example: A reclamation database which has stored information of all the reclamations of a plant during its lifetime, in an easily searchable form. Compare this to a quality manager who learns by doing and takes the knowledge with him when they leave the company. It's rather obvious that, ceteris paribus, the former organization is better off in the long run in the event of changing personnel. Indeed, Sriram and Stump (2004) find support for the assertion of quality programs improved effect after IT investments. Alavi and Leidner (2001) state that digitalization can act as enabler of organizational memory in databases and thus increase the companies learning capabilities. Another good example is managerial use of BI's – programs which store and processes relevant information for managers to improve their decisions both in speed and accuracy. A study by Leidner and Elam (1995) suggests that the use of BI's is positively related to problem solving speed of middle and senior managers. In their study Real et al. (2006) find support for their hypothesis stating that "Information technology has a positive influence on organizational learning as a knowledge creation process" – albeit in their empirical study they do not differentiate how IT helps knowledge creation process.

Many of the information technologies directly affect both internal and external communication within companies. Recent technologies include e-mail, conference calls and video-conferences. Rise of these communication channels helps forming of weak ties. Weak ties are social relationships where the correspondents are somewhat familiar, having an occasional discussion. Thus, weak tie connections can not really be considered as friends. Dewett and Jones (2001) assert that these weak ties help organizational learning as people who are better connected are sharing more information with each other. They

note that even if in some cases members of organizations may not have sufficient motivation for providing information even if the links are provided, there are still many motivational sources such as improved self-esteem, identification with organization and organizational culture. They argue that normally these sources should provide enough motivation for sharing relevant information among peers if the venues for sharing are presented.

Concepts of enterprise 2.0 which are more fully discussed in sub-section 3.3, also contribute to company's internal learning capabilities as employees can more readily find relevant information from corporate intranet pages and blogs. McAfee (2006) notes that to create a vivid environment for employees to start discussing things in web 2.0 environment, the managers need to firmly guide the first steps of initiation. It's as important to cut the environment loose at correct time to get the organization on board and to give them the feeling of ownership of the internal media.

Absorptive capacity theory defines firm's ability to recognize the value of external information, assimilation of it and applying it to their commercial ends as absorptive capacity. Absorptive capacity theory is thus used to explain external learning of organizations (Dong and Yang, 2015). Joshi et al. (2010) further divide absorptive capacity into two phases: potential and realized absorptive capacities. Potential capacity consists of knowledge acquisition and assimilation while realized consists of knowledge transformation and exploitation.

Digitalization provides several technologies to enhance both potential and realized absorptive capabilities. Data retrieval techniques such as query systems and search engines help to identify and retrieve relevant information from varied knowledge sources with relative ease and accuracy. This vastly enhances the potential absorptive capabilities when compared to non-digitalized approach. Realized absorptive capabilities enhance the transformation of the acquired knowledge. Most new information gained does not help the company directly. Usually the information needs to be transformed to fit the context of each company. Digitalization affects this process much the same way as in internal learning discussed earlier. As an example, BI's are used to chew through large amounts of data to achieve new insights and understanding while visualization tools can be used to map different sets of data to combine their information for new knowledge (Joshi et al., 2010).

3.3 Organizational agility

Organizational agility is seen as a necessity rather than objective or strategy in today's fast paced world (Alavi et al., 2014). In a recent study by Economist Intelligence Unit, vast majority of executives (88%) identified agility as a key aspect considering global success (Yang et al., 2014). Agility has two main benefits, first being able to respond to business threats effectively in a timely manner. Second is the ability to identify and cap-

italize opportunities as they present themselves. According to the theoretical framework of resource based view (RBV) an organizational agility can be seen as a distinct unimitable advantage thus supporting long term advantage in company performance (Alavi et al., 2014).

Alavi et al. (2014) define organizational agility as means of responding to rapid environmental challenges. In addition, agility also allows companies to exploit opportunities for innovation and competitive actions (Yang et al., 2014). Metaphorically agility can be described as organizations ability to steer its course in rapid fashion. Sambamurthy et al. (2003) assert that digitalization increases capabilities of organizations, agility among them. Organizational agility may be divided in two different sub-sections. Organizations workforce agility refers to the different aspects of human resources and their cumulative effect on agility (Alavi et al., 2014). Business process agility refers to the ease and speed in which companies can adapt their business processes to respond to threats in their markets.

In their research Alavi et al. (2014) set out to find what organizational concepts have factor in workforce agility. They find many different theoretical models of the subject in their literature review. Yet there are very few empirical studies. Based on previous theoretical work they make two hypotheses on the subject. First one being divided into three parts regarding organizational structures: low formalization promotes workforce agility, decentralization promotes workforce agility and flat structure promotes workforce agility. Their second hypothesis is that organizational learning promotes workforce agility. Their research model is shown in Figure 4.

Figure 4. *Research model for organizational agility (Alavi et al., 2014)*

They place the organizational structures as antecedents for organizational culture including learning which is conceptualized being an antecedent of agility as well. Their

study supports the views that low formalization among organization may not be solely promoting organizational agility as they don't find support for the hypothesis. Formalization in organization refers to rigidness of instructions and ways of work. If anything, it should have mixed results. On one hand, it should promote agility. This is due employees being open, even motivated, to experiment and try out new ways of doing things, so the initial barrier for innovative, agile solutions should be low (Chen et al., 2010). However, high formalization has been shown to motivate people to try out new solutions and ideas (Nicholas et al., 2011). Conclusion is that organizations should reach for the middle ground in formalization – having some, but not too much. Alavi et al. (2014) find statistically significant support for their hypotheses about decentralization and flat organizational structures being enablers of workforce agility. Subjects of decentral decision making as in virtual organizations and digitalization acting as enabler of flatter organizational structures are discussed in the sub-section 2.1 of this thesis. These are naturally linked to agility, as by definition an agile organization can make quick decisions. This is the case, if the employee who confronts a challenge is empowered to make the decision on the matter by himself rather than having to ask an opinion of a superior.

Yang et al. (2014) delve into the world of business process agility. Their basic assumption is that business process agility is the key mediator in how digital capabilities generate value for companies. This, they argue, is because digital capabilities are enabling rapid business process actions, facilitating flexible business processes and enabling business process innovation. Their empirical study finds evidence to support this claim. The study demonstrates two significant variables controlling the effect of business process agility towards company performance. These variables are the amount of environmental hostility and environmental complexity. Environmental hostility is the amount of resistance from external forces that prevents firm's sales or growth. It might be the result from political, societal or economic factors. As the amount of environmental hostility grows it directly reduces the impact business process agility has on company performance. This is somewhat intuitive, as there is not much to be gained from rapid changes in the business processes if there is no change allowed in the environment. Environmental complexity is rather straight forward term – it describes the amount of moving parts in firm's operating environment. Yang et al. (2014) found direct link between environmental complexity and the mediating power of business process agility. The more complex the environment, the greater impact business process agility has. This is also an intuitive result – the more sudden opportunities are presented, the more agility is needed to grasp them.

One way companies are increasing in agility is by adopting new working techniques and technologies offered and enabled by digitalization. Enterprise 2.0 is a term that was coined by Allister McAfee on 2006 in his article titled "Enterprise 2.0: the dawn of emergent collaboration". It refers to companies using web 2.0 related technologies in their organization. The article, and later a book, set out to define how these technologies

affect the organizations using them. Term web 2.0 was coined in 2004 to promote a conference by O'Reilly & Associates. Since then it has expanded in use and now refers to any and all web applications where the users create the actual content of the platforms while the companies merely create the place to show the content created. Well known web 2.0 platforms include Facebook, Flickr, Instagram, Twitter and various platforms enabling blogosphere. Technologies associated with web 2.0 include RSS-feed, podcasts, cloud-services and Ajax.

In his article, McAfee (2006) defines enterprise 2.0 technologies as all those that comply with six components: Search, Links, Authoring, Tags, Extensions and Signals. He refers to these qualities with and acronym SLATES. *Search* function is a standard for contemporary pages but rather surprisingly many of the intranet pages seemed to be lacking a good search function at the time. McAfee asserted that to improve searching functions of intranet-pages, *links* needed to be built up by a large crowd. Modern pagerank-based search functions are operating by giving each page a rank. This rank is decided by how many times the page has been linked along with the pagerank of the linking pages. *Authoring* is way to elicit knowledge from people who previously would have shared it over e-mail for some small subset of possible interested readers. Authoring tools enable company intranets become tools for many people to work and share knowledge with. *Tags* help with categorization of the intranets content as well as searching for relevant information. Free tagging by any members of the work community enables a wide array of different patterns and information flows to become visible and traceable for anyone in the company. *Extensions* refer to recommendation systems, such as the one found on Amazon.com, which suggests likely products based on what others who bought or viewed a particular product have also bought. The final element of SLATES is *signals*. As the number of sites that an employee wishes follow multiplies it becomes time consuming to manually follow them all. This is avoided if the sites send out a signal each time they are updated so interested followers know when to look for updates instead of having to periodically check through all of them.

In Table 1 Consoli (2013) highlights the differences between enterprise 1.0, as in a conventional enterprise, and an enterprise 2.0. Table 1 actually sums up many of the effects of digitalization identified in this thesis in a nice way – some of the items have their own section or are fully included in one, explaining them further. New open and flexible structures, along with hierarchy, centralization and location vs mobility are discussed in sub-section 3.1, organizations size and shape. Digitalizations effect on agility – which includes agile production as well - is explained in this section while competitions turning into cooperation as well as companies change into customer oriented ones are both talked about in sub-section 3.5 under title business ecosystems.

Table 1. *Differences between enterprise 1.0 and 2.0 (Consoli, 2013)*

Enterprise 1.0	**Enterprise 2.0**
Closed and rigid structure	Open and flexible structure
Rigide	Agile
Hierarchy	Network
Centralization	Distribution
Competition	Collaboration
Traditional marketing	Social Marketing
Product-oriented	Customer-oriented
Intranet-extranet	Web 2.0
IT driven	User driven
Top down	Bottom up
Location	Mobility
Owner standards	Open web based standards
Planning production	On demand production

As for managerial part, McAfee (2006) sets up a high challenge – in order to succeed in transformation to enterprise 2.0, managers need to be guiding in the beginning but they also need to sense when it is right time to step away from that position and to let the media be grown by the employees – even if they say things the managers wouldn't like to hear. Just presenting the options made available with IT will not change the behavior of the organization.

3.4 Digital innovation

Digital innovations have recently received a fair amount of studies (Nylen and Holmström, (2015); Fichman et al., (2014); Fernandez-Mesa et al., (2013); Dibrell et al., (2008)). It has been stated that we are currently entering the golden age of digital innovation. Major new digital innovations arrive at much smaller intervals than before. During 1980's a major new technology broke through once every decade, now there seems to be many different breakthroughs just around the corner at any given time (Fichman et al., 2014). Rapid pace of digital innovations is enabled by the very basic nature of digital technology: ease of reconfiguration. Digital innovation processes are also much different from those of the industrial era. The difference is highlighted in solutions where digital technologies are embedded in traditional products (Nylen and Holmström, 2015). For example when a car manufacturer added an entertainment system into their vehicle, surprising amount of challenges surfaced from the difference of innovation processes (Henfridsson et al., 2014). These embedded products envelope

almost everything within the broad term “internet of things” (IoT). This could very well be the reason why there is a perceived need of understanding how digitalization affects innovation.

Fichman et al. (2014) define digital innovation as follows: ”We define digital innovation quite broadly as a product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied in or enabled by IT”. Nylen and Holmström (2015) stated that digital technology contains unique properties which enable new types of rapid and unpredictable innovation processes. These processes demand companies to have agile technologies, organization structures and cultures to cope with the fast cycles of innovation. Dibrell et al. (2008) define innovation as “a process or discrete event; any idea, practice, or object that the adopting individual or organization regards as new.” Digital innovations offer great benefits but they also present a great challenge in understanding the properties of digital innovation processes (Nylen and Holmström, 2015). Fichman et al. (2014) divide digital innovation into three subcategories. First one is digital process innovation. This category encompasses all the new ways of doing things within an organization enabled by digital assets. Second one is product innovations. Product innovations contain all the products and services the company sells to its customers. Final category is business model innovation. Business models are the ways in which companies extract money from their customers.

Digital innovation process has four stages. In *discovery phase* new ideas are discovered and their potential for development is assessed. During a *development stage* the idea for the technology is developed into a working innovation. *Diffusion stage* sees the innovation spreading through its potential user base. Finally, in the *impact stage* a full potential of the innovation is realized. As for the innovating company, the value is gained at this stage as the innovation has been matured into a product or process improvement (Fichman et al., 2014).

Discovery phase may entail the company generating its own innovations or actively scan the ideas from outside of their limits. Henry Chesbrough coined a term *Open innovation* to capture novel ways of handling innovations and R&D. Traditional way has companies guarding their innovations as business secrets. Open innovation is used to define how firms tackle inbound and outbound innovations without trying to own the ideas. Inbound open innovation is an idea that has come up within the environment of the company that the company could use. Outbound idea is an innovation within company that it has no direct use to the company, but could be commercialized by some actor in the business ecosystem (Cui et al., 2015).

Cui et al. (2015) focus their study on the effects of digitalization on inbound open innovations. They posit that the strategic alignment of IT, further discussed in sub-section 3.6.6., acts as a moderator for inbound innovations. Good strategic alignment of IT’s

thus increase both the volume and quality of innovation of the company as it facilitates improves search possibilities. Whelan et al. (2010) set out to modernize *gatekeeper theory*. Gatekeeper theory was first developed in 1970's by Allen (1977) in his book "managing the flow of technology". The theory states that if an R&D department has so called gatekeeper personnel within it, it will be much more effective in capturing inbound innovations than companies without one. A Gatekeeper is a person who actively seeks out data from outside of the company, classifies it, changes it to fit the organization and finally distributes it to persons who benefit the most from it. Gatekeeper was shown to be an important person in the era before digitalization as the information was scarce and good contact network was required to acquire it. Internet, among other things, has totally changed this picture. Due to digitalization, vast amounts of information are available to anyone who is willing to use time to seek it. In their study, Whelan et al. (2010) find that gatekeepers still exist after a fashion in contemporary firms. It is very rare that one person would do the whole gatekeeping by himself, but rather the role has been split out to two persons. First one sifts through the information and verifies it. He then sends it to second one who is knowledgeable of the internal proceedings of the R&D department and is able to recodify and distribute the data he's given.

There is an additional way of looking into effects of digitalization on innovation. This is by assessing how digitalization changes other, analogical innovation processes. Dewett and Jones (2001) suggest that digitalization moderates the effects of organizational characteristics leading to improved innovation. This is mainly due to the improved collaboration and coordination allowed by enhanced communications within companies. In their study, Dibrell et al. (2008) find support to their hypothesis that in the presence of a firm strategy of innovation, and emphasis on digitalization will be positively associated with financial performance in small and medium sized firms. This, along with the rejection of their other hypothesis stating that innovation alone is positively associated with financial performance in small and medium sized firms support the claims made by Dewett and Jones (2001).

Nylen and Holmström (2015) propose a managerial framework for companies to be able to constantly adjust their operations in order to support digital innovations. The framework consists of three dimensions: product, environment and organization. Product dimension is further divided into two areas: user experience and value proposition. User experience is increasingly important as modern customers are used to get good experiences. Measuring digital innovations user experience revolves around usability but also aesthetics. Final measure is how engaging the innovation is. Value proposition defines the business model and revenue generation model of the innovation. One of the key issues is bundling and unbundling of products to offer suitable packages for customers. For example Apple's iTunes was first to challenge conventional music industry's bundles of songs by selling individual songs instead of whole albums. Environment is cov-

ered with digital evolution scanning- being aware of what goes on. This dimension is already discussed earlier with inbound innovations. Organizational dimension is divided into two areas. First one is skills which are needed to reap benefit from digital innovation. Companies should promote continuous learning of digital technologies to keep up. Indeed, some old capabilities may even be hindrance of new digital innovation processes. Second area of organizational dimension is improvisation. Within this area the authors assert that companies should promote loose enough leadership for innovation to be able to exist throughout the organization rather than in specified R&D division.

3.5 Business ecosystems

Business ecosystem is a term for a group of companies focusing on the same market or product, often interacting with each other. Origins of the term are in biology. New Oxford English Dictionary (1993) defines biological ecosystem as "a community of living species, occupying a habitat and interacting with the environment in which they live." Business ecosystem is quite direct analogy for ecosystems of nature. In his study, Li (2009) finds three characteristics for business ecosystems: *symbiosis*, *platform* and *co-evolution*. All involved parties work with each other and gain from each other's success. They work along one product or service, the platform. Evolution to the central technology leads to evolution of whole ecosystem. Similarly, fall of the keystone player could cause the fall of the whole ecosystem including all the smaller companies. As for an example of business ecosystems, Microsoft has created their own ecosystem around PC's with Windows. Intel is a major player in Microsoft's ecosystem, but there is a myriad of other smaller companies as well. These minor companies provide third party software that works with Windows, or are hardware producers working with hardware compatible with Windows operating system.

Digitalization plays a central role in development of the business ecosystems. This is due to the enabling role of digital technologies in automating business transactions. Many digital age ecosystems encompass such vast amounts of technologies that it would be nigh impossible for any single company to cover them all (Korpela et al., 2013).

Zahra and Nambisan (2012) identify four different models for business ecosystems. In *Orchestra model* there is one strong keystone player, or a dominant company, orchestrating the effort of all other players in the ecosystem. Microsoft's ecosystem is an orchestra model ecosystem. *Creative Bazaar model* offers a global market of ideas and innovations for the keystone player to shop in. Keystone company then commercializes these products. *Jam Central model* has multiple independent organizations working on same effort to produce a completely new field of business. There is distinct lack of centralized leadership in the ecosystem – most companies are equals. *MOD station model* originates from PC gaming industry, where companies allow their customers to create modifications, or "mods", to their games to enhance the gaming experience. MOD sta-

tion adopts this approach into business ecosystems – the bigger players provide the initial architecture for a tech that the smaller players then start modifying.

Several typical actors in the business ecosystems were identified from the literature. Most of the ecosystems have either a dominant keystone player or few of them. Keystone player is the company or group of companies who mainly decide where the ecosystem is headed (Lu et al., 2014). They also seek to maintain health of each member of the ecosystem, as well as create platforms such as services or tools that are open for all the companies in the ecosystem to act upon (Clarysse et al., 2014). In addition ecosystems contain multiple smaller niche companies. They are companies that are operating in ecosystems containing much larger companies and having business value much greater than their own. Niche actors carve a small corner for themselves from the ecosystem. Typically these corners are only capable of sustaining small scale business, thus making the keystone players uninterested in them (Lu et al., 2014). Suppliers come for both software and hardware. They are typically making business with the keystone players, not directly with the end users. Vendors are the storefront of the ecosystem, providing end user with access to the product created by the system. Some keystone players provide this interface by themselves, but it is often outsourced for third parties (Lu et al., 2014). End users are perhaps the most important actors in the ecosystem, as they are the ones bringing in the money. They are either individuals or companies who are using the value created by the system. Governments, while not really a part of the ecosystem, are still very much involved as they are setting the legislative frameworks in which the ecosystem must operate and might grant some financial support for innovations (Clarysse et al., 2014). Sometimes these frameworks may help the business; other times it might make it impossible to continue or to at least have a major transformation. Academia is often considered part of the ecosystem – many times being part of the research and development process of the products within the system (Clarysse et al., 2014).

It is noteworthy to mention close cooperation between the companies within ecosystem. Traditional supplier-buyer relationship seems to be diminishing in favor of more close partnerships between two companies. Inter-organizational networks exist for both competitive and cooperative actions. Two companies might be cooperating on one front and competing on another. Through the collaboration the companies leverage their interdependencies and generate an advantage over single companies with full value chain in their own hands (Clarysse et al., 2014).

In an ecosystem affected by digitalization there are several common technologies and actors for such technologies. These technologies and actors were isolated to create a better image of the ecosystems within the realm of this research. High level conceptualization of such ecosystems was elicited from the references. This conceptualization is presented in Figure 5. Hardware consists of traditional computers and sensors. Fresh additions to hardware are increasing amounts of connectivity and mobile devices. IoT is

a hype word that is being passed around. To function, IoT needs all devices to be able to wirelessly connect into internet. Software providers are producing different types of software for the ecosystem. Some of it is intended for the end-user, some of it is being utilized within the ecosystem itself. Products include different corporate management systems (e.g. SAP, ERP), mobile applications and services for the end users. Some products are used internally within the business ecosystem.

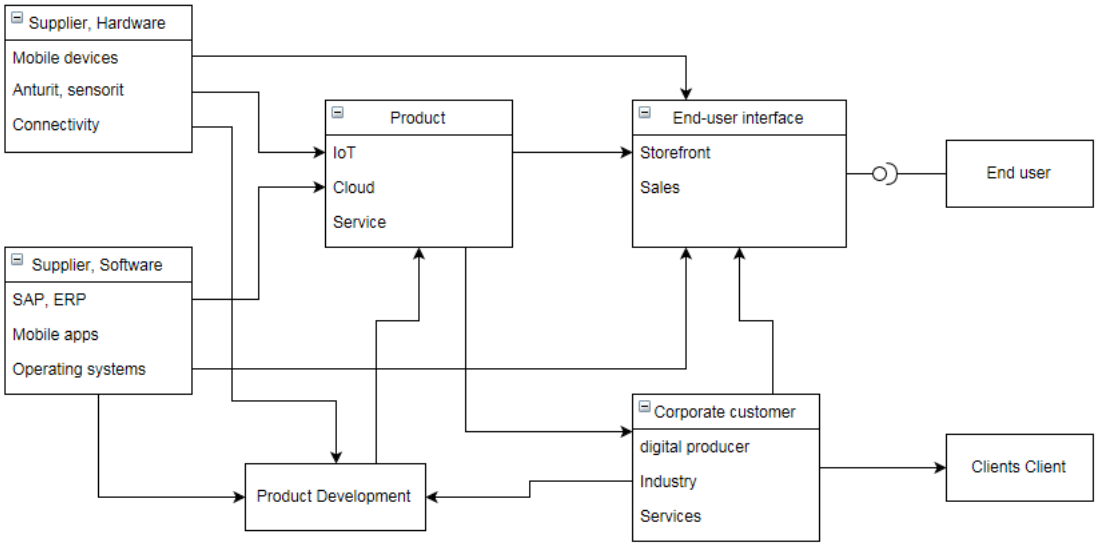

Figure 5. *Conceptual model of business ecosystem (by Author)*

Products can be aimed at corporations or directly to individual customers. When the product is aimed at a corporation, the trend seems to be thinking more and more of the customer's customer, and customer's business processes. Mentality is to understand the customer well enough to be able to create value for their customer with the products instead of forcing customer's to buy bulk products that might not be suited for their needs.

3.6 Facilitators and barriers of digitalization

There are a few studies regarding the inhibiting effects of organizational inertia and incumbent systems (Haag, 2014; Polites and Karahanna, 2012), and large body of research on how innovations diffuse and are adopted in companies (Jeyaraj et al., 2006; Jones et al., 2010; Yao et al., 2009; Scupola 2012). Main theoretical models featured in these studies are *technological acceptance model* (TAM), *the unified theory of acceptance and usage of technology* (UTAUT) and *technology-organization-environment framework* (TOE). Each is further explained in this section. In addition there is small stream of extant literature on drivers and barriers of IT adoption in organizations. Beyond these points, however, no literature was found with the used methodology. Managerial perspective on how to facilitate digitalization seems to be almost white area in the

map – even though many studies suggest top management support is a key issue in IT adoption and diffusion.

3.6.1 Inertia

Organizational inertia is seen as a barrier for adopting digitalization in organizations. Polites and Karahanna (2012) define inertia as: *"inertia in an IS context as user attachment to, and persistence in, using an incumbent system (i.e., the status quo), even if there are better alternatives or incentives to change."* Haag (2014) further conceptualizes organizational inertia to have five sub-dimensions. These are cognitive, behavioral, socio-cognitive, economic and political aspects. Cognitive dimension refers to managerial tendency of using incumbent systems even while knowing there are better alternatives available. Key manager having much resistance to new systems can easily hold back the whole organization. Behavioral inertia is the tendency to keep doing things in certain way, just because they've always been done that way. Socio-cognitive dimension consists of change-inhibiting culture in company making changes hard to implement. Economic inertia entails both sunk costs in legacy systems as well as costs of adopting the new system. Political inertia refers to environmental reasons – partners and customers holding back the adoption of new innovation as it would affect them as well (Haag, 2014).

Polites and Karahanna (2012) find support for their claim that individual working habits lead to organizational inertia. Habits can be considered to be a good thing since carrying out habitual tasks requires less concentration and leaves the employee's mind available to think other tasks while shortening decision times (Polites and Karahanna, 2012). However in the context of adopting new systems or advancing digitalization habitual working methods need to be broken in order to advance with the new way of working.

3.6.2 Technology acceptance model

Technology acceptance model (TAM) has been widely used in organizational studies. Gangwar et al. (2013) consider it being the dominant model for explaining technology adoption at all organization levels and at individual level. It was adapted from the theory of reasoned action. Since it has been used extensively, it has developed some advantages such as well researched and validated inventory of psychometric measurements (Gangwar et al., 2013). TAM assumes that the more accepting users are to use a new system, the more likely they are to use time and effort on learning and adopting the new system over the old one. (Jones et al., 2010).

TAM conceptualizes two key antecedents for adoption of new system. First one is perceived ease of usage. Perceived ease of usage is defined as "the degree to which the prospective user expects the target system to be free of effort" (Gangwar et al., 2013). This is rather intuitional – the easier a new system is to use, the happier persons are to

adopt it. Another antecedent is perceived usefulness. Its definition is as follows: "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" (Gangwar et al., 2013). Perceived ease of use affects the perceived usefulness as well as the attitude of user. These perceived notions of the technology to be adapted form individuals attitude toward using the new technology. This attitude then motivates a behavior intention which in turn initiates the actual behavior (Wu et al., 2011.) Conceptual model of TAM is shown in Figure 6.

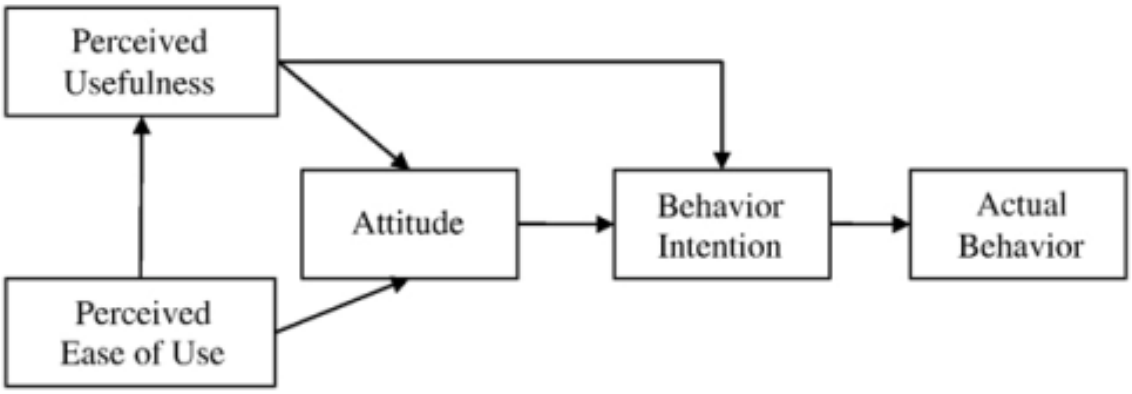

Figure 6. *Conceptualization of TAM (Wu et al., 2011)*

Some forms of TAM take out attitude, arguing that the antecedents affect the behavior intention directly. These are called parsimonious models of TAM. Key thing in TAM is that it doesn't make any assumptions about the actual quality of the new technology or innovation but focuses on what the user perceives of it. In their study of forced technology situations Jones et al. (2010) found that managerial support has major influence over perceived ease of use. In all cases it should be possible to influence the perceived ease of use with proper education during implementation of the technology.

3.6.3 The unified theory of acceptance and use of technology

Past research on user acceptance of technology has been rich in volume and also in theories generated (Williams, 2015). The unified theory of acceptance and use of technology (UTAUT) was combined from several theories in 2003 by Venkatesh et al. They reviewed and integrated eight dominant models of the time to create one with more explanation power. Theories included in forming UTAUT are: Theory of Reasoned Action, the Technology Acceptance Model, the Motivational Model, the Theory of Planned Behaviour, a combined TBP/TAM, the Model of PC Utilization, Innovation Diffusion Theory, and Social Cognitive Theory. (Venkatesh et al., 2003) In their study, Venkatesh et al. (2003) show that UTAUT outperforms the theories it has been based

on. Since its creation UTAUT has been widely used in variety of fields (Williams et al., 2015).

As can be seen from Figure 7, UTAUT has some degree of similarity with TAM. This is not surprising as TAM is one of the theories UTAUT has been based on. UTAUT adds six new constructs in addition to those found from TAM – and discards attitude. The new construct in direct determinants of behavioural intention added is social influence. Another new construct is facilitating conditions, which is seen as direct determinant of use behaviour (Williams et al., 2015).

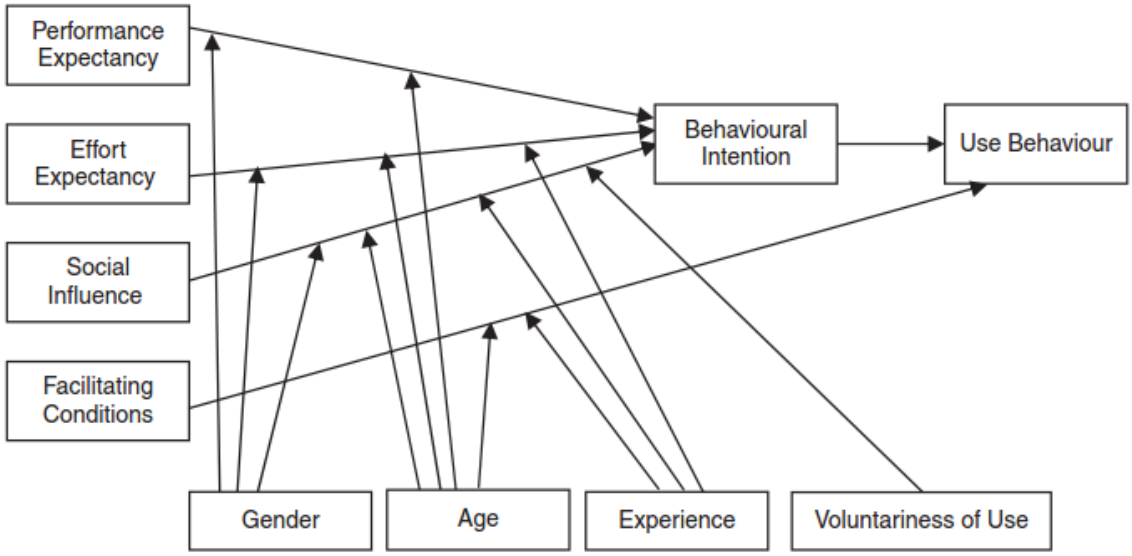

Figure 7. *Conceptual model of UTAUT (Venkatesh et al., 2003)*

The other four constructs that the model adds are conceptualized as moderators for the direct determinants. These are user's gender, age, experience and voluntariness of use. These moderating constructs are not applicable for organizational research as such. However, it can be argued that these constructs can be applied to organization as well by calculating mean values of all the employees of the organization. Indeed, few studies have been made on organizational context with UTAUT (Gangwar et al., 2013).

3.6.4 Technology-Organization-Environment

In their meta-analysis of research conducted between 2010 and 2012 Gangwar et al. (2013) identify Technology-Organization-Environment (TOE) framework as one of the more widespread frameworks when researching IT adoption. TOE framework was originally developed by Tornatzky and Fleischer (1990). Main benefit of TOE is that it is free from industry and company size restrictions. Critics of TOE state that the framework is just taxonomy and doesn't really offer any conceptual depth. It contains *three contexts* which are explained in the next paragraphs and elaborated in Figure 8.

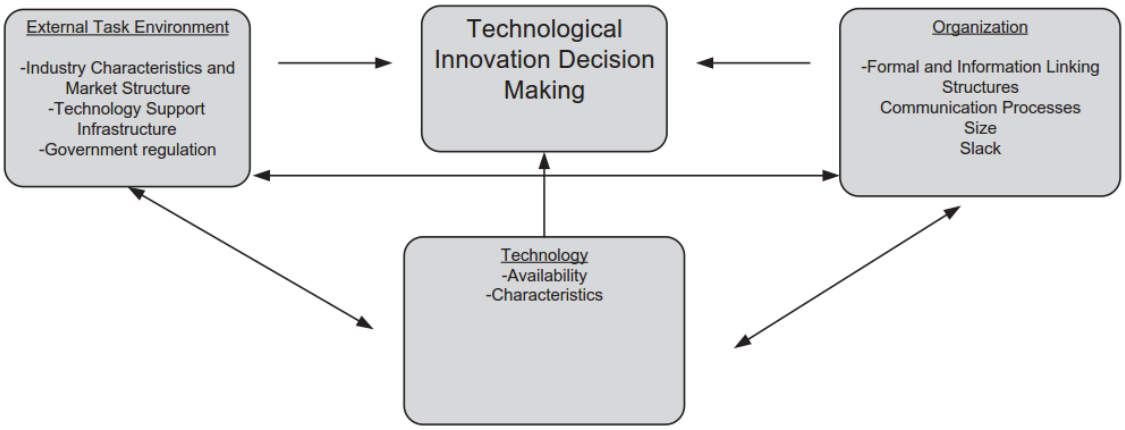

Figure 8. *The context of technological innovation (Tornatzky and Fleischer, 1990)*

Technological context holds all the variables influencing adoption of innovation. Gangwar et al. (2013) found that*:* "The studies found that system assimilation, trailability, complexity, perceived direct benefits, perceived indirect benefits and standardization are significant variables while observability is found insignificant"

Organizational context is the most interesting one considering the scope of this thesis. It refers to organizational characteristics and resources of company. The studies identify several significant aspects of organization: degree of formalization, managerial structure, trust, human resources, organizational slack, innovation capacity, knowledge capability, linkages among employees, financial resources, firm structure, operational capability, strategic use of technology, technological resources, top management support, quality of human capital, organizational knowledge accumulation, expertise and infrastructure and organizational readiness (Gangwar et al., 2013; Bradford et al., 2014). Many of these organizational topics identified in TOE are tied to findings on the effects of the digitalization in this research.

Environmental context focuses on the environment in which the company operates. In this case it means mostly factors influencing whole industry, such as government regulations or incentives. "Significant variables in environmental context include customer mandate, competitive pressure, external pressure, internal pressure, trading partner pressure, vendor support, commercial dependence, environmental uncertainty, information intensity and network intensity while government regulation is not identified as significant variable" (Gangwar et al., 2013).

3.6.5 Facilitators of digitalization

Some studies have set to find out what drives digitalization. Some of the answers are intuitive and others maybe not so. Yao et al. (2009) find support for the very intuitive assumption that bigger IT spending helps in adopting new technologies. Human resources management practices have also been linked as factors facilitating digitalization

(Carroll and Wagar, 2010). Jeyaraj et al. (2006) published a meta-analysis of the research made in the subject of diffusion of IT-based innovations between 1992 and 2003. In their study of 99 research articles they find four best predictors for IT application, here presented in Figure 9. The scores in the figure are calculated as percentage of the times the factor was found significant from all the studies it was used. External pressure was found being significant facilitator of IT adoption in all six of the studies it was tested on. External pressure stems from suppliers, customers or industry standards. Professionalism of IS unit was found significant in 7 studies of the total 8 times it was studied. This finding is seconded by Scupola (2012) who identifies lack of knowledge to specify system requirements and lack of IT competence as organizational operative barriers. External information sources was also found to be significant in 7 of the eight studies it was studied. Top management support was studied the most of the best predictors. It had been in 12 studies, of which 10 found it to be significant (Jeyaraj et al., 2006).

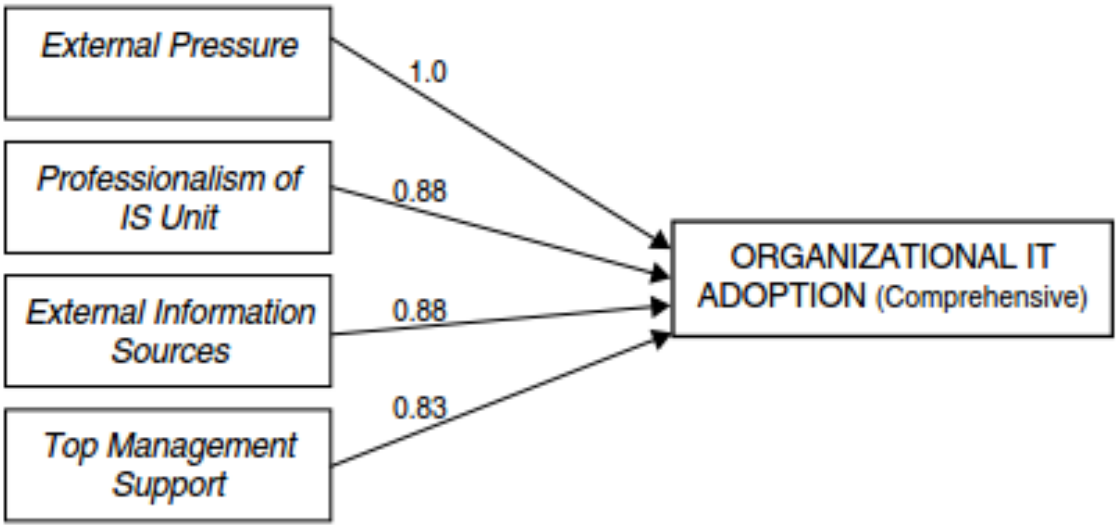

Figure 9. *Facilitators of IT adoption (Jeyaraj et al., 2006)*

Scupola (2012) studied ITC adoption in facilities management supply chains of Denmark. She extracted both organizational and technology driven facilitators for the adoption process. These findings present support to the work of Jeyaraj et al. (2006), offering organizational drivers closely related to top management support. These drivers include company policy and better strategic and tactic facilities management decisions (Scupola, 2012). She also identifies seven external drivers and barriers such as industry characteristics, supplier interdependence, lack of collaboration among software providers and government regulation (Scupola 2012).

3.6.6 Information systems strategic alignment

A topic that borders the effects of digitalization is information systems (IS) strategic alignment. There is a fairly large body of research done in this topic (Preston and Kara-

hanna, 2009; Reich and Benbasat, 2000; Johnson and Lederer, 2010; Alaceva and Rusu, 2015), including the barriers and inhibitors of IS strategic alignment on companies. The results of these studies are included in this thesis, as they offer reasons why information systems are not perceived as working well in companies - something that should act as a barrier for further digitalization as well.

There is no clear, agreed on definition or model for strategic alignment of IS. Preston and Karahanna (2009) find two views for the term in their literature review of the subject. First one, the intellectual dimension of strategic alignment, defines it as alignment between business and IS on various dimensions such as strategy, plans or infrastructure of processes. The second one, the social dimension of strategic alignment is defined as the mutual understanding and commitment to business, objectives and plans between business and IT departments.

Alaceva and Rusu (2015) argue that companies cannot reach intellectual dimension if the social dimension is not achieved before. Their research model is reprinted here in Figure 10. They study the social dimension in their case study of a large Swedish company. They divide this dimension in four subgroups: Shared domain knowledge between business and IT executives, Successful IT history, Communication between business and IT executives and connections between business and IT planning. It seems that communication, connection and shared domain knowledge should be interlinked as concepts, as they are mainly asserting that the main barrier of IS alignment is lack of communication and understanding between business and IS departments.

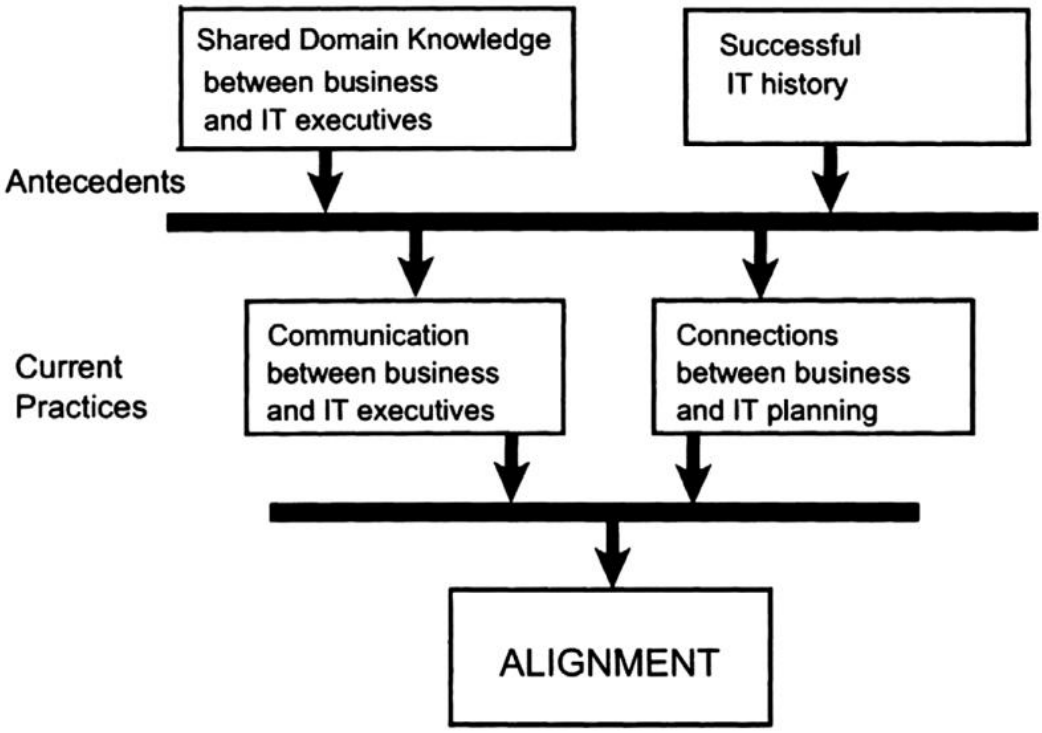

Figure 10. *Research model of Alaceva and Rusu (2015)*

A study by Johnson and Lederer (2010) support the finding of Alaceva and Rusu (2015), with the result that the prequisite for IT alignment is mutual understanding of CEO (Chief Executive Officer) and CIO (Chief Information Officer) of the company. Conceptually the results from these two studies are very close even though the terms used are a bit different.

4. EMPIRICAL RESEARCH

Empirical work of this thesis was made as a part of Need 4 Speed program in a VIA Group project called G-Accelerate. The project was initiated to fulfill a need of companies to advance efficiently in digitalization. Need 4 Speed (N4S) is four-year a Finnish Strategic Research and Innovation Agenda (SRIA) program that aims to create foundation for software intensive businesses in the new digital economy. It has three main areas where it focuses: delivering value in real time, deep customer insight and mercury business. The project consortium consists of 13 large industrial organizations, 16 SMEs and 11 research institutes and universities (Digile, 2015).

4.1 G-Accelerate in N4S context

Three main area have been defined where N4S SRIA program aims to improve the performance of Finnish companies. These areas are: delivering value in real time, deep customer insight, better business hit-rate and mercury business – find the new money. Vision of the N4S SRIA program is:" By 2017 the Finnish software intensive industry is the recognized leader in business innovation and fast implementation of products and services in the digital economy. This has been achieved by adopting a real-time experimental business paradigm, providing instant value delivery based upon deep customer insight" (Digile, 2015).

Mercurial business refers to extremely agile business where new opportunities are quickly pursued and new found market niches are filled in an instant. Companies should be arranged in a way and have such capabilities that this agile way of working is as effortless as possible to achieve. To achieve mercurial business targets the companies need to have deep customer insight and capabilities for delivering value in real-time. They are prerequisites of rapid, controlled experiments in new business domains (Digile, 2015).

Real time value delivery aims at new business paradigm for producing additional value with products in real time. Real time value delivery needs to be enabled with organizational and technical changes. Technical infrastructure is one of the key bottlenecks of the new culture for real-time value delivery. Advanced tools, interfaces, methods, APIs, technical infrastructure etc. are needed in order to achieve delivery of value in real time. A mix of heterogeneous technologies is required for implementing dynamic and adaptive environments that fulfil the quality requirements in personalized way on-demand for service execution. These environments need to be flexible enough for the introduction of new features and removal of obsolete ones. These integration and deployment

tools, processes and methods are needed to support new digital ecosystems in fast-cycled multi-organization environments. Additionally, tools and methods for, in example a new version release in automated manner for selected user groups are needed. Organizational culture must change to accommodate such experimentation as a daily practice. The new organizational cultures must support the transition towards new ways of working (Digile, 2015).

The key prerequisite for better *business hit-rate* in new real-time digital economy is the companies' ability to gain *deep customer insights*. In the new global markets companies must better understand their customers. Understanding what features, functions or user interface solutions their products and services should have is not enough. New insights on how they could provoke, delight, gratify, shape or touch the users in a new way and with new products or services are needed as well. Feedback for gaining such insight needs to be collected from wide array of sources in order to cover differences in gender, age and cultures of the user base. Predicting the future impacts in markets relies on companies utilizing heterogeneous data and information including market trends and weak signals within the data. This requires new technical infrastructure along with methods and tools to improve innovation along with co-production with the users including potential end-users as well. Technical infrastructure refers to issues such as feedback mechanisms which automatically collect, analyze and visualize data and information collected from the users (Digile, 2015).

N4S SRIA considers its goals achieved if following conditions have been met in the future. *Delivering value in real time:* "The Finnish software intensive industry has renewed their existing business and organizational ways of working towards a value-driven and adaptive real-time business paradigm. Technical infrastructure and required capabilities have been established to support the transformation." *Deep customer insight:* "The Finnish software intensive industry is utilizing the new technical infrastructure, new capabilities as well as various sources of data and information for gaining and applying the deep customer insight. This significantly improves the return of investments in service and product development." *Mercury Business*: "New Goal Driven Hunting Culture" - Mercury business approach expanding beyond existing business has been created and adopted by the Finnish software intensive industry with several successful examples of adjacency towards the new markets and business areas. The new Mercury Business approach is enabled by the continuous and active strategy and the new leadership style. What is important to note that the two breakthrough targets above are enablers and prerequisites for meeting the Mercury Business breakthrough target, as well as key elements of the real-time business system" (Digile, 2015).

VIA Group is a Helsinki-based company that offers management consulting and various training sessions to increase leadership. They have joined N4S SRIA with a G-Accelerate project, led by dr. Pertti Aaltonen. G-Accelerate aims to create a tool to help companies understand where they stand in the digitalization front. Main goal of the pro-

ject is to develop a way to measure which elements in the organization, its management and leadership should be adjusted to better seize the value from the new digitalized business ecosystems. Analyzation of the data measured with the tool provides requirements and suggestions for improving management processes and leadership in organizations. The scope of this thesis ends with the creation of the G-Accelerate tool; its usage will be left for future research. As such, the G-Accelerate tool fits in most of the key areas of N4S SRIA, as all of the main areas require high amount of digital capabilities from the companies.

4.2 Methodology applied in the research

Grounded theory methodology is appropriate when the research is set to develop or modify a theory, explain a process and develop a general abstraction of the interaction and action of people. It offers a macropicture of situations rather than detailed micro-analysis (Creswell, 2012). There is a lack of existing theory on the management processes and leadership capabilities regarding the organizational change toward mercurial and digitalized one. Grounded theory has an advantage in sensitive or confidential topics due to the generation of abstractions (Creswell, 2012). In this study, all the raw data is kept confidential as was agreed during the interviews. Grounded theory is therefore well suited for this research.

To start the project, dr. Aaltonen conducted interviews with twelve companies from different sectors and different sizes. All together nineteen informants were interviewed. Interviewed companies were mostly selected from within the N4S SRIA consortia, with an aim at variety in size and position in their relevant ecosystems. This was achieved well, as some companies could be considered as keystone players in their ecosystems while others were partners to a large company in their respective fields. Four additional companies were chosen to be included to the study from outside of the consortia. This was to augment the variety of companies in the study in order to have a full coverage of the intended field of companies in the study.

The interviews were semi-structured with some amount of variation left to pursue topics of interest in each case as they were uncovered in during the interviews. Questions were derived from a theoretical perspective to cover the areas of interest as wholly as possible. This perspective was combined from several sources: books of Adner (2012), Schein (1992) and Kauppinen (2013) as well as an article by Zott et al. (2011). The structure of interviews consisted of ten areas to go through in roughly two hours. In the introduction phase the motivation for the study was described. Permission to record the interview was asked with a promise of confidentiality.

Second phase of the interview consisted of identifying the company and the person. Person was asked about his or hers background, role and experience in the company. Details of a company, or in some cases a division of larger company, that were enquired

were size of business, number of units and personnel and industry area divided into hardware, software, manufacturing business or services.

In *third* phase the questions were about how the company is functioning at the moment. Information was sought through to questions such as: What are the products or services and who are the main customers? Who are the competitors and how does the company differ from the competition in advantageous way? A distinct point was to find out how the company generates money. I.e. what are the things they are billing for, who are they billing and how do they decide how much to ask from a product or a service.

Fourth phase of the interviews focused on interviewee's description of the IT functions of the company and how it affects the other processes and systems in place in company. Processes and systems in this section are to be understood in very wide way – the topics were ranging from management and organizational issues through innovations and new business areas to culture and stakeholders. Fine grained interest was shown for IT department relations to top management, their understanding of business and cooperation with the rest of the organization. In the case of software producers this phase evaluated the way they are producing the software and how it affects systems and processes of the company.

Fifth phase explored the awareness of relevant business ecosystems of the companies. Interviewees were asked to identify the key actors of their relevant business ecosystems and to draw a map describing the ecosystem. Interesting topic is the degree of cooperation between different actors – are the companies in the ecosystem suppliers and customers or partners with each other? Several topics were discussed regarding customer relations and how well does the company know its customers and their capabilities. Business partners were talked with many sub-topics. Interviewees were asked to estimate what would their partners tell when they describe the interviewees company as a partner for example.

Sixth phase sets out to find how the interviewee's company assesses its customers IT readiness and the effect it has to the relations of the two companies. Topics of interests are identical to those discussed in phase four but from the customer perspective. Interviewees were asked to evaluate their own and their customers IT process maturity selecting from scale of 0 to 4. Level 0 was described as chaotic; run with undocumented ad hoc decisions. Maturity level 4 describes a company where IT strategic alignment is fully achieved.

During *Seventh* phase the role of the company in their relevant business ecosystem was clarified. The techniques that companies utilize to monitor the changes in their business ecosystems were also topics of discussion. Changes in business ecosystem include issues such as: change of actors, changes in actor's business models, value propositions and changes in boundaries of ecosystem. Adapting to these changes was also discussed

in regard of possible change in role within ecosystem, performance indicators, management systems, strategy and organization.

Eight phase was a short one, consisting of just a few questions regarding the increase of data transfer speed. Its effect on the ecosystem, customers and partners was gauged.

Finally, *ninth* phase topics for discussion were the future visions of companies along with the forces driving and inhibitors prohibiting these changes in the companies' environments. Foreseen sub-topics to be discussed in this phase highlighted in the questionnaire include technology, legal changes, investments and changes in prices of different products or services.

These interviews were recorded and the records were transcribed. This produced 162 pages of text. Transcriptions were then disseminated producing 1069 lines of findings. The findings were essentially short concrete statements of the interviewees. These statements were then grouped together to form categories of statements from similar issues. Table 2 shows the original grouping from early stage of the research process as well as number of findings assigned to each category.

Table 2. *Original codification of data*

Code	Findings	Explanation of category
CUN	134	Customer understanding, insight, customer requirements
COO	103	Shared activities, Cooperation, Collaboration, Coopetition, Trust
ECO	91	Ecosystem, partnerships
BMO	90	Business model design
PRO	57	Product
CAP	49	Capabilities & competences
CUL	46	Culture
OTH	46	Other
CUS	45	Customer segments
RND	40	Research & development
LSH	35	Leadership capability
CCU	31	Customers' customer, end customer understanding etc.
DSE	24	Digital services
ORG	24	Flexible & adjustable organizationdal structures
KPI	23	Performance indicators, monitoring
DSY	22	Data systems, ERP, Management system, leadership system, reporting
NBU	22	New business, innovations
PRC	18	Process oriented / centric
LEA	16	Lean, Agile, Cost efficient
CDB	15	Cloud, Data Bases
STR	15	Strategy
TDA	13	Transparent Data / Activity
ITR	12	Information technology's role

SPE	12	Speed
STS	12	Strategic sales through all level interaction, sales, customer relations
UND	12	Shared understanding, insight
M2M	10	Machine to machine, internet of things (IOT)
DRE	9	Digital readiness
PRD	9	Predicting
REA	9	Real time data
RIS	9	Risk management
SBU	9	Service business
ENT	8	Entrepreneurship, Empowerment, Self-leadership, Trust
PRJ	7	Project
VCR	7	Value creation, Value adding sales
FIN	5	Financing, Capital
SME	5	Social media, Viral marketing
CCH	4	Continuous Change
DMI	4	Datamining and analysing
FLE	3	Flexibility

Theoretical sensitivity highlighted in grounded theory methodology literature was achieved with a literature review by author, setting out to find out different effects of digitalization on organization as well as organizational barriers and facilitators of digitalization. Full results of the review are presented as a section 3 of this thesis. Literature review for each topic was continued until no further significant effects were discovered as dictated by the methodology. Interplay with the data consisted of going through same data multiple times by multiple researchers, comparing the findings. After the first set of interviews there were, however, no further interviews while creating the G-Accelerate tool prototype. This was partly due to the prototype nature of the tool and partly due to time constraints on the project. It was felt that the saturation achieved with the first interview and the meticulous mulling of the data during category creation provided enough insights to go on with the questionnaire for the companies.

Forty categories were first created from the findings picked up from the data, as seen in Table 2 above. Large portion of these categories were then eliminated or combined to create resulting final 13 categories. The elimination and combination process took place in several iterations each reducing the number of categories until conclusion was reached. The information from the literature review was used in supporting this process or category reduction.

4.3 Categories from the data

After the initial categorization of the findings shown in Table 2, there were multiple iteration loops until consensus was reached and categorization was declared final. The final categories are presented in the Table 3 below. Comparing it to Table 2 presented in

sub-section 4.2, it can be seen that the final theory is much denser and richer than the first drafts. Table 3 has a column labeled agreement-percentage, which houses an agreement-percentage for each category. It is a percentage that was calculated by comparing the opinions of two researchers about the items in categories. All the items that were disagreed were divided by the total amount of items in the final category producing this percentage for each category. As stated in section 2, if a category has an agreement percentage of over 80%, it should be considered as valid category. All the remaining categories achieved at least this threshold – in many cases with a good margin as well. Thus it was agreed that consensus was reached. Following sub-sections contain more detailed descriptions of each of the thirteen categories.

Table 3. *Final categories*

Code	Category title	Agreement-%
CUN	Customer understanding, insight, customer requirements	98 %
COO	Shared activities, Cooperation, Collaboration, Coopetition, Trust	81 %
ECO	Ecosystem, partnerships	97 %
BMO	Business model design	83 %
CAP	Capabilities & competences	92 %
CUL	Culture	93 %
KPI	Performance indicators, monitoring	100 %
LSH	Leadership capability	100 %
CCU	Customers' customer, end customer understanding etc.	100 %
NBU	New business, Innovation	95 %
MSY	Management system, reporting	82 %
ORG	Organizational structures	100 %
PRC	Process oriented / centric	100 %

Customer Understanding, coded CUN

Customer understanding was identified as one of the key areas for a company actively working in an ecosystem. This category assesses the firm's ability to sense its customer needs and how well it is able to provide answers to these needs. Polar opposite of a customer orientation would be to impose stock programs to all customers with no regard on how well they fit the customer's needs.

Cooperation, collaboration, trust, coded COO

Cooperation in this research means all the cooperative and collaborative actions of company with both suppliers and customers. The category consists on statements about closeness of the cooperation and trust in reality. For example, do the employees share same physical working space? It also measures how mature capabilities the focal company has at creating cooperative projects with different actors in their business ecosystem.

Business ecosystems, coded ECO

Understanding how business ecosystems work and monitoring the status of the business ecosystems is increasingly important for companies as they become more and more tangled into these ecosystems. Implication of this is that a change in the business ecosystem reflects directly to all the companies working within it. Business ecosystem category defines how well the companies monitor their relevant business ecosystems and how much they even think about business ecosystems.

Business model design, coded BMO

Business model design category holds all issues that have to do with how the business of the company works. This includes marketing strategies as well as product portfolio the company is offering. In this research, project planning processes are integrated into the business model design category. The category measures the firm's interests on business models of client's and partners. Even though the category spreads throughout ecosystem, it doesn't mean that the ecosystem has its own business model but rather signifies that each actor has their own business models.

Capabilities and competences, coded CAP

Capabilities and competences define how and on what circumstances a company can act. Capabilities are formed from employees understanding of the company business and operations and partially from workforce agility. Good communication capabilities towards customers and partners are required when operating in business ecosystem.

Culture, coded CUL

Culture category sets out to define the company's culture towards digitalization and the management efforts to affect the culture. Company's tolerance of risks and how fast the culture may be changed – and with how much resistance a change is met with in the company - are measured within this category. Internal trust and openness for new ideas belong to culture category as well.

Performance indicators, monitoring, coded KPI

Performance indicators and monitoring category holds all the findings regarding the key performance indicators (KPI) of the companies. This includes how well they are functioning and whether or not they are actually monitoring the correct issues. KPI's are functioning correctly when they yield relevant information for the managers, who can be assured of the status of the measured subjects and base decisions on these indicators.

Leadership capability, coded LSH

Top management support has been identified as one of the key drivers of digitalization in several studies. Leadership capabilities contain the findings that have to do with the management of companies. These include the perceived importance of management, openness of top management and effectiveness of the management.

Customers Customer, coded CCU

Understanding customer's customer measures how well the focal company is able to monitor either the end-user of their product or the customer of their customer. This entails understanding the changes in business, technology or process needs of the end customers. Understanding customers customer well is a sign of deep understanding of customer needs which is considered essential in today's business environment.

New business areas, innovations, coded NBU

New business areas are ones that innovations make possible. The road from innovation into product or service takes a while and usually includes some further refining. This is why research and development issues are grouped into this category along with the innovation support of the company. Management support for innovation is a relevant issue within this category as innovations and new businesses inherently require tolerance of risks.

Management systems, reporting, coded MSY

Management systems category sets out to define how well the different data systems utilized in the company support its other functions. Key question in this category is: are the systems quick and easy enough to use and to provide value and information when needed in the form it would be needed? Management systems are identified to have impact on several different aspects of the organization: agility, management, reporting and design of new products.

Organizational structures, coded ORG

Organizational structures are considered as one of the features that will change when company transforms into enterprise 2.0. This category consists of the findings regarding the actual state of organizational structure. Another sub-section of findings in this category is the way organizations structure is being continually developed by management.

Process Oriented, coded PRC

Process orientation category defines how well companies can measure and improve their own processes. Evaluation of customers and partners process is also considered

here. Some findings have to do with inertia of process changes that may surprise the company when they would need to improve these processes.

4.4 G-Accelerate tool

G-Accelerate tool prototype is the final product of this thesis. G-Accelerate project will continue on to iterate and validate the tool based on customer responses. The G-Accelerate tool prototype consists of questionnaire of 160 questions for companies to fill. After analyzing the answers an assessment can be made regarding organizational areas that have enhancement possibilities in context of digitalization. Full questionnaire is kept confidential within the research consortia, but some example questions from each category can be seen in Table 4. The questionnaire is originally in Finnish, example questions for this thesis have been translated by author.

G-Accelerate prototype tool has an added dimension on top of the categorization drawn from the data. The dimension is based on the work of Kauppinen (2013) while the representation of it in Figure 11 is made by author. This additional dimension is added to the tool be able to isolate the possible changes needed in the organization more closely and draw more information from the answers.

The new dimension consists of two axis as shown in Figure 11 below. First one divides the questions in two parts. Left side has questions regarding people, personnel and processes, coded P. Right sides questions are about systems and business, coded B. Personnel and process related questions include all those where a single person can make a choice or perform a task as specified in process description. For example, R&D's tendency to highlight products technical marvel instead of customer gains would be a P-question. Business and systems related questions include larger decisions that are not normally made by single person in the organization and how well the organization understands it customers. Customers business model analyzation and business ecosystem analyzation clearly falls under B-category along with internal reporting of the company to name a few examples.

Second axis has three dividers carving out four areas along the line. They are numbered from one to four. First area consists of the low level work tasks related questions. These are all daily items the organization or personnel face, such as discussions with suppliers and customers or setting the prices of products and services. Second area has all the questions from operative level. Operative level is bit higher than the daily items – it can be seen as the processes guiding the daily decisions and tasks or projects to which the daily tasks of the first level are done. Decision speed of management systems and clear line-organization structure that supports daily work would both be good examples of topics in operative level. Third area is again a bit higher than the second one. It consists of strategic issues. It's not much connected to daily issues anymore but concerned with a bit longer term issues. General organizational structures and the perceived ability to

steer business ecosystems in long run are items clearly within strategic level of thinking. Organizations culture resides in this level as well. Finally the fourth area at the top consists of questions which have to do with the very large issues facing the company – it is again one step higher than strategic level. One might call it tactical level. Analyzation of the business models of different actors in the business ecosystems or denoting a difference between suppliers and partners are issues of tactical level. Each question in the G-Accelerate tool prototype was assigned an additional code, such as "P2", to denote what it is measuring in this second dimension.

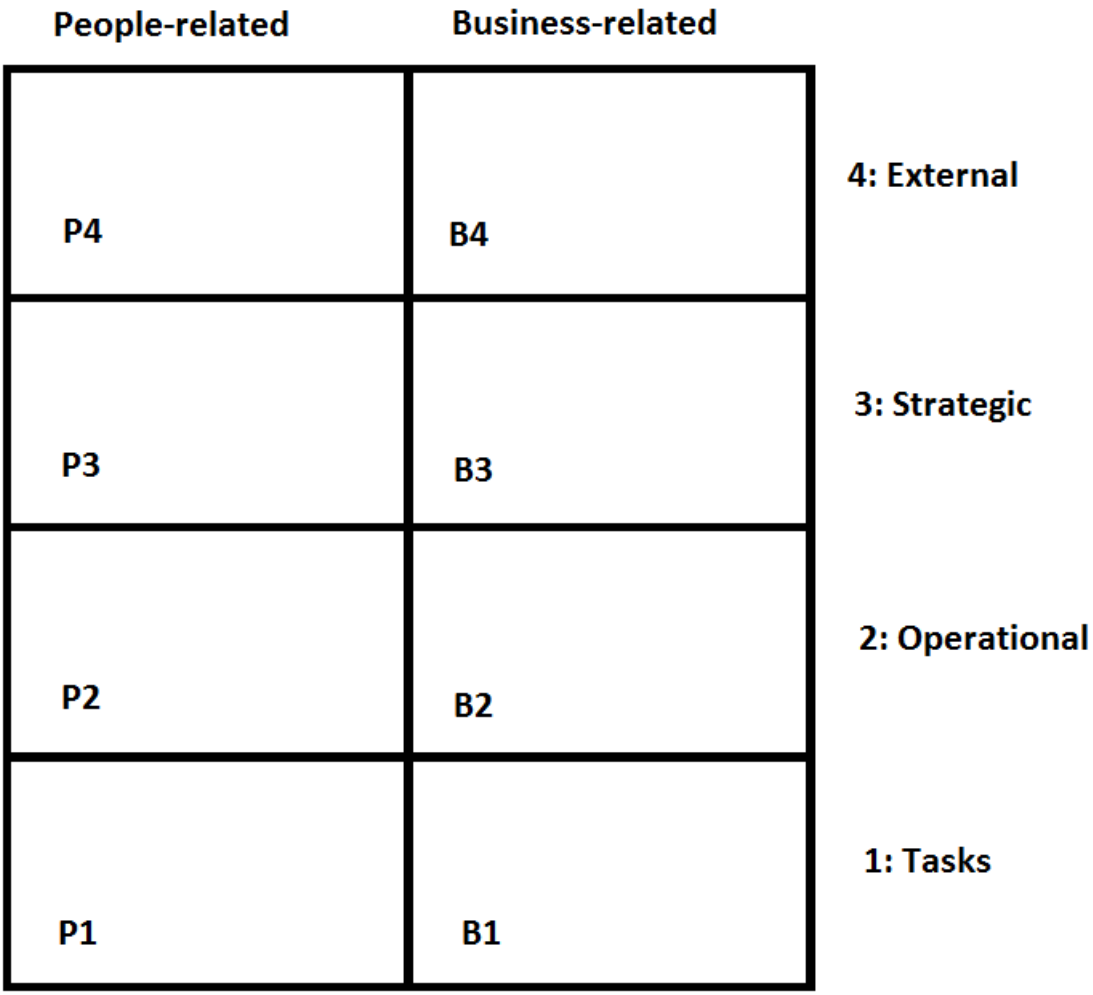

Figure 11. *Second dimension of G-Accelerate tool (by Author)*

All together the G-Accelerate tool prototype has 160 questions. These questions are divided in categories created from the data. Each question in the G-Accelerate tool prototype was also assigned an additional code, such as "P2" to denote what it is measuring in this second dimension. Example questions shown in Table 4 are taken directly from the prototype of the tool. Each question is heavily rooted in the raw data. It is possible to trace each question back into original findings and from there to the data in transcribed form to see the context from which it originates. Category in which each question belongs to is shown in the column "Code". Quadrant-column then shows where the

questions are in the second dimension of the tool. Lowest amount of questions from one category is 7 while highest is 20. Most categories have comfortable amount of 10 to 14 questions. Quadrant-wise levels 2 and 3 are a bit more congested than the extremities of the scale. This is normal, as most changes that can be made in organizations are happening in these levels. All quadrants have enough questions to remain valid.

Table 4. *Example questions from the G-Accelerate tool*

Question	**Code**	**Quadrant**
We plan even our smallest projects very carefully	BMO	B1
Our employees have deep understanding of every level of our business	CAP	P2
We can easily understand the business model, technology and process changes of our customers customers	CCU	B4
We share more and more of the risks involved with our partners	COO	B3
Our understanding of and capabilities for quick changes help us succeed in the long run	CUL	P3
It's easy to discuss with customers people responsible for business	CUN	P1
Our reporting is quick	DSY	B2
Our partners work in our workspace more often than not	ECO	P4
Our goals and the way they are set is transparent to everyone	KPI	B2
Our internal feedback is processed very quickly	LSH	B2
We can respond to the challenges of quicker paced business developement	NBU	P2
Our management actively develops our organization structure	ORG	P3
We are able to generate new business by automatizing customer's processes	PRC	B3

The G-Accelerate tool is in essence a psychometric scale. Likert scale is the most commonly used scale for psychometric questionnaires. As a result, it has decade's worth of research done on how it should be designed to be effective and to yield valid results. Some results from this research are shown in sub-section 2.3. Due to the amount of knowledge accumulated over the years, Likert scale was a natural choice of questionnaire form to be used in G-Accelerate tool. After reviewing relevant literature on the subject, the properties of the scale were decided based on the findings from literature. Design choices that were made are presented below. It is a standard for the scale to be horizontally aligned. This was accepted for G-Accelerate as well, as there was no evidence found of vertical questions yielding improved results. As the amount of questions from each category in both dimensions is high enough, it was deemed that four options are enough for each question without endangering validity and reliability of the questionnaire. Even number of choices means there is no neutral option in the scale. This forces the respondent to have an opinion on each question. If the questions are not applicable in the respondents area, there is an additional "not applicable"-choice available. All the questions are asked in positive light, decreasing the chance for errors in answering the questions and making the questionnaire more user-friendly. The scale is an-

chored in both ends with “Strongly agree” and “Strongly disagree”, having no anchors in between.

4.5 Validity and reliability

Section 2 describes the assessed measures for achieving reliability and validity in this research. One of these measures is elimination of biases. The interviews were all made by a single person, thus eliminating the possibility of interviewing bias. The interviews also had a written structure to back them up to ensure all the relevant questions were asked in similar fashion. The interviews were treated as private data that will not be shown to any outsider. This was communicated to the interviewees before the interview, thus reducing the chance of interviewee not mentioning some key issues. The transcriptions of the data were then handled by two researches on separate facilities to eliminate bias from personal opinions.

One of the key factors for validity in grounded theory methodology was identified as the selection of first samples. In this research, case companies in the research were selected from a large range of different business perspectives. For the data to be fit in context, the sources need to have visibility over whole phenomenon. The amount of different fields of case companies provides wide visibility over the phenomenon of digitalization. The additional four companies outside of consortia were added to research to address the width of visibility of interviewees.

Fitness also sets requirements for the persons who are being interviewed. They must be knowledgeable, willing to participate and experienced with the phenomenon. Several companies submitted more than one person to interview thus widening the range of experience of the phenomenon. Interviewees were high ranking members of companies – mostly C-suite managers with long experience in digitalizing industry. In total, there were 16 interviewees with average relevant experience of 22 years. The most experienced interviewee had 38 years of experience while even the most inexperienced interviewee had five years of relevant experience. Conclusion is that the interviewees and the companies selected fulfill the fitness requirement.

Fitness of data was also continuously improved during the research, as is evident from section 4. The progress of categories can be tracked from the initial codification to final one. No further interviews were conducted after the initial ones due to time restraints on the project. This was partially mitigated by having two separate researchers conduct codification and comparing the results. According to Tuomi and Sarajärvi (2009) the validity may be considered to be good, if the agreement level is 80% or above. This was achieved across all the categories as shown in Table 3 in sub-section 4.3.

At the end of the research the prototype of G-Accelerate tool was ready and it was presented to the companies that were originally interviewed at the beginning. The reception

was good and the companies found the tool presenting their views expressed in the interviews. This is an indication of successful, valid and reliable research.

5. CONCLUSIONS AND DISCUSSION

Previous sections contained the information gathered in this study. This section consists of the conclusions and discussion of the thesis, summing up the work. Also included are the limitations of this thesis and thoughts for future research opportunities.

Conclusions

This thesis set out to discover the effects of digitalization in organizations as well as to identify the organizational barriers and facilitators of digitalization. The effects of digitalization are discussed in section 3 of this thesis. Root source for most of the effects is improved communication possibilities. This is not very surprising, as organizational outcomes are very highly depending on good and timely communication of information. Identified organizational effects include size and shape of the organization, organizational learning, organizational agility, innovation capabilities and evolution of business ecosystems. The *shape of the organization* is found to be less structured and flatter than the organizations of industrial era. Each employee has access to more information of the company than before, enabling more informed decisions. *Organizational learning* capabilities are improved mainly due to data codification and improved analysis possibilities. *Organizational agility* is the result of several contributing factors – but it is clearly identified as a required attribute for contemporary companies. *Digital innovation* refers to digitally improved innovating capabilities of organizations. Innovation capabilities are mostly improved due to increased amount of information being available through different sources when compared to the industrial era. *Business Ecosystems* have begun to gain attention instead supply chains or suppliers and customers. Existence of business ecosystems is at least partially enabled by digitalization due to much cheaper communication and controlling expenditures.

Barriers and facilitators of digitalization are discussed in sub-section 3.6. Organizational inertia is identified as a barrier for digitalization. This is quite understandable – inertia consists of the will to keep doing things in the way they have always been done. *Technology acceptance model* (TAM) is presented as it is used in many digital innovation diffusion studies. It conceptualizes perceived ease of use and perceived importance as key antecedents of behavior intention leading to actual behavior of accepting a new technology. Another popular model is *unified theory of acceptance and use of technology* (UTAUT). It is a derivate of TAM which infuses several models into one. It adds some aspects to the model, but is more focused on individual user acceptance. Third model of innovation diffusion presented in the study is called *Technology-Organization-Environment* (TOE) model, which contains three contexts. Organization

context offers some significant variables such as quality of human capital and top management support for organizational innovation diffusion. Support for the findings of TOE model is found in the scarce body of research that has been made from direct topic of facilitation of digitalization. Facilitators include external pressure, professionalism of IS unit, external information sources and top management support as summed up in Figure 9 on page 29. Strategic alignment of IS is discussed in a separate sub-section as it can be seen as facilitator of digitalization as well. Main prerequisite for strategic IS alignment is identified to be good relations between CIO and CEO – or in another words, good relations between IS unit and business unit.

Selected methodologies were followed throughout the study. The methodologies and reasons behind the selection of these methodologies are explained in section 2 and their application in the research is depicted in section 4. Empirical research produced a prototype of G-Accelerate tool for finding out the strengths and weaknesses of organizations capabilities with digitalization. The prototype of G-Accelerate tool was created in cooperation with dr. Pertti Aaltonen of VIA Group. The tool received warm welcome when it was introduced to the original interviewees. Work on the tool will continue after this thesis is submitted. Tasks ahead are validation and improving the prototype of the tool. The questionnaire of which the tool consists is confidential within the N4S research consortia and cannot be reprinted in this thesis. Some example questions are shown in Table 4.

Discussion

Most of the final categories in the G-Accelerate tool seen in Table 3 in sub-section 4.3 can be linked to the theory review. *Customer understanding* can be inferred from organizational learning and business ecosystems discussed in sub-sections 3.2 and 3.5. *Sharing activities in co-operation* and *ecosystem and partners* are both discussed thoroughly in sub-section 3.5 – titled descriptively as business ecosystems. *Business model design* doesn't have an own sub-section but has been discussed in organizational agility at subsection 3.5. Organizational learning affects the *capabilities and competences* an organization has. Organization's *culture* is a wide topic. Its effects and antecedents can be seen in organization's size and shape, organizational learning, organizational agility and digital innovations, all discussed as separate sub-sections in the review. *New business innovation* matches one to one to the sub-section 3.4 named digital innovations. *Understanding customer's customer* is one of the results of thinking business ecosystems. *Organizational structures* have a direct counterpart in the literature review in sub-section 3.1. *Management processes* are somewhat discussed while thinking about organizational agility.

Few of the categories in the tool are not well covered within the literature review. *Leadership skills*, *management systems* and *key performance indicators* are not matching well with theory review. This is due to lack of matching literature from these areas in

the literature review conducted. While the author cannot claim that no literature exists of these topics, the claim is that no substantial bodies of research are available on the topics with the lens applied in this thesis or they would have been unearthed in the review process. Overall the amount of theoretical alignment with the prototype tool is rather good and gives density for the theory behind the tool.

Agility was highlighted in the theory review with a whole sub-section written of it. It was highlighted in this thesis as it had a substantial body of literature available claiming the importance of agility. It was also one of the last categories to be eliminated from the G-Accelerate tool. There were good arguments both for keeping it in and for leaving it out. Argumentation for keeping the category is mainly its importance from the literature as well as some evidence from the interviews. This was finally not seen as substantial enough. Most of the possible questions for agility-category would have been directed at other categories and those questions still exist in the G-Accelerate tool. For example, question: "Our strategy is being developed continuously several times per year" is directly measuring leadership capabilities. However, this particular leadership capability attribute will influence the organizational agility as a continuously updated strategy improves the cycle with which strategic changes are made. Another example for the point in case would be the following question: "We are continuously improving our product portfolio" is directly an organizational matter. Again, it is an organizational matter that also measures agility. Thus organizational agility is seen as a second order phenomenon in the organization resulting from many different parts that are more clearly measurable as parts of their original first order categories.

Managerial contributions of the final G-Accelerate tool will be extensive with clear indications on where the organizations weak spots lie. As the scope of this study cuts out at the untested prototype version of G-Accelerate tool, these results cannot be claimed for this thesis. This thesis merely sums up the current ongoing discussion in the digitalization matter and illustrates the creation process of the tool. As such, the managerial implications of the thesis are limited to the barriers and facilitators of digitalization identified in the literature review. The barriers found in this thesis seem to be applicable in wide amount of organizations as they are rather universal. Facilitators that were identified are also applicable to wide array of organization. Key message would be: top management needs to understand the capabilities of IT division and support digitalization.

Limitations

This thesis was made in time of four months. G-Accelerate project was started before the thesis and it will continue afterwards. Research before this thesis consists of interview design and conducting the interviews. The scope of this thesis ends at the creation of prototype version of G-Accelerate tool, not including any interpretations of test cases for the tool. As a result, the G-Accelerate tool is not validated as a part of this thesis. As

discussed earlier not all the categories of the tool have matching sections in the literature review which can be considered as limitation to the theory density.

This research is qualitative in nature. This means that while the subjects for the interviews were carefully selected, there is not that many of them. Total of 13 companies is not enough to make widespread generalizations. Iteration loop for interviews that is highlighted in grounded theory methodology was omitted in this research. This constitutes a possible source of bias for the data. However, as the intention for the data is to produce a prototype of the tool, it was decided to be sufficient. Author's belief is that the G-Accelerate tool will undergo several revisions before it takes it final shape as feedback is gained from both the companies which partook in the research as well as totally new companies using the tool.

Future Research opportunities

Organizational study with the lens of digitalization seems to offer some fruitful research paths for future. Naturally continuing current research path lays the goal of ready G-Accelerate tool which can be used to help companies identify their position in the digitalization roadmap. Notable interesting area of research would be the dynamics and managerial aspect of how a group of companies work and optimize their business in a digital ecosystem.

As stated in discussion, there was a distinct lack of extant literature from the categories of key performance indicators, leadership capabilities and management systems. Research on these categories seen through the lens of digitalization would make novel research contributions to extant literature.

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