



Digital Innovation Labs – Building up enterprise digital competencies

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ABSTRACT

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In the modern world, the digitalization and requirements that it brings to companies and their employees is a growing challenge. New technologies and new ways of working are creating a need for new competencies that must be build-up to keep up with the competition in the markets. The objective of this thesis was to find out how companies can use digital innovation labs to build up their digital competences. The purpose of this thesis was to collect the information on how and to which areas of digital competences the use of innovation labs promote digital competence development. The qualitative research design followed an inductive approach that led to a certain theory that was derived from observations. Used methods were a theoretical literature review, interviews and analysis of correlations of findings.

This thesis revealed that the usage of digital innovation labs builds up the digital competencies that their users we're needing to survive of challenges created by digital transformation. There are certain characteristics that are common for all types of digital innovation labs, and these characteristics are enablers for competence development. One major finding was that these characteristics differentiate the digital innovation labs from normal company Research and Development department.

In conclusion, the usage of digital innovation lab builds up competences and the new ways of working but including them to company's business models is challenging. However, a successful company needs to adapt to the challenges of the digital world.

Keywords: digital innovation lab, digital competence, digital transformation, innovation

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Digitalisoituminen ja sen tuomat haasteet ovat kasvava ongelma yrityksille ja niiden työntekijöille. Kehittyvä teknologia ja uudet työskentelytavat tarvitsevat uusia digitaalisia kompetensseja, joita yritysten ja niiden työntekijöiden pitää kehittää pysyäkseen mukana kilpailussa. Opinnäytetyön tavoitteena oli selvittää miten yritykset voivat käyttää digitaalisia innovaatiolaboratorioita omien digitaalisten kompetenssiensa kehittämiseen. Tämän opinnäytetyön tarkoituksena oli kerätä tietoa miten digitaalisten innovaatiolaboratorioiden käyttö edistää digitaalisten kompetenssien kehittämistä ja mille digitaalisten kompetenssien osa-alueille osaamista tarvitaan. Opinnäytetyö laadittiin laadullisena eli kvalitatiivisena tutkimuksena ja siinä käytettiin induktiivisen päättelyn logiikkaa, joka on laadullisen tutkimuksen lähestymistapa. Käytettyjä menetelmiä olivat teoreettiset kirjallisuuskatsaukset, haastattelut ja löydösten korrelaatioiden analyysi.

Opinnäytetyö selvitti digitaalisten innovaatiolaboratorioiden käytön kehittävän digitaalisia kompetensseja, joita digitaalisten innovaatiolaboratorioita käyttävät yritykset tarvitsevat selviytyäkseen digitaalisen muutoksen aiheuttamista haasteista. Erityyppisillä digitaalisilla innovaatiolaboratorioilla on yhteisiä ominaisuuksia, jotka auttavat digitaalisten kompetenssien kehittämisessä. Yksi tärkeä löydös oli, että nämä ominaisuudet erottavat digitaaliset innovaatiolaboratoriot perinteisistä yritysten tutkimus- ja tuotekehitysosastoista.

Yhteenvetona voidaan todeta, että digitaalisen innovaatiolaboratorion käyttö kehittää digitaalisia kompetensseja ja uusia toimintatapoja, mutta niiden sisällyttäminen yrityksen liiketoimintamalleihin on haasteellista. Menestyvän yrityksen on kuitenkin sopeuduttava digitalisoituvan maailman tuomiin vaatimuksiin.

Avainsanat: Digitaalinen innovaatiolaboratorio, digitaalinen kompetenssi, digitaalinen muutos, innovaatio

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ABBREVIATIONS

3D	Three dimensional
AI	Artificial intelligence
DIL	Digital Innovation Lab
EU	European Union
FABULOS	Future Automated Bus Urban Level Operation Systems
GDPR	General Data Protection Regulation
GPS	Global positioning system
ICT	Information and communication technology
IMD	International Institute of Management Development
IoT	Internet of things
JRC	The European Union Joint Research Centre
R&D	Research and development
SMAC	Social, Mobile, Analytical and Creative

1 INTRODUCTION

1.1. Background

Today business requirements are changing rapidly and the overall trend in product development life cycles has been to shorten them. Some companies will not react to this in time, while others will collect the fruits of their success by following the waves of digital disruption. Surviving the dynamics of the markets is no longer ensured by monitoring what may have worked in the past, but by changing the basics and building on new ideas and innovative approaches. (Forbes 2018.)

Traditional companies have discovered the growing threat of emerging new companies aggressively penetrating the market and rapidly growing their market shares. Many traditional companies have begun to invest a lot of resources and effort to find a solution because their business is struggling with needed development speed and flexibility. Companies have begun to look for the solution to the problem beyond the boundaries of their internal organizations. In many cases, the usage of digital innovation labs has been openly involved in their efforts to deal with digital change. (Forbes 2018.)

1.2. Objective and purpose

The objective of this thesis is to describe how a company can utilize DIL's (Digital Innovation Lab) to develop its own digital competencies.

The purpose of the thesis is to collect information on how and in which area of digital competencies the usage of innovation labs helps the company to develop itself. The Research method is to seek these development areas and development methods through interviews and complement the current theoretical body of literature, by providing an overview of possible correlations between digital competencies and the possibilities that DILs provide to their customers to improve them. In this paper, the key characteristics of DILs will be defined and analysed, in relation to the build-up of digital competencies.

1.3. Problem statement

Technological development is fast and getting even faster, it has a strong impact on all aspects of human life, both business and society. Digitalization leads to new business models and companies cannot escape the change it brings. New players in the markets are using new technologies, disrupting entire traditional industries or even creating new ones. New technologies create new opportunities, and new skills and competencies are needed to exploit them. The new companies that were build up by digital transformation seem to have more of these skills and ability to exploit them better than the large traditional organizations.

As part of their digitalization strategy, also large multinational companies in Europe began to open digital innovation labs. These facilities are owned and funded by the organization, but they operate outside its boundaries. Although the usage of DIL's increases continually, there is little knowledge about the correlation between their features and ways of working and how they enable the users of the DIL's to develop needed skills. (Holotiuk & Beimborn 2017.)

There are few research papers that help to find a common understanding of digital competencies and reveal variables that help to categorize them. Literature broadly covers the importance of new competencies for business and innovation success. The following questions guided this thesis:

- Why do large companies struggle to keep pace with the innovation process and get disrupted by new entrants?
- How are DIL's different to traditional R&D departments?
- What are the key digital competencies needed in today's and the futures markets? How can DIL's help to build them up?

1.4. Scope and limitations of the thesis

This thesis focusses on innovation labs operating in the public and private sector and includes perspectives from experts from various industries. This approach

helps to identify common experiences of DIL usage. As the research is of exploratory character, its aim is to identify and evaluate potential relations between DILs and the build-up of digital competencies. Through a comprehensive literature review, the DIL's general characteristics, ways of working and the definition of digital competencies are to be determined. These findings are then tested for confirmation through a qualitative analysis from expert interviews.

Due to the scope of this research, the sample size was limited to five interview partners that worked in various areas of business. In order to paint a broader picture, further research will benefit from both additional expert perspectives from all areas, and this way help discover the global relations between the competencies and DIL's.

1.5. Structure of the thesis

This thesis contains five main chapters.

Chapter 1 presents the background, objective and purpose, problems statement and the scope and the limitations of the thesis.

Chapter 2 contains the theoretical literature review that tries to explain the effects of digital transformation, its impact on business and the challenges that companies have to cope with. The theoretical literature review also presents current research topics that deal with digital competencies and skills and their rising relevance for business and society. Innovation, innovation labs and digital innovation labs, including their importance for companies as well as their structures and features, are covered at the end of the theoretical literature review. At the end of chapter 2, there is a brief summary of the theoretical findings.

Chapter 3 contains a description of the research approach and method, how data is collected and analysed. The research framework is then presented – it seeks a correlation between DIL characteristics and digital competencies.

Chapter 4 presents interview partners and key findings from the interviews and it summarizes the results of the analysis.

Chapter 5 is the conclusion. This chapter includes the answers to the research questions. The theoretical implications reflect on the results based on the literature, and the practical implications present the impacts and benefits of the thesis

in practice. In addition, the limitations of the thesis are presented as well as ideas for future research.

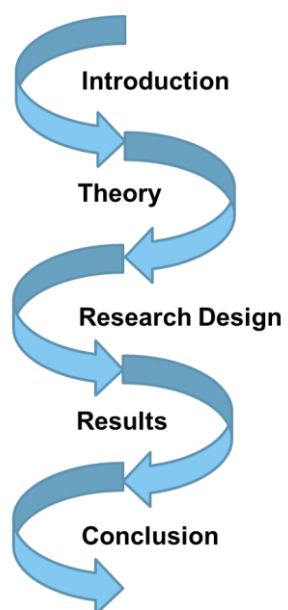


FIGURE 1. Structure of the thesis

2 THEORETICAL LITERATURE REVIEW

2.1. Digitalization

Digitization is a generally used term and it has several definitions. There is no clear common definition of digitization. One business-related definition is "The use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business" (Gray et al. 2015, 1319-1320). Gartner has also proposed a business-related definition and describes digitization as "the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business." (Gartner IT Glossary 2019.) A second, more technology-oriented definition, is "the process of converting something to digital form" (Merriam-Webster online dictionary 2019). The Oxford Dictionary describes the term as "the conversion of text, pictures, or sound into a digital form that can be processed by a computer." (Oxford Dictionaries | English 2019.) All these definitions imply the change of analogue information to digital that can be handled by computers.

Digitalization started when the first computers were invented. After that, the process has been gaining more and more speed every year. The first actual bounce of digitalization came in the 1990s when the Internet came into public use. Ever since, more and more daily tasks every day- and business life have been digitalized. Digital technology is embedded in the core of many organizations' products, services and operations (Yoo et al. 2012).

The use of ICT in the economy is also growing at a rapid rate. As an example, here are some of the different techniques that are already in use with the car: Bluetooth system, smartphones, GPS positioning system, traffic information coming from the navigator. Digitalization brings the gap between the digital and the physical world closer together. The digital world has three key elements: Digital information, data usage and analysis and the exchange and use of data between people, devices, machines through digital communications networks. All this is made possible by the increasing amount of data, decreasing data storage costs,

the development of analytics, and more advanced data transfer. (Digitalization and Energy 2017.)

Several techniques are integrated into various everyday areas with digitality. Examples are today's smart homes, e-health care, smart cities and smart mobility. The aim of digitalization is that the products and services offered by the companies face the actual needs of the customers. Many other areas also benefit from digitalisation, for example, cultural artefacts can be digitized, thus allowing better storage and better security from destruction.

According to the i-SCOOP article, digitalization, especially in business, means using digital technologies in business, business models and processes. Frequently it means that everything would be in digital format in the workplace and the use of paper is reduced. But digitalization is also a lot more, for example, work tasks are changing when using digital tools, getting better communication due to new tools. In the end, digitalization creates many new opportunities. Digitalization is a change in digital business and digital management. (i-SCOOP 2015.)

2.1.1 Digital transformation

Westerman et al. (2011) define digital transformation as “the use of technology to radically improve performance or reach of enterprises”. Another well-known, more holistic view describes digital transformation “as the changes that the digital technology causes or influences in all aspects of human life.” (Kaplan et al. 2004, 689.) Based on these definitions, the major difference of the term ‘Digital Transformation’ to ‘Digitization’ is the aspect of digital transformation being a continuous process whereas digitization implies the format, on which information is being processed and communicated.

Digital transformation is not just about technology, it is a change and it is a question of when and how it happens. It also impacts other organizations such as governments and public sector institutes which are involved in solving societal challenges. For example, pollution and ageing populations are challenges where digital technologies can be used. In the industry, the efforts and strategy of digital

change are usually more urgent, as companies want to stay involved in development. A digital transformation strategy goal is to take advantage of the possibilities of new technologies and their impacts in the future, in a faster and innovative way. Digital transformation is an ongoing journey, like change and digital innovations. It impacts each industry and it may also affect to all organization's divisions, functions and processes and of course it may impact the business model. (i-SCOOP 2015.)

What is a digital transformation? There are many definitions and it depends on the company, leaders and industry. We are still in the early stages of understanding all the different aspects of digital change and the stages of implementation. According to an article published by Forbes Insights research, 45% of companies believe they have moved beyond the intermediate level in terms of their digital transformation and consider themselves either advanced or leaders. The 55% that remain are either just beginning their digital transformations or have some technologies in place, but not on an enterprise-wide level. (Forbes Insights 2016.)

Digital technologies have changed the world and reshaped the industry. Many companies are seeking and conducting large-scale efforts to gain the benefits of these trends or are forced to try to keep up with the pace of their competitors. In McKinsey Global recent survey of digital transformations, more than 80% of responders answered that they have taken efforts to make digital transformation in their company. However, the success rate of these transformations is surprisingly low - in an earlier survey, less than 33% of the organizational transformations has improved company performance and sustained those gains. And the latest results from the same survey show that the success rate is even lower, only 16 % reported success and in addition, 7% reported success at the beginning but the improvement was not continuous. The success rate seems to be related to the company size - organizations having less than 100 employees were 2.7 times more likely to report success in digital transformation compared to organizations more than 50000 employees.

The survey also shows that most of the companies (68%) are digitalizing the organizations operating model, whereas less than half reported that the objective

was to launch new products or services or interacting with external partners via digital channels. Among the successful companies were those that deployed more technologies than the others - technologies mentioned were artificial intelligence, the Internet of Things, and advanced neural machine-learning techniques. Usage of these technologies is one advantage and another one is a set of factors that might improve the odds to make a successful digital transformation. These factors can be categorized to five categories, like having the right digital-savvy leaders in place, building capabilities for the workforce of the future, empowering people to work in new ways, giving day-to-day tools a digital upgrade and communicating frequently via traditional and digital methods.

Related to my topic, the interesting success factor is the building capabilities for the workforce of the future. That includes investing to build up the skills needed in new digital way of working. The companies that offered programs to identify, define and develop skills needed for digital way of working were more successful compared to those who did not. This means building up digital competencies that the employees need in the new digital way of working. (McKinsey & Company 2018.)

2.1.2 Digital disruption

In their paper, Christensen et al. (2015) argue that the term 'disruption' is often misunderstood and used too loosely to describe the concept of innovation shaking up an industry. The authors clarify and describe 'disruption' as "a process whereby a smaller company with fewer resources is able to successfully challenge established incumbent businesses." (Christensen et al. 2015, 46.) Therefore, the focus seems to be on the increase of competition through the emergence of smaller, more innovative players in traditional industries.

Another, far more complex, concept of digital disruption was recently summarized by Skog et al. (2018) and is described as "a type of environmental turbulence induced by digital innovation that leads to the erosion of boundaries and approaches that previously served as foundations for organizing the production and capture value". Both definitions refer to the change of the current situation through the introduction of innovative ideas. That is a change that is due to evolving digital

technologies and business models. Technologies and models seem to "disturb" the value of existing products and services. In this case, the products and services must be reassessed.

Robotics is one example of disruptive technology. Robots that have talents, senses and intelligence can perform different tasks that were considered very expensive to automate. Society has benefited and will benefit from such technology. Robotics is certainly one of the most disruptive technologies of the 21st century.

The usage of the Internet changes the business environment of companies (Nielsen et al. 2017). An example of this is online courses and virtual guidance which was not possible before. This means, for example, online lectures, webinars, online teamwork, online examinations, etc. This is possible because we have the technology and knowledge needed to utilize all this.

Digital disruption is the subject of a significant amount of research papers. As stated above, digital disruption describes a process that forces companies, that had been industry leaders for decades, to rethink their entire business model. This process is often initiated by new companies that hold fewer resources but successfully apply disruptive technologies such as AI, robotics, IoT or the blockchain into their business models, hence, creating a competitive advantage.

Some of the most famous disruptors are Spotify in music streaming, Netflix in movie and tv-series streaming, Airbnb in short-term accommodation offering and Amazon in web- and cloud-based services. These companies were among the first ones to offer their services to their customers on multiple platforms like PC and mobile devices. Spotify and Netflix also provided enough wide content in streaming business to get more interested customers that were willing to pay the monthly fee to use them. Airbnb succeeded to have a wide enough base of apartments for rent around the globe. Amazon provides an easy platform for web shopping. The common issue with these companies is the user-friendly user interface and easiness to take new services in use.

An interesting topic is why in some industries former market leaders are in danger of losing their position due to digital transformation. According to Christensen et al. (2015), one major reason why the big companies are endangered by disrupters is that current market leaders often focus to improve those products or services that are currently most demanded by the customer. At some point, these constantly improved products or services start to exceed the needs of some segments, while other segments are left ignored. New disruptive entrants take benefit of this gap by targeting their offering to these overlooked segments and offering products or services with more suitable functionality, often combined with a lower price.

In order to identify the sources of digital disruption (start-ups or incumbents), a survey was conducted by the International Institute of Management Development (IMD). According to nearly 1,000 executives from 15 different industries, it is substantially depending on the industry itself whether start-ups are the most likely source of digital disruption.

Start-up definition according to Neil Blumenthal, co-founder and co-CEO of Warby Parker is "a company working to solve a problem where the solution is not obvious, and success is not guaranteed" (Forbes 2013). And if the start-up finds the solution to the problem, it becomes successful and threatens the traditional companies acting in the same business area.

According to the IMD, more than half of the executives in media and entertainment, consumer packaged goods, telecommunication, and retail sectors consider the start-up companies as a major threat. However, in industries with higher entry barriers, such as healthcare, pharmaceuticals or oil and gas, the start-up companies are not considering as a disrupting force. (Wade & Shan 2016, 2.)

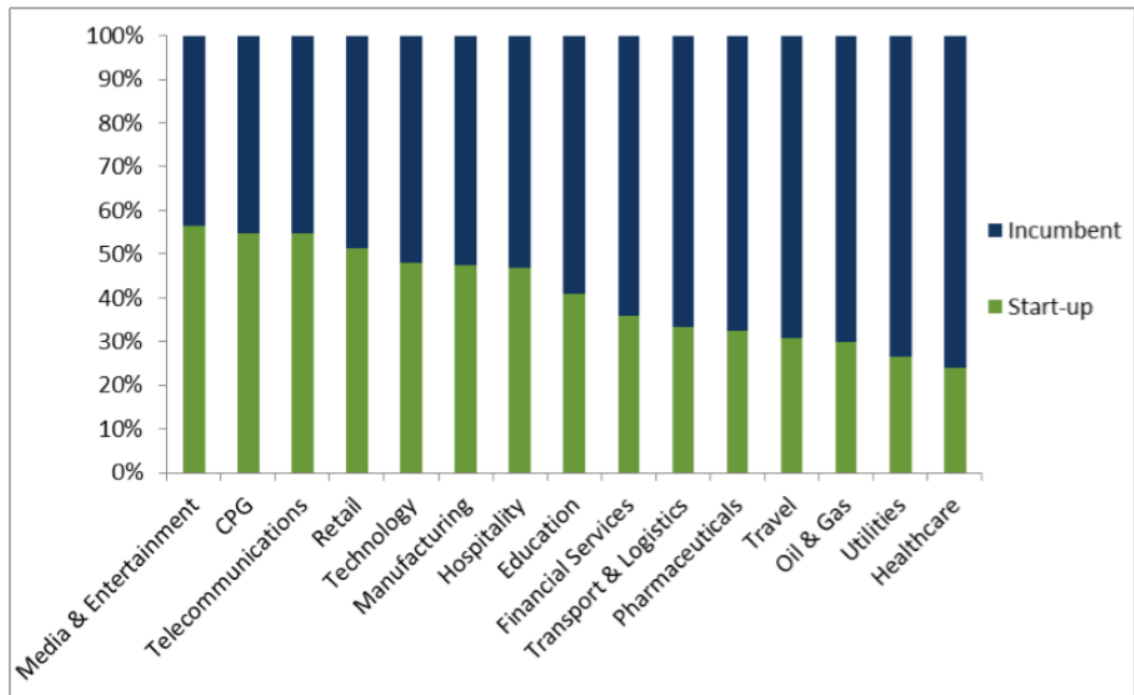


FIGURE 2. Large differences in the perceived source of disruptive threats across industries (IMD)

Leaders have also identified the reasons that lead start-ups to be considered as a disruptive force in certain industries. Relative advantages are a faster innovation capability, greater agility, a risk-taking and experimentation company culture as well as highly digitalized products /services. (Wade & Shan 2016, 3.) Digital disruption does not stop at reshaping industries and business models. This Digital disruption has a far broader scope, having a substantial impact on economy and labour, government and regulation, education, commerce, service and goes through all other levels of our society. (Stewart et al. 2017, 299.)

2.1.3 Trends and developments

Digitalization and globalization mean more and more changes to current practices. The mere introduction of technologies is not enough. To get the most out of them, many things must be considered, for example, what to do with a large amount of data? How to find the right people to work? Or does artificial intelligence take jobs away from people? Companies must adopt new technologies, for example, different platforms and software are providing new business opportunities and without them, the company will not succeed in global competition.

By looking at the growing trends in digitalization, we can see how they are linked to each other. IoT solutions need 5G networks, edge computing, blockchains and cloud computing. IoT solutions produce a huge amount of data and Machine learning and Artificial Intelligence is needed to handle the growing amount of data.

The figure 3 shows the hype cycle that helps to represent the maturity, adaption, and social application of example technologies. (Newman 2018.)

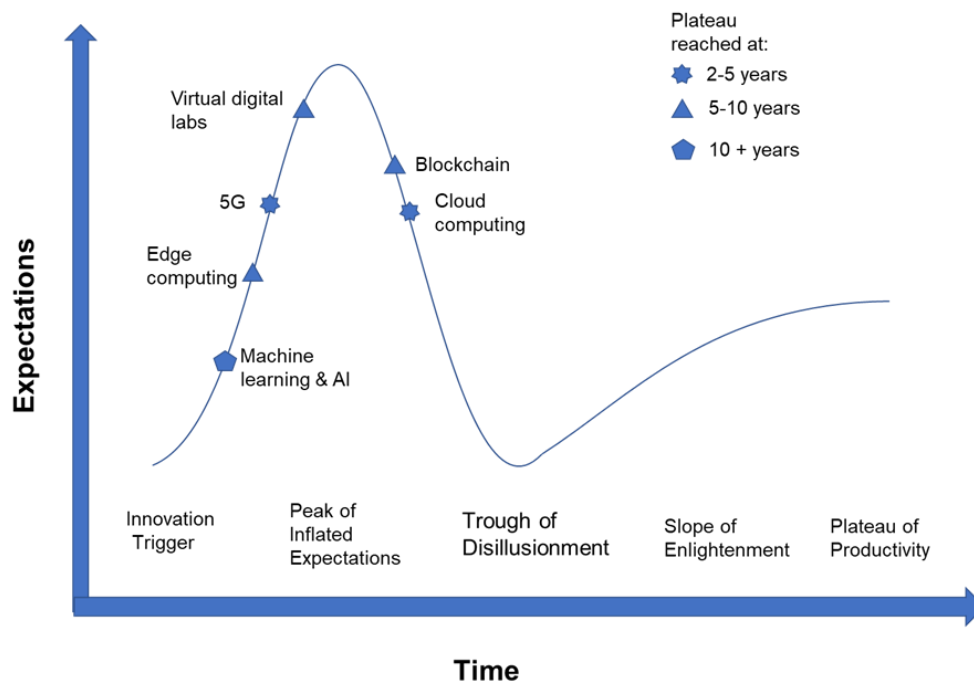


FIGURE 3. Hype cycle (Gartner 2018)

Following are some examples of current digitalization trends that according to Forbes will be growing in the near future (Newman 2018).

5G: The next generation of mobile networks. The first commercial 5G mobile networks are soon in use and the new models of mobile devices that support this new mobile network technology will be on the market this year. 5G networks allow even more data to be consumed with mobile devices. 5G networks are also enabling the Internet of Things devices to transform the data produced by devices to other IoT devices or to cloud services. (Supalla 2018.)

Cloud Computing: Cloud services can be categorized to public, community, private or hybrid clouds. The current trend shows that the companies have realized that setting all to the public cloud, private cloud or datacentre that companies have is not the best option. Sometimes companies need to use a mixture of these or all of them. The usage of applications or data flow must work seamlessly no matter where the services are located. Various cloud services and the Internet of Things (IoT) will produce large amounts of data to help companies get valuable information at just the right time. Data types are, for example, measurement data, statistics, analytics, feedback, etc. A big challenge is to get the information that you need and distinguish essential information from the irrelevant. With rightly filtered and analysed data, companies can improve their customer experience and service. (Newman 2018.)

Blockchain: It is a digital record of transactions that enable the safe way to transfer data between devices. The most commonly known application of blockchain is the Bitcoin, but it is used many other ways too. It is one of the needed technologies that services and solutions that are based on IoT, like Smart Cities and Autonomous Vehicles will use. The IoT devices leverage smart contracts to other IoT devices and these contracts then model the agreement of data transfer between devices. Many major companies like IBM continue to invest a big amount of money to search for new application beyond cryptocurrency. (i-SCOOP 2016.)

Machine Learning and Artificial Intelligence: These two are the technologies that can be used to handle the data produced by cloud services and IoT. The amount of data is increasing all to time and recent studies have shown that 90% of world data was produced last year. The same research also claims that only 1 % of that data is used effectively. The improved processing power of computers and this way more used Machine Learning and usage of AI will increase the amount of analysed data. (Newman 2018.)

Edge to Core: As the IoT becomes more and more used and the number of connected devices skyrockets, the amount of data that the devices will become too massive to be processed by the cloud computing. More processing power is needed, and edge computing can provide it. Edge computing means computing

infrastructure near the source of the data. Concepts like Autonomous Vehicles and Smart cities need data to be processed in real-time and cloud computing may not be fast enough to support it. (Newman 2018.)

Virtual or digital labs: Testing products, services and business models in virtual environments speeds up the manufacturing process, decreases costs and thus ensures that you have developed exactly what you need. Often we talk about Digital Twins, which means an exact digital copy of a process, product, or service. 3D printing, in turn, is an ecological and time-saving way to produce products. 3D printing touches almost all tangible areas. (Newman 2018.)

European Data Protection Regulation (GDPR): It is a law that regulates the processing of personal data, which applies in all EU countries and provides better protection of personal data and better control of data processing. Companies really need to take responsibility for how they handle privacy and personal information. To enter European markets, the non-European companies must comply with the GDPR rules. The GDPR might be starting the global trend that companies fulfil the requirements of how they treat personal data and privacy. (Newman 2018.)

2.1.4 Challenges for business

Today many companies are currently dealing with digitization, but what are the exact challenges that companies must master in order to make the change digital change a success? Leaders of companies have to understand how certain technologies will affect their business in order to maintain market shares. Various sources in the literature show that increased competition, changes in customer needs and corporate culture are seen as major challenges.

Increased Competition

The fact of increased competition, especially in traditional industries, is linked to digital disruption (2.1.2). Digital services, artificial intelligence and robotization will strongly change the basics of business and the competitive situation in all indus-

tries. For example, Amazon Go and the domestic Nordic ID have developed systems to make transactions easier and faster. Every company should invest in changing business operations because the speed of digitalisation will surprise all of us. This requires investment in technology and artificial intelligence as well as the development of business processes. The more digitally capable of serving the customer, the better the company succeeds.

According to the research of IMD (2016), this relative balance has shifted in favour of start-ups. Brands like Uber, Airbnb and WhatsApp have developed a strong brand identity within a relatively short period of time (Wade & Shan 2016,4). In contrast, well-established brands that were the market leaders in their industry (e.g. Nokia, Kodak or Blockbuster) could not keep pace with technological progress. Additionally, disruptive start-ups began to grow its customer base extensively.

Customer Needs and Requirements Changes

There has been a lot of discussion about the impact of digital disruption, new business models and new technologies, and it is important that the customer is involved in these discussions. Companies should have a clear understanding of their customers' needs. As technology advances, customer behaviour is constantly changing. Therefore, companies need to adapt to a more customer-oriented way of thinking to maintain their competitive advantage. (Pankewitz 2017,194.)

For example, customers in the automotive industry today are much more environmentally conscious, while fashion industry customers pay attention to sustainability. The image of the company and the expectations of the customers are more important today. Therefore, customer expectations must be considered in areas such as marketing, packaging, product and service activities, and customer service. (Boureau 2017, 147.) Customers also expect transparency, flexibility and participation in product and service development.

Disturbing technologies and companies that apply them in their business models are constantly rising customer expectations. In order to keep up with their customers' expectations, companies need to produce innovations. According to Pankewitz (2017), this is only possible if the whole organization adopts the digital way of thinking. Inflexible organizational structures and a corporate culture that does not have experimental thinking and has little fault tolerance complicate this process. (Pankewitz 2017, 193-195.)

Organization Culture

One of the biggest obstacles to a company's success in the digital age is the lack of suitable organizational culture. Digitalization should therefore also be reflected in organization culture. This is a key observation of the McKinsey study, published in 2017, in which global leaders participated. Avoiding risks, poor customer orientation, and quiet mindsets hinder large organizations from innovating (Goran et al. 2017). Solving these cultural problems is inevitable in our digital world. As stated above, innovation is particularly important for competitive advantage.

For a company, it is important to understand what innovation means so that they can change their culture and processes accordingly. Innovation is the application of better solutions that meet new requirements, inseparable needs or existing market needs. (Vossen et al. 2017, 223.) Meeting new requirements with better solutions requires combining risk-taking and creativity. Risk avoidance is characterized as fact that most large companies do, and it represents a major problem for them, as previous studies found a strong positive link between digital performance and risk-taking culture. (Wokurka et al. 2017, 110.)

A further problem for traditional organisations is rigid processes and strict hierarchies. A digital company culture that promotes ownership and provides employees with the latitude to make judgment calls, can react faster to changes in the environment and customer expectations. Inflexible processes and strict hierarchies also cause problems. Digital organization is open to changes in customer behaviour, a new way of communicating and generates value and content. The basic requirement for successful cultural change towards digital one is

the digital way of thinking. (Hemerling et al. 2018.) It is also understood in a digital culture that the demands of customers are rising, and the importance of the easy way of making business is emphasized. Many of the companies that have started their operations in the digital age will naturally understand this and invest in improving their customer experience. (i-SCOOP.)

2.2. Competencies

Competencies are a combination of individual knowledge, skills and attitudes. Ruohotie (2004) defines competencies to mean an individual attribute, the ability of an employee to achieve a set of achievements defined by specific criteria in different work tasks and situations. According to Helakorpi (2017), competencies acquired formally and informally should additionally be distinguished. The learning process must develop knowledge and skills in an integrated way, and the competencies base creates the opportunity for students to develop the skills needed in working life. (Ruohotie 2004.) In this thesis, competencies refer to knowledge, skills and attitude to meet the requirements of a situation or performance.

Digitalization is not only changing business models and industries but also greatly impacting the workers employed in them. In recent studies, the trends and developments in the average workers' competencies and skillset have been analysed. In research by Accenture in 2017, growing demand for a new set of skills and capabilities has been observed as a result of the outbreak of the digital economy. Examples of such skills that are exponentially growing in relevance include:

- Applying enhanced soft- and communication skills both in-person and virtually
- Technical affinity and knowledge how to operate with technologies, professional tools and data sources
- Creative problem-solving and novel thinking
- Growth mindset for continuous learning and adaptation to change

In the most recent findings from McKinsey Global Institute (2018), there is a dramatic increase observed in the demand for skills in the technological sector, followed by social- and emotional skills and the higher cognitive capabilities (Appendix1). In addition, this change in the competencies requirement and demand is forecasted to be even more significant in the years to come. The future optimal skillset will then consist of basic digital skills, creativity, complex information processing and advanced data analysis.

On an organizational level, McKinsey observes a trend of overall mindset change supported by a culture of continuous learning and improvement by providing training opportunities to the employees, while organization structures become more agile to support the collaborative team networks.

When observing these trends, it can be clearly identified that technological change has brought the need for a specific type of knowledge and capabilities that go beyond the use of technology itself. Increased connectivity, smart applications, robotics and artificial intelligence are just a few examples of technology that changes the way products and services are produced and delivered. Through this change, a new way of working has been developed, which requires having so-called digital competencies. (McKinsey Global Institute 2018.)

2.2.1 Digital competencies

In recent years there have been several contributions in the field of digital skills and competencies. Research is devoted to finding a common understanding of digital competencies and their impact on every aspect of human lives. As digitization evolves, digital competencies became the centre of current discussions, particularly in employability, workforce, innovation creation, teaching, university program design and all other spheres of society. Ravenscroft et al. (2012) even argue that to fully participate in life, people must be digitally competent and that low levels of digital competencies need to be tackled to allow all people to be functional in our society. He goes further by arguing that, due to the strong adaptation of technologies in our society, it is vital to think of digital competencies as an essential requirement for life, or even as a survival skill (Ravenscroft 2012, 80).

Through the consolidation of various definitions for digital competencies Ravenscroft (2012) produced a definition that tries to include the main elements: “Digital Competencies is the set of knowledge, skills, attitudes, abilities, strategies and awareness that is required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; behave in an ethical and responsible way; collaborate; create and share content and knowledge for work, leisure, participation, learning, socialising, empowerment and consumerism.” (Ravenscroft 2012, 84.)

According to Crummenerl and Seebode (2016) from Capgemini Consulting, digital competencies encompass the social, mobile, analytical and creative (SMAC) skills. The authors explain that the new way of working requires collaboration and exchange through social platforms and networks, for which given social skills for teamwork and cooperation are required. The mobile skills, on the other hand, represent the ability to use tools and applications, which allow for virtual team collaboration, as this is unavoidable at every international company. Analytical skills and creativity are required for the handling of the increasing complexity of tasks and processes, for which a solution-orientated approach and critical thinking are necessary. (Crummenerl & Seebode 2016.)

Reynolds et. al (2010) use the term ‘digital literacy’ that refers to digital competencies not only as skills to use and perform tasks on ICT, but includes complex skills such as cognitive, motoric, sociological, and emotional that people need to effectively get along in our digital environment. In their work, Reynolds et al. identified the most basic competencies that are required to live and take advantage of the opportunities provided by technology. Reynolds et al. (2010) also split competencies into critical and other basic competencies. Critical ones are those that are required to be part of this society (e.g. abilities to connect to a network, send/receive emails, search for information, etc.), whereas other basic competencies are required to exploit technology (e.g. sharing and exchanging ideas, awareness of assistive technology, awareness and understanding of technology changes, etc.) (Reynolds et al.2010, 218).

In a more economical context Reynolds et al. (2010) highlight that even with the availability of technology, organizations will not be able to take full advantage if employees lack well developed digital competencies and literacy. Oswald and Kleinemeier (2017) rather focus on a more business-related aspect and share the view of Reynolds et al. (2010) by arguing that only if employees can use digital technologies, they can apply it correctly and generate value for the organization. Innovation is fostered by digitization that in turn requires a workforce with digital skillsets. According to Oswald and Kleinemeier employees need the ability to think inter-disciplinarily while being continuously aware of the latest digital developments. A further highlighted aspect is a fundamental competency in dealing with complexity and the increased tempo as the intensity and speed of change increases due to digitization. (Oswald & Kleinemeier 2017, 75.)

Responding to these rapid developments requires adaptation and flexibility, which means to be able to rapidly transpose to this new way of working. In this context, Vivarelli (2015) summarizes that in an organization, digital competencies need to have an external focus towards providing value to the customer as well as providing service that represents the collective learning. Even though it has been a common practice for centuries to first create a product and then find a way to market it, this practice has radically shifted in the past few years. Customer-centricity and user testing are now trending practices. Creating such an external, customer-orientated, problem-solving mindset is therefore considered as a central digital competency. (Vivarelli 2015.)

It is more challenging to try to model and categorize the skills to certain competency areas. In literature research, one of the most complete models is the DigiComp 2.1 by EU JRC. It models the individual's digital competencies and can be used to model and categorize competencies of one individual. (Carretero et al.2017.)

DigiComp 2.1 conceptual reference model

The European Union Joint Research Centre (JRC) has created over the years a conceptual reference model of digital competencies. The first version, DigiComp 1.0 was published in 2013 and since that there have been updates to that model and the current version is DigiComp 2.1. In my thesis, I realised that it is useful

to have one common model of digital competencies that maps the different skills mentioned in interviews with a common reference model.

The current model has five dimensions:

1. Competencies areas identified to be part of digital competencies
2. Competencies descriptors and titles that are pertinent to each area
3. Proficiency levels for each competency
4. Knowledge, skills and attitudes applicable to each competency
5. Examples of use, on the applicability of the competencies to different purposes.

However, the DigiComp 2.1 model does not define the fourth dimension. In my thesis, the first two dimensions are enough to categorize the interview answers. (Carretero et al.2017.)

The first dimension, competencies areas identified to be part of digital competencies, divides the competencies to five main areas. These areas are:

1. Information and data literacy
2. Communication and collaboration
3. Digital content creation
4. Safety
5. Problem-solving

Each main competencies area is then divided into individual sub-categories. This is the second dimension of the DigiComp 2.1 model - Competencies descriptors and titles that are pertinent to each area.

The third dimension, Proficiency levels for each competency, set the levels how the people can use certain competencies and combined with the fifth dimension that describes examples of use in employment and learning we can better try to map the skills mentioned in interviews to this conceptual reference model.

The fourth dimension, knowledge, skills and attitudes applicable to each competency is not defined in this DigiComp 2.1 version.

The fifth dimension in this model sets examples of each dimension two areas and help to understand better in practice what the dimension two sub-competencies areas mean. (Carretero et al.2017.)

My thesis uses the first two dimensions to map the digital competencies making it to 21 different sub-categories in five main competencies areas. I do not try to measure the proficiency levels of the competencies, or how the proficiency levels were built up when people used DILs, but map the competencies main areas that DIL customers are trying to build using DIL's. (table 1).

Table 1. Digital competencies (Carretero et al.2017)

	Main competencies area	Sub competencies area
1	Information and data literacy	
1.1		Browsing, searching and filtering data, information and digital content
1.2		Evaluating data, information and digital content
1.3		Managing data, information and digital content
2	Communication and collaboration	
2.1		Interacting through digital technologies
2.2		Sharing through digital technologies
2.3		Engaging in citizenship through digital technologies
2.4		Collaborating through digital technologies
2.5		Netiquette
2.6		Managing digital identity
3	Digital content creation	
3.1		Developing digital content
3.2		Integrating and re-elaborating digital content
3.3		Copyright and licences
3.4		Programming
4	Safety	
4.1		Protecting devices
4.2		Protecting personal data and privacy
4.3		Protecting health and well-being
4.4		Protecting the environment
5.	Problem-solving	
5.1		Solving technical problems
5.2		Identifying needs and technological responses
5.3		Creatively using digital technologies
5.3		Identifying digital competencies gaps

Digital competencies main areas

DigiComp 2.1 conceptual reference model has five main digital competencies areas, which are information and data literacy, communication and collaboration, digital content creation, safety and problem solving (Carretero et al.2017).

Information and data literacy

Defined in DigiComp 2.1 – “To articulate information needs, to locate and retrieve digital data, information and content. To judge the relevance of the source and its content. To store, manage, and organise digital data, information and content” (Carretero et al.2017).

This main digital competencies area is related to information in digital format. It is divided into three subcategories:

1. Browsing, searching and filtering data, information and digital content
2. Evaluating data, information and digital content
3. Managing data, information and digital content

Examples of this main digital competencies area are: how to search information from digital sources, how to compare and critically evaluate information from digital sources and how to modify and store information in digital format (Carretero et al.2017).

Communication and collaboration

Defined in DigiComp 2.1 – “To interact, communicate and collaborate through digital technologies while being aware of cultural and generational diversity. To participate in society through public and private digital services and participatory citizenship. To manage one’s digital identity and reputation” (Carretero et al.2017).

This main digital competencies area is related to communication in digital format. It is divided into six subcategories:

1. Interacting through digital technologies
2. Sharing through digital technologies
3. Engaging in citizenship through digital technologies
4. Collaborating through digital technologies
5. Netiquette
6. Managing digital identity

Examples of this main digital competencies area are: how to use digital technologies to interact, how to share information using digital technologies, how to use digital tools and technologies to collaborative processes, how to behave and adopt culture of digital communication methods and how to create or manage one or multiple digital identities (Carretero et al.2017).

Digital content creation

Defined in DigiComp 2.1 – “To create and edit digital content. To improve and integrate information and content into an existing body of knowledge while understanding how copyright and licences are to be applied. To know how to give understandable instructions for a computer system” (Carretero et al.2017).

This main digital competencies area is related to digital content. It is divided into four subcategories:

1. Developing digital content
2. Integrating and re-elaborating digital content
3. Copyright and licenses
4. Programming

Examples of this main digital competencies area are: how to create and edit content in digital format, how to modify, refine, integrate and improve content in digital format on top of existing one, understand how licenses and copyright apply to digital content and how to create sequence of instructions or program to solve tasks (Carretero et al.2017).

Safety

Defined in DigiComp 2.1 – “To protect devices, content, personal data and privacy in digital environments. To protect physical and psychological health, and to be aware of digital technologies for social well-being and social inclusion. To be aware of the environmental impact of digital technologies and their use” (Carretero et al.2017).

This main digital competencies area is related to the safety of digital personal data, privacy or devices, protecting health and well-being or environment. It is divided into four subcategories:

1. Protecting devices
2. Protecting personal data and privacy
3. Protecting health and well-being
4. Protecting the environment

Examples of this main digital competencies area are: how to protect devices and digital content, how to protect personal data and privacy, how to avoid health-risks on physical or psychological level using digital technologies and how to be aware environmental effects of digital technology usage (Carretero et al.2017).

Problem-solving

Defined in DigiComp 2.1 – “To identify needs and problems, and to resolve conceptual problems and problem situations in digital environments. To use digital tools to innovate processes and products. To keep up-to-date with the digital evolution” (Carretero et al.2017).

This main digital competencies area is related to needs and problems and how they can be solved using digital technologies. It is divided into four subcategories:

1. Solving technical problems
2. Identifying needs and technological responses
3. Creatively using digital technologies
4. Identifying digital competencies gaps

Examples of this main digital competencies area are - how to solve technical problems when using digital devices or solutions, how to recognize needs and how to solve the need using digital technologies, how to creatively use digital tools or solutions to solve problems or problematic situations in the digital environment. How to identify gaps in digital competencies and develop own digital competencies. (Carretero et al.2017.)

2.2.2 Enterprise competencies management and build-up

The change in the average needed competencies profile due to the integration of modern technologies is a challenge that companies need to closely consider. Establishing a clear strategy on the competencies management across all organizational levels can be seen as a critical step for handling the potential issues related to changing competencies needs.

For example, Oswald and Kleinemeier (2017, 75) have identified the issue of a generation divide, which implies that employees are in different levels of familiarity with digital tools. Younger employees are more used to work with digital tools and ways of working than their older colleagues.

This generational gap might even lead to a negative impact on the company's attractiveness as an employer for the digital talent if the deployment of digital tools and processes is too slow or limited in availability (Oswald & Kleinemeier 2017, 76). And this is not the only potential negative effect – digital literacy can gravely affect the collaboration between the different groups. Therefore, for an employer, it is critical to consider these factors and closely follow the developments of technology that impact competency management in a company.

Technology and digital environments in the company might change so quickly that employees' competencies do not follow it. This creates a gap between technology and know-how. Crummenerl and Seebode (2016) explain that as a first step, these competencies need to be identified and integrated into a digital competencies model, that in the second step it can guide processes for recruiting, training or outsourcing.

In a Harvard Business Review Article, PwC revealed how they prepare and train their workforce due to digitization. The consultancy company rather focuses on up-skilling their own employees than completely relying on recruiting new digital talents. To enhance or develop digital competencies, PwC implemented a strategy for the digital workforce that enables employees to participate in workshops and seminars before application of new methodologies like design thinking (Fenlon & McEneaney 2018, 1–3). Initiatives like this can be very costly and hence companies have been seeking more optimal solutions. The proposal of a DIL as a solution will be therefore evaluated for its applicability and effectiveness to build up digital competencies.

2.3. Innovation

According to the European Parliament, innovation is an adaptation of a new product, a new process or a new market that creates economic results, benefits, well-being or efficiency. The innovation process involves companies, public research institutes and financial institutions interacting with skills, knowledge and ideas. (Briefing European Parliamentary Research Service 2016.)

Traditionally innovation is often defined as a new product, a new process or a new organizational structure. Research results and inventions are innovations if they involve commercial interests and financial goals. According to the basic definition, innovation is, therefore, a new idea commercially exploited. In a traditional product development project, the entire innovation process from idea to product takes place within the company, meaning that the company has all the necessary know-how. (Inkinen et al.2009, 7.)

When talking about a business perspective, it is good to make a distinction between an idea, an invention, and an innovation. In technology innovations, these three follow each other in the innovation process, but for example process, service and business innovations do not necessarily have an inventive step. According to the basic definition, innovation is a new idea commercially exploited.

Innovations can be divided into categories for their novelty value:

1. a new company
2. a new industry
3. a new world

Innovations can still be categorized in several ways. Usually, innovations are divided into radical and incremental innovations. Radical innovation means new products or services to new markets and incremental innovation means a low and gradual improvement of the current product or service. (Apilo et al. 2007, 22–23.) The term innovation is used in many ways. Especially in everyday conversation, innovations are mixed with ideas and inventions, in which almost everything is considered an innovation. Innovation is something where ideas, inventions and other developments have been successfully put into practice. (Pohjola & Koivisto 2013.)

In innovation activities the strategy is important, if there is no strategy or it is defined inaccurately, there is no activity. The innovation strategy must be commercialized and must be based on the company's business strategy. The strategy should enable innovative thinking and encourage new opportunities in company choices and investments. (Solatie et al. 2013, 141,145.)

In her doctoral thesis, Noora Buser from Finland investigated the importance of knowledge for innovation. "Knowledge that comes from the interaction between people and that gives us a new insight is essential to innovation".

In her view, companies should give employees time to exchange information, as the best ideas come more often at a coffee machine than at the meetings, in other words, to encourage employees to talk to each other. (HS 2019.)

2.4. Open innovation model

Innovation research and modelling have evolved over the years. The paragraphs below show how innovation research has evolved into the current open innovation model.

The examples in chapter 2.1.4 represent only a small part of the challenges that companies are facing now. The wave of digital transformation has no limitations

on the extent of the change it brings. As described in the previous sections, innovative technologies and risk-based companies that utilize them in their dynamic organizational structure are interfering with business models and even the entire industries.

Von Hippel and von Krogh (2003) have identified two different types of social innovation models - private investment model and the collective action model. These models define the social role of innovations quite strictly.

In the private investment model, innovation is supported and produced through private investment. Most of the benefits of these supported innovations go back to private investors. In the private investment model, the dissemination of information outside the organization is avoided, as every lost innovation is considered to reduce the innovation benefit of the innovator. According to Von Hippel and von Krogh, protecting information is unnecessary, because leakage of information can never be eliminated. (von Hippel & von Krogh 2003, 212–213.)

In the model of collective action, the concept of the common good is applied. The model of collective action requires that innovators give their knowledge for the common good, in other words, the information is open to everyone. In this model, the threat may be to motivate developers who bring innovation, and free riders, who in the collective action model, because of the unencrypted knowledge, can benefit themselves from the results achieved without participating in the activities themselves. In this case, the benefits of the actual activities of the involved actors remain weak compared to free-riders. (von Hippel & von Krogh 2003, 213.)

The Chesbrough Open Innovation Model looks at innovations from a slightly different perspective. When von Hippel and von Krogh look at innovation through social impact, Chesbrough focuses on the emergence of innovations.

The concept of open innovation, introduced by Henry W. Chesbrough, is described in *Open Innovation: The New Imperative for Creating and Technology* (2006) how companies have moved from a closed innovation process to a more open innovation model. An open innovation model challenges a closed model based on traditional knowledge and knowledge control (Chesbrough 2006).

Open innovation is based on the idea that a company is no longer successful alone. Open innovations are one way to meet the future challenges of product development. Closed innovation happens in the traditional R&D department, the majority of innovations, research and development are done inside the company itself. (Torkkeli 2007.)

One of the latest definitions of open innovation is defined in the publication: *New Frontiers in Open Innovation* by Henry Chesbrough, Wim Vanhaverbeke and Joel West (2014) where it is defined as “ a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization’s business model.” (Chesbrough et al. 2014, 17.)

Why are research and development (R&D) departments not enough anymore? As Knott (2017) from Harvard Business Review explains, despite the continuously increasing investments and employment in R&D, there is a trend of decreasing relative returns. The conclusions of my thesis are directed towards companies and their ability to innovate. The reasons given so far, such as the constraints of the combination of organizational structure, culture and workforce skills, have found some solutions to these restrictions in the so-called open innovation model.

According to Chesbrough et al. (2006, 1-3), introduce R&D as an open system in which valuable ideas and paths to market come both from inside and outside, provides a source for value creation and value capture. The authors highlight that even the most capable R&D functions need to identify, connect and leverage external knowledge in order to promote the idea generation and synergies. Experts from Capgemini Consulting (2015) argue that the open innovation model allows enterprises to track and embrace the disruptive change by engaging in a start-up ecosystem, such as incubators, accelerators or creating their own innovation lab. Following this analysis, digital innovation labs seem to be a form of an open innovation model, that tackles the slowdown in the in-house innovation process by going beyond the organizational boundaries and integrating external expertise and knowledge.

Torkkeli et al. (2007, 31) in turn, defines open innovation as follows: “Open innovation is a model of a variety of ways in which an enterprise can utilize external information (in addition to conventional information from public sources) and market channels in its business, either in its own innovation process alongside internal R&D activities or in commercializing its own innovations in addition to conventional business.”

2.5. Innovation labs

Innovation labs are often related to technology and business issues. Innovation labs can also support innovation in democracy and governance. Each innovation laboratory has its own way of doing things and understanding what innovation work requires. Innovation requires cooperation and dialogue with various stakeholders, such as researchers, entrepreneurs, citizens and decision-makers. This broad community can challenge the traditional business and open closed mind-sets. Labs can act as local movers for change, but digitalization allows also help to solve global challenges. (Gryszkiewicz et al. 2015.)

What is a digital lab?

The definition of the digital or virtual lab - virtuality is made by digital technologies - can be defined as a computer program that allows a student to run simulated experiments via the web or as a stand-alone application. A digital lab could be a set of simulations put together, for examples there can be applets, flash-based demos or animations. (Bajpai 2013.) The digital lab enables services, products ideas and business models to be developed and tested in a virtual format.

According to McKinsey, Digital Labs can create products, create and share new experiences, create new businesses and achieve a lasting competitive advantage digitally. This all gives the company the opportunity to get new digital value. (McKinsey Digital.)

Today, digital change is needed everywhere. It is a megatrend that creates new business areas, markets and major changes in business processes, digitalization increases productivity and efficiency gains. It also modifies existing business models, a good example of this is what Uber has done to taxis.

Digital labs help you to find solutions, for example, digital conversions and make them as easy as possible. Digital labs give the possibility to bring an actual user experience between the developer and the tester and this way ensure better quality. A digital lab enables a platform for cooperation between companies, start-ups and science. It can be a physical or virtual space with the ability to create and implement new digital ideas in a creative environment. These labs are designed to create a new digital future with new digital business models, innovative products ideas and digital technologies. Failures are allowed and these are quickly accumulated as a learning experience. Digital labs are part of digitization strategies. Today several companies are building digital labs to accelerate their own innovation and digitization process.

Crisp Research AG (2016) defines digital laboratories as "developing ideas and business models for digital products" (Ramus & Velten, 2016, 4). Authors consider digital laboratories as tools and programs used by multinational companies and small and medium-sized enterprises as part of the digitalisation strategy. The figure 4 shows how they classify digital laboratories into an innovation laboratory, a business builder, an accelerator and an incubator (Ramus & Velten 2016, 1). This thesis focuses on laboratories for digital innovation.

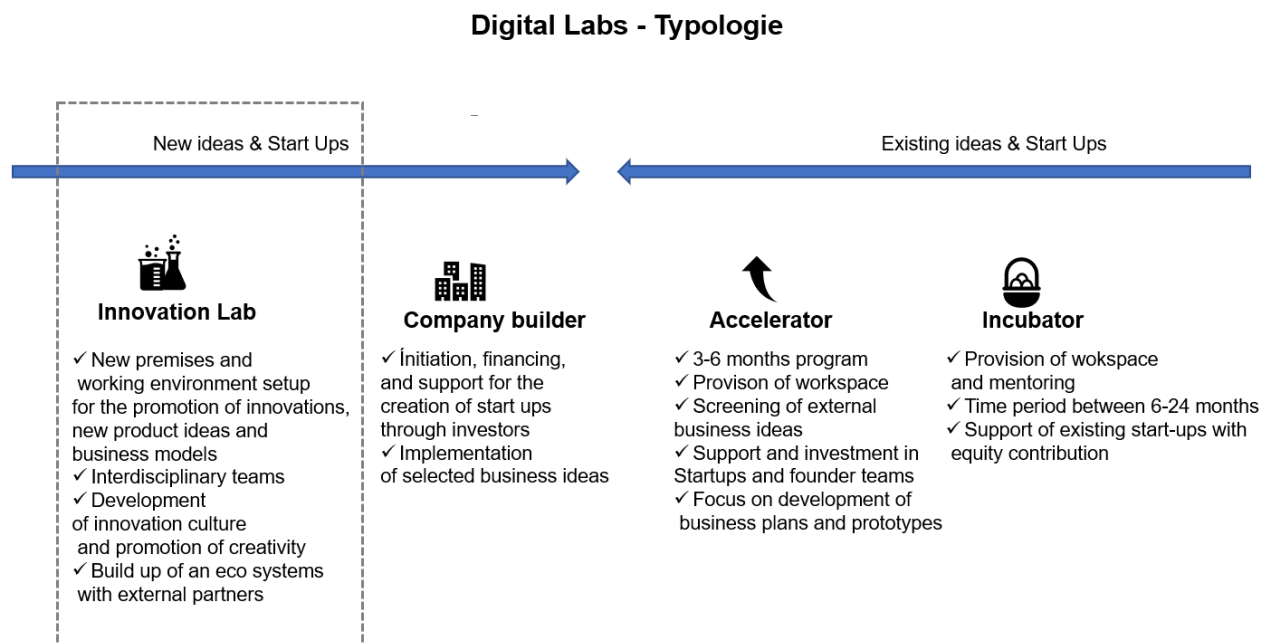


FIGURE 4. Categorization of Digital Labs (Crisp Research AG 2016)

2.5.1 Digital innovation labs

What is a digital innovation lab?

The innovation labs and their modern, digitized version - digital innovation lab, have become a need for today's companies. The fear of being disrupted by start-ups has made many companies open their own innovation labs. Companies are seeking new business opportunities and long term sustainable growth with new innovations. The normal R&D and innovation labs are not the same thing, innovation labs give more freedom to develop ideas than normal R&D that normally uses more strict development methods. Therefore, several companies keep their innovation labs as separated from the main company. (Tendayi 2018.)

The goal of the digital innovation lab is to develop digital innovations. Companies concentrate resources to these labs as an effort to improve the success of digital innovation. According to the study, these DILs have not been in the focus of academic research, and so there is limited knowledge in the literature about these DILs. DILs are separate units that explore new innovations and improve existing businesses. These labs require a lot of collaboration between different departments, people with various backgrounds and connect people from business and IT departments. Lab users are working to turn their new ideas into new opportunities for the companies. (Holotiuk & Beimborn 2017.)

Clear and valuable definitions are rarely available for Digital innovation labs and often limited to certain sectors and research fields. Therefore, I created a definition that tends to catch all aspects by considering the terms separately (as depicted in figure 5). Based on the literature review, I define digital innovation labs as facilities or ecosystems that offer an inspirational environment for individuals to promote the flow of innovative ideas, and provide all necessary resources for interdisciplinary teams to put them into realization in order to overcome the barriers of the digital transformation.

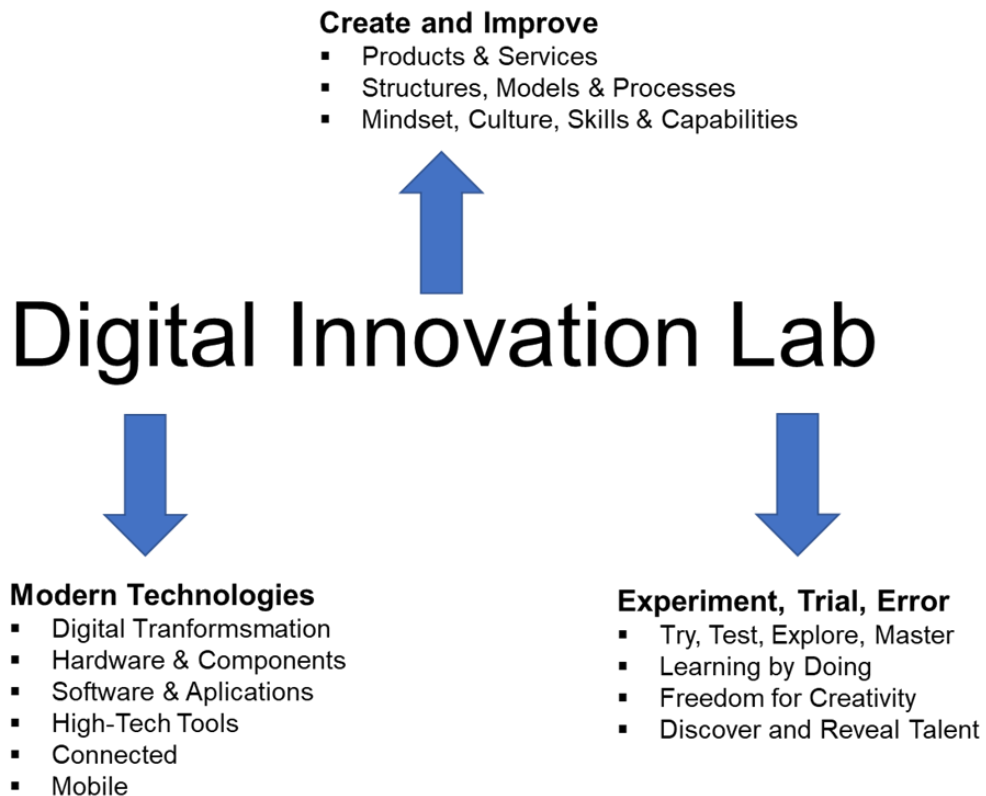


FIGURE 5. The methodology of defining Digital Innovation Labs

The majority of DILs are commercial, funded by industry seeking new business opportunities with start-ups. There are also non-profit, public DILs – they are funded by cities or public-sector players like governments or the European Union.

Many financial companies have also launched innovation labs - For example, OP Group 's internal innovation unit is called OP Lab. Last year, it launched 40 new services or products with start-ups and other partners. OP Lab has 50 employees and collaborates with employees from over a hundred partner companies. (Talouselämä 2018.)

Labs act as a catalyst for creativity and must provide an experience where employees can perform tasks in multipurpose teams, acquire new skills and promote new ideas. The popularity of laboratories is increasing in all industries and it seems to be the most promising approach to resolving disruptions. Empirical research on the effectiveness of innovation laboratories is not yet available. This is due to the lack of indicators for measuring innovation. On the other hand, the

success of DILs is illustrated by several success stories and the growing profitability of the business model.

2.5.2 Structure and features of DILs

Considering the limited number of academic sources covering the topic, there is no clear description or guideline on what a DIL consists of and what are its unique features. Following the analysis made so far and the definition provided at the beginning of the chapter, a basic model on the features and structure of DIL will be proposed.

Normally, a DIL follows the structure and business culture of a start-up. That way, a DIL is getting rid of the complexity, bureaucracy and unnecessary documentation and reporting that in general are required in every larger enterprise. Through flat hierarchies and close collaboration between all functions, DILs are striving towards lean practices and simplicity.

In the view of Crummenerl and Seebode (2016), digitalization requires flexibility, self-organization, innovation, cross-functional integration as well as a learning- and test environment to facilitate creativity and innovation. Following these requirements, it can be concluded that all of these are perfectly fitting into the business model of a DIL. Innovation labs are bringing people together to share ideas and create products and solutions through joint efforts and expertise. In these circumstances, the employees have the freedom of bringing their ideas to life and are encouraged to do so. Pragmatic thinking and focus on the true value-add are supported by the short development cycles and idea testing.

Thinking on the background, structure and features of a DIL, its common characteristics identified in the analysis above can be summarized as follows:

- ✓ Experimental Environment
- ✓ Entrepreneurial and Lean
- ✓ Cross-disciplinary and Collaboration
- ✓ Innovative Methods and Technologies
- ✓ Customer Orientation

2.6. Summary of Academic Findings

According to Murawski and Bick (2017), there is just a small amount of research concerning developing the digital skills of the workforce. They say that more research is needed on issues such as identifying the competencies needed to ensure employability in the digital age and how companies can improve their employees' ability to handle digitalisation (Murawski & Bick 2017, 723). Although a DIL can be considered as a tool to develop competencies, the literature does not provide evidence on how innovation labs can facilitate these competencies.

Looking at the characteristics of DILs identified so far, a correlation can be observed between the requirements for digital competencies and the features of a digital innovation lab. The entrepreneurial and experimental character of an innovation lab does provide freedom for creativity, high error tolerance and not strictly limited resources. Experts gathering from different domains and backgrounds in a DIL, to create a common product or a service, can emphasize the teamwork, information sharing and co-operation skills. Using different perspectives leads to a broader scope of view, and expands the basic understanding of product or service in different technical and non-technical areas. The core of the open innovation model is bringing ideas together from inside and outside and sharing expertise. Following the same principle, innovation labs aim towards co-operation of different knowledge domain to trigger innovation. Using modern methods and approaches for product development, such as lean and design thinking emphasizes the problem-solving and critical thinking capabilities of an employee.

Since there is no empirical evidence of this observation, from a theoretical perspective, it can be concluded that the defining characteristics of digital innovation labs have a close correlation with digital competencies. As new disruptive innovations impact both businesses and their employees equally, DILs can be seen as an instrument used by both parties for enabling the successful way to build up competencies for digital transformation.

3 RESEARCH DESIGN

This chapter discusses the research design and implementation of the research.

3.1. Research questions

The research questions addressed in this research are discussed below. My thesis has two research questions. The research questions are based on preliminary research on current studies about DILs, digital competencies building and digital transformation.

Research question 1:

What digital competencies do companies want to develop with the use of digital innovation labs?

This question seeks the answer what are the digital competencies that are needed in the company to be successful in the market? How can we categorize the competencies? Are there competencies areas that are needed for success that were unknown before the use of digital competencies labs?

Research question 2:

How may digital innovation labs support companies to develop these competencies?

The question seeks the answers about how digital innovation labs can help to develop the needed skills. What is needed for building up the competencies successfully? What ways of working do the DILs use? What facilities do the DILs normally have, and how are they exploited?

3.2. Research approach

This picture presents the constructive research approach of this thesis. It started with studying the research topic and getting a better understanding of the research topic. After that, I made literature research to find out what information is available in academic papers and publications. Then I wrote about theory and created a series of interview questions to get information about the usual features of DIL's and how these helps to build up the competencies needed by DIL users. Interviews were made face-to-face or by conference call. The results were collected and analysed to see what features of DIL help to build up digital competencies of DIL users and what competencies they want to build up. After that, the correlations between the features and competencies were listed in the results.

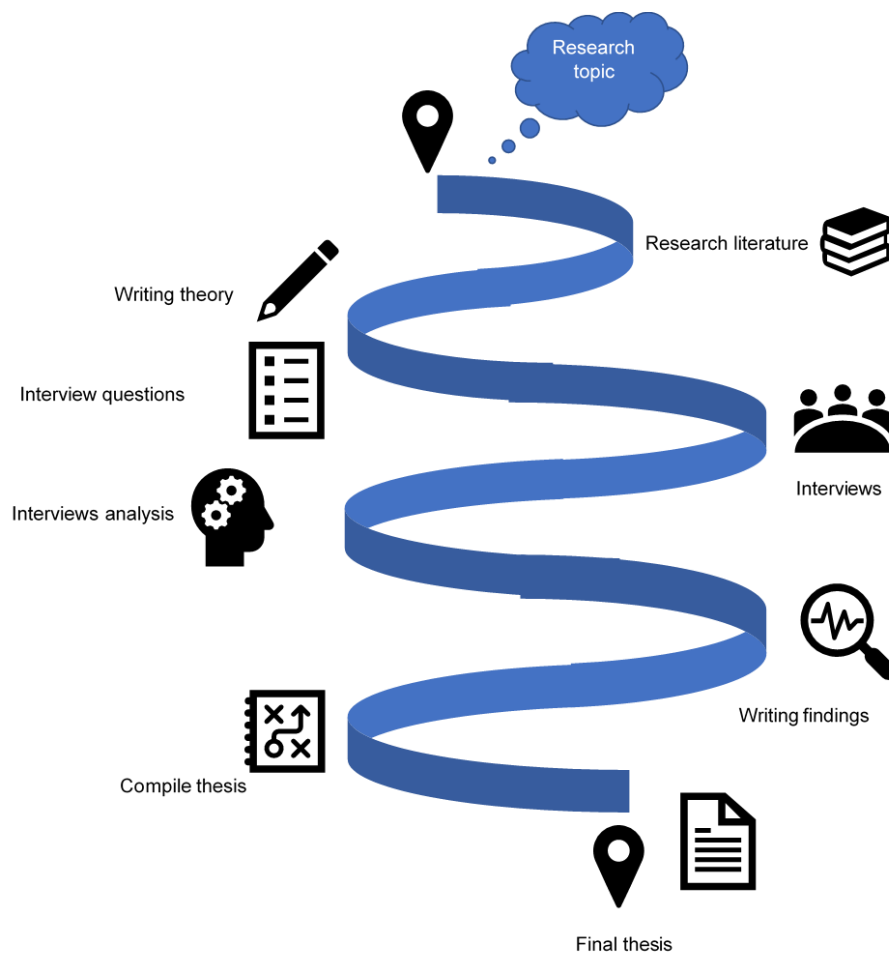


FIGURE 6. Research Approach

3.3. Research method

This chapter describes the design approach of this thesis aiming to identify features of digital innovation labs and how these can help to build up digital competencies. After theoretical research of this topic, two research questions (3.1.) were identified and a research framework was developed. As described in the figure 7, features represent a digital innovation lab aspect and competencies that are build up by them refer to the DIL user aspect. The combination of both aspects leads to new products/services, and to new innovations and business value.

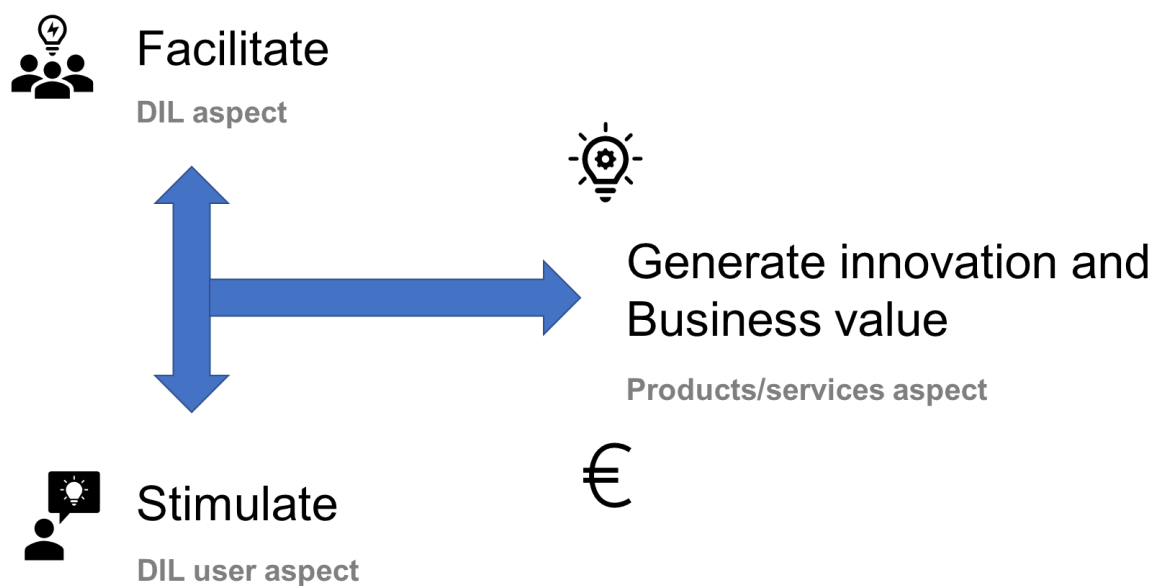


FIGURE 7. Research Framework

I chose a qualitative research design for my thesis. Qualitative research design follows an inductive approach that leads to a certain theory that is derived from observations. This approach helps to understand how experts that are working in digital innovation labs view the effectiveness of digital innovation labs in building up digital competencies through features that are common for the labs (Merriam 2009; Creswell 2014; Eriksson & Kovalainen 2008).

Since the correlation between specific features and the building up of digital competencies is rarely researched, my study is exploratory research. Exploratory research investigates a problem, that is not clearly defined and is conducted to have a better understanding of an existing problem. To gain first-hand insights from the research topic, the expert interviews are conducted with personnel of

digital innovation labs that operate in different sectors and industries. Before sourcing the interview partners, an interview guide is developed (Appendix 3).

3.4. Interview structure

I arranged several interviews to find out how DIL's work in practice, what are the typical characteristics of these labs, what are the digital competencies that DIL customers are seeking by using them and how the DIL's build up the competencies that their customers are seeking. Finding interview targets in Finland was challenging because there are not many pure innovation labs yet in Finland but more incubators and innovation hubs. Therefore, I included interviews also from one German and one Swiss digital innovation lab. This arrangement also shows if there are differences between the labs by geographical location.

The persons interviewed are ones that work in DIL's as employees on an operative level and conduct the daily activities with their customers. To get a broader view the labs used in interviews are in both the public and private sector.

The data collection approach was semi-structured questionnaire – asking open-ended questions to interviewees. The interview questions were sent to persons in advance to give them time to think the answers. The questionnaire can be found in Appendix 3. The interview started with a general introduction of person and company and continued with the interviewee's opinions about digital transformation and usage of digital innovation labs to handle it. The following topic of the interview was the digital competencies, how to categorize and prioritize these competencies, what are the essential digital competencies for employee of DIL and does the interviewee see any restrictions that could prevent to build up competencies using DIL's. The last topic of interview handled questions about the typical characteristics and methods used in DIL's, how does the interviewee see the location and design of the office space affecting the success of the DIL, what are the differences between DIL and typical company R&D. Finally, the interviewee could give remarks and feedback at the end of the discussion.

The interviews were conducted between April and June 2019 and continued in September 2019. The interviewees were experts in innovation labs in various positions. In my thesis, I used interviews as a data collection method.

The interviews can be used to clarify matters relatively quickly and to gather in-depth information on the research subject. (Ojasalo et al. 2015, 106.) More common interview methods include a structured interview, a semi-structured interview, and an unstructured interview. (Kananen 2015, 145.) The semi-structured interview was chosen as the interview method. In this method the questions are pre-prepared, but their order can be changed according to the flow of the interview and the wording of the questions can be changed (Ojasalo et al. 2015, 108). When preparing for an interview, it is necessary to test the questions by using a pre-interview (Hirsjärvi & Hurme 2015).

The interviews were conducted face to face in the work environment of the interviewees or through a video call, and they lasted approximately 60 minutes. The interviews were recorded because it made it easier to concentrate and observe the interviewee. In addition, re-listening to the interview again helps the researcher to understand what the interviewee really meant by their answers and the recording acts as a note (Ojasalo et al. 2015, 107). The interviews were written down (transcribed), which is a tool for analysis (Ojasalo et al. 2015, 107). The transcribed interviews were loaded into MAXQDA application for analysis.

3.5. Data collection

Data collection plays a very important role in research. Two different sources are used to collect data to this thesis, primary- and secondary sources. A primary source is data directly collected by the researcher and not widely available. Secondary data is data already collected or produced by other researchers and is already widely available. There are differences between primary data and secondary data, but the most important difference is that the primary data is factual and original, while the secondary data is already analysed and interpreted from the primary data.

I used primary and secondary data in my thesis. Due to the qualitative research design of this thesis, primary data collection is an important part of this thesis and was collected through interviews.

Primary data

I identified and acquired interview partners through online tools and social media such as Google, XING and LinkedIn. Through preliminary research of digital innovation labs, I found a small number of company digital innovation labs that I approached directly. However, the number of DILs in Finland is not yet very large, so it was difficult to find suitable interviewees.

To increase the probability of getting positive feedback and an interview, I approached DILs first by email and later by phone. The email included a description of the research topic and the interview guide that I prepared before the interviews. Finally, I identified five interview partners and interviews were kept either online via Skype/Google Meet or in person at the company premises. The interviews were recorded and transcribed. The transcribed interviews were moved into MAXQDA for analysis.

Secondary data

The theoretical background of my thesis is based on experiences and observations from the literature analysis. Academic databases such as Ebscohost, ScienceDirect, Springer Link, and Google Scholar were used to find the sources for the literature review. The amount and quality of results varied with the search term and the database. Especially the SpringerLink database often provided suitable chapters of the books that were widely used throughout the theoretical literature review.

I studied various business areas and companies to get a broad understanding of the effects of digitalization, what problems companies are facing with digitalization and how they are responding to them. Consultancy company reports were used to get the latest insights and trends in innovation labs.

3.6. Data analysis strategy

The MAXQDA program facilitates and supports qualitative, quantitative and mixed research projects. It allows you to import, organize, analyse, visualize and publish all electronically collected data, including interviews, surveys, PDFs, spreadsheets (Excel / SPSS), bibliographic data, images, videos and web pages.

MAXQDA is an all-in-one software for research and teaching purposes across a wide range of disciplines.

I analysed the primary data with MAXQDA. After the transcription of the recorded interviews, I browsed the transcripts to get familiar with the data. Then I read the transcription files in MAXQDA thoroughly and highlighted important information. In order to describe the content better and to identify themes or patterns in the interviews, I defined preliminary codes. I assigned these codes according to the key aspects of the interview questions. The table 2 shows the codes and a description of information assigned to codes. I grouped the codes in order to identify patterns or themes in data.

Table 2. Coding Overview

Code	Description
Personal/Professional Information	Refers to all information that deals with the interviewee's position, background, organization, etc.
Definitions	Definitions of DIL, digital competencies or any other definitions of major terms
Challenges	The interviewee's view on challenges that digital transformation states for business and society
Requirements	Competencies that people should have/obtain in order to successfully participate in the digital society and/or business
Limitations	Limitations of DIL regarding the build-up of new digital competencies
Location	All information that refers to the location of a DIL and if/what impact location has on people/creativity/openness etc.
Methods	Methodologies commonly applied within DIL (e. g. Kanban, Agile, Design Thinking, etc.)
Focus	The technological field, the sector or the industry on which the lab focusses
Lab vs. R&D	Interviewee's view on traditional R&D departments and the main differences perceived
Competency	Information on digital competencies that the interviewee's lab facilitates
Characteristic	Information on common characteristics that help to facilitate these competencies

4 RESULTS

This chapter describes the companies that participated in the interviews and the interviewees. In addition, the data for each DIL are described in the tables and the key findings found in the interviews are mentioned.

After that, the summary of the different views collected through interviews about the characteristics of innovation labs and digital competencies is presented. This qualitative research provides an overview of methods facilitating digital competencies in DIL. Interviews were conducted to different types of DIL's. Having results from a public sector, company internal and commercial open DIL shows that most the characteristics and the competencies that users of DIL are seeking are common in all three types of DIL.

The characteristics mentioned in the interviews are shown in the table 7 at the end of chapter 4.2.1.

4.1. Interviews

4.1.1 Interviews 1&2#: Forum Virium Helsinki

Forum Virium is an innovation unit of the City of Helsinki. The city of Helsinki has a mission to become the most functional smart city of the world and Forum Virium is the way to achieve this goal. Its purpose is to develop new digital services and urban innovations. Virium co-operates with companies, universities, public sector organizations and Helsinki residents. Forum Virium is a separate non-profit seeking company that co-operates with industry players from IT, telecom, energy, universities of Helsinki city area and business sectors. (Forum Virium Helsinki, n.d.) The funding for Forum Virium innovation projects comes from the City of Helsinki and different funding resources of the Finnish government and the European Union. Forum Virium also collaborates with other European cities innovation labs and other cities around the world. (European Commission, n.d.) Forum Virium's core knowledge areas are IoT and Open Data. Helsinki is ranked among the six smartest cities in the comparison of the EU Parliament. Through various development projects, Forum Virium aims to promote the emergence of digital urban

services and these ideas are close to the everyday life of the users. This gives also new business opportunities to companies that co-operate with Forum Virium.

One of the Virium projects - Kalasatama – is an intelligent neighbourhood in the City of Helsinki, where the users have been involved from the start. For example, the garbage cans have IoT sensors that measure the amount of garbage in can and notify when the cans are needed to be emptied. The food wrappings have tags that IoT sensors monitor and this way the flood of garbage produced by food can be followed. (Forum Virium Helsinki, n.d.) Another example of Virium Helsinki's development project is project FABULOS. One of the objectives of the FABULOS (Future Automated Bus Urban Level Operations Systems) project is to find out how cities can use self-controlled buses as part of public transport. There will be a bus connection between Kalasatama and Pasila, another district of the City of Helsinki, in 2020 that uses an autonomous vehicle. This is to prototype robot-driven busses in the urban environment. In the project, citizens and companies are trying to resolve how automated vehicles could improve their daily lives. The goal of Helsinki is to make inhabitants walk, cycle and use public transport instead of their own cars. (Forum Virium Helsinki, n.d.)

Interviews #1 and #2

I interviewed two people who work in Forum Virium, one of who is the Technical Lead of IoT projects and the other one who is in the function of a Project Manager. With these two interviews, I tried to get a broad view of Forum Virium as digital innovation lab and understand which characteristics and competencies can be defined from the perspective of the public sector DIL. Both interviewees had a similar professional background in the telecom sector - that is no surprise in Finland where Nokia and other telecom sector companies have been a major factor for the national industry.

Innovation Lab Canvas

Table 3. Innovation Lab Canvas Forum Virium

Strategy and Structure	
•Innovation Ambition	Transformational
•Innovation Topic	Various
•Number of Innovation Topics	Multiple
•Innovation Focus	Service and Product Innovation
•Strategic Innovation Trigger	Digital Transformation In The Public Sector
Process and Execution	
•Location	3rd Party Location
•Lab Duration	Ongoing
•Continuity	One Time
•Process Guidance	Semi Guided
•Branding	Co-branding With Partners
•Openness Of Participation	Ecosystem Innovation
People	
•Selection Process	Application Process
•Teams	Multiple, Cross-industry And Cross-functional
•Team Competition	Non-competitive
•Education	Participant Level
Exploitation and Financing	
•Output Implementation	3rd Party Implementation
•Payment	Project Fee Based on Effect

Key findings

The interviews disclosed that Forum Virium is a non-profit independent organization that co-operates with industry and other public-sector innovation labs. Both interviewees pointed out that co-operation is an important element for a successful innovation lab. Through this collaboration between labs and with industry, the successful ideas, products and solutions developed in innovation lab are later transferred to commercial companies that continue the development with normal business models. One common feature was the usage of Open Data - in this case, data collected from several sensors regarding environmental, traffic and other data and providing it for free and openly to be used in digital solutions that better everyday life of the residents of the city. Another term mentioned by both interviewees was IoT - Internet of Things. This is related to Open Data and the

standardization of IoT interfaces to enable easier development of digital services that are based on data provided by IoT. One interesting point of view that was mentioned in both interviews was end-user involvement. In their opinion, it is important that the users of the digital products and solutions are involved already at the beginning or in the innovation phase of product or solution design. That is not usually the case in a traditional product development model. This guarantees that the solutions are optimally developed and adapted for the users who are using them.

4.1.2 Interviews #3: Accenture

Accenture has opened its 10th Liquid Studio in Helsinki. The purpose of the fast application development centre is to help companies and organizations accelerate innovations and prepare for the digital transformation by leveraging new capabilities, technologies and practices. Based in downtown Helsinki, Liquid Studio experts help organizations to experiment with technologies and services that are revolutionizing their operations and customer experience. (Accenture, n.d.) The Liquid lab is a DIL of a typical consultancy company that offer its services to the company's customers, e.g. external companies.

“The next driver of growth and competitiveness for Finnish organizations is continuous, agile innovation,” says Frank Korsström, Managing Director of Accenture Nordic and Finland. “We help our local customers rapidly innovate and scale into production. In addition, we support them to adopt the changes brought by digitalisation, evolving customer expectations, new technologies and new competitors. Here at Liquid Studio, we can help our customers to make the most of the opportunities that lie ahead.” (Accenture, n.d.)

Konsta Saarela, Nordic Director of Accenture Liquid Studios, says that consulting is experiencing a time of change. “Nowadays, strategy consultants work with service designers and technology experts. If we want to find new disruptive innovations, we need to work with a wide variety of professionals. According to Saarela, Liquid Studio believes that conflicts are an asset. Liquid Studio is a place where innovation can become tangible in a short time. We build pilots and prototypes, challenge business models and test new technologies”. (Talouselämä 2018.)

Interview

I interviewed one service designer who works in Accenture's Liquid lab as Head of design. This interview was done to a person who works in the private sector digital innovation lab. With the interview, I try to get the picture of private sector DIL and whether it's characteristics and competencies differentiate from the ones in the public sector or company internal DIL.

The background of the interviewee is similar to that of the other interviewees – longer experience from coding and usability before current position in DIL.

Innovation Lab Canvas

Table 4. Innovation Lab Canvas Accenture

Strategy and Structure	
• Innovation Ambition	Transformational
• Innovation Topic	Various
• Number of Innovation Topics	Multiple
• Innovation Focus	Service, Product and Business model Innovation
• Strategic Innovation Trigger	Digital Transformation In the Private Sector
Process and Execution	
• Location	3rd Party Location
• Lab Duration	Ongoing
• Continuity	One Time / Repeated
• Process Guidance	Fully Guided
• Branding	Co-branding with Partners
• Openness Of Participation	Ecosystem Innovation
People	
• Selection Process	Application Process
• Teams	Multiple, Cross-industry and Cross-functional
• Team Competition	Non-competitive
• Education	Participant and Management Level
Exploitation and Financing	
• Output Implementation	Integrating existing Organization and Process
• Payment	Project Fee Based

Key findings

The Liquid Studio is a bit different DIL than the Virium Helsinki. It offers its services to Accenture customers that want to use a digital innovation lab but don't

have one in the own company. The interview revealed that the needs of the customers are basically the same as in the public sector and company internal ones, but the need of organizational and business model changes can be seen more in this case. This reflects the challenges that digitalization brings to traditional company R&D – the current methods used are no longer enough in the modern digitalized world.

The same terms as “end-user involvement”, “customer experience” and usage of data to create new services were mentioned in this interview too. The same applies to the characteristics of a DIL – experimental environment, cross-disciplinary collaboration, customer orientation and innovative methods and technologies.

In the case of Liquid studio, the mentioned competencies were the same as the other DIL’s – Information and data literacy, communication and collaboration, digital content creation and problem-solving. The difference compared to the public sector and company internal DIL was the customer’s need for competencies related to rearranging organization and business models.

4.1.3 Interviews #4: Anonymous DIL

A DIL who is name was not wanted to publish, is called in this thesis as Anonymous DIL. It is one that works inside the company, acting as the company’s own internal innovation unit to enable the digitalization strategy of the company.

The mission of the Innovation Lab is to enable the company to digitize and strive to be customer-centric by creating successful user experiences, delivering customer-validated results and scaling solutions across the globe. Its main goal is to build and deliver global innovative solutions to the company’s customers. Through customer validation, value-adding operations are tested and validated in phase product development, saving resources by focusing on simplicity.

Interview

The interview was conducted with a Digital Marketing Expert from the company's Innovation Lab unit, the company is a multinational financial services provider. The interviewee did not want the company name or personal data exposed to the public.

Innovation Lab Canvas

Table 5. Innovation Lab Canvas Anonymous DIL

Strategy and Structure	
• Innovation Ambition	Core (Existing)
• Innovation Topic	Pre-defined
• Number of Innovation Topics	Multiple
• Innovation Focus	Product and Service Innovation
• Strategic Innovation Trigger	Digital Transformation
Process and Execution	
• Location	3rd party location
• Lab Duration	Ongoing
• Continuity	Repeated
• Process Guidance	Lab consulting
• Branding	Company branded
• Openness of Participation	Consumer, user & expert integration
People	
• Selection Process	Application process
• Teams	Multiple
• Team Competition	Non-competitive
• Education	Company level
Exploitation and Financing	
• Output Implementation	Integrated in existing organization
• Payment	Equity model

Key findings

Traditional companies have set up DIL as a tool to handle the “new normal” and to support the digital transformation process. In this company DIL, a variety of projects are executed by a group of people from different disciplines, activities and backgrounds over a pre-defined period, and the primary goal of all participants is to produce a result at the end of this period. Therefore, collaboration and teamwork are essential for successful results.

Many of the innovations can be seen as technology-driven rather than content-driven, and companies cannot adapt their organizational structures and processes according to the innovations. This is the reason why traditional companies

are investing in DIL's. Customer-centric design and analysing usage data are important when developing applications and functions that are needed by customers and produce value for them.

At the same time, improving user experience and analysing customer data enables more automation and can be used to redefine business processes.

4.1.4 Interviews #5: Impact Hub

Impact Hub Bern, Switzerland, is again a bit different compared to the three other DILs examined. It does not define itself as a digital innovation lab, but enterprise innovation hub that is part of a bigger international network of innovation hubs. Each hub in the network work as an independent company that makes its own decisions and can use help from other hubs in the network if the projects are bigger or international.

The hub defines itself as "An Impact Hub consists of three distinct elements. First, it is a vibrant community of passionate and entrepreneurial people who share an underlying intention to bring about positive change and act as peers to cross-fertilize and develop their ventures. Second, it is a source of inspiration that provides meaningful content through thought-provoking events, innovation labs, learning spaces, programs and facilitated conversations that support positive impact. Third, an Impact Hub is a physical space that offers a flexible and highly functional infrastructure to work, meet, learn and connect." (Impact Hub n.d.)

Interviews

I interviewed one person who works as a project manager for innovation and start-up projects. The background of the interviewee is in both the academic world and the private sector. She has also worked in a start-up company in her career. In the modern world, a big part of innovations are related to digitalization and having a viewpoint of this type of innovation lab or hub will confirm whether the same characteristics and needs for competencies can be seen in this kind of innovation lab that is not only concentrating to digitalization.

Innovation Lab Canvas

Table 6. Innovation Lab Canvas Impact Hub

Strategy and Structure	
<ul style="list-style-type: none"> • Innovation Ambition • Innovation Topic • Number of Innovation Topics • Innovation Focus • Strategic Innovation Trigger 	<ul style="list-style-type: none"> Transformational Various Multiple Service, Product and Business model Innovation Lean Start-up Thinking
Process and Execution	
<ul style="list-style-type: none"> • Location • Lab Duration • Continuity • Process Guidance • Branding • Openness of Participation 	<ul style="list-style-type: none"> 3rd party location Ongoing On Time/Repeated Fully Guided/Semi Guided (coaching&sparring) Co-branding with Partners Ecosystem Innovation
People	
<ul style="list-style-type: none"> • Selection Process • Teams • Team Competition • Education 	<ul style="list-style-type: none"> Application process Multiple, Cross-industry and Cross-functional Non-competitive Participant, Company and Management Level
Exploitation and Financing	
<ul style="list-style-type: none"> • Output Implementation • Payment 	<ul style="list-style-type: none"> New Start-up Project Fee Based

Key findings

Impact Hub acts as an incubator to start-ups where the new start-up can come with the new idea and have all necessary office facilities, co-working spaces, people from other areas, experts to coach the start-ups and investors to finance the innovation if it can be seen a potentially successful one. Successful projects can after that also be part of accelerator-program, where the aim is to accelerate the business by collecting finance and customers for the innovation.

The hub also provides services for the companies that want to try new ideas and create new innovations more freely than in their own development process.

The Impact Hub case shows the same characteristics as the others, experimental environment, entrepreneurial and lean, cross-disciplinary collaboration

and customer orientation. The similarities with the commercial DIL are the emphasis of business modelling and start-ups. Same applies to competencies, however, the customer need of digital competencies is not shown as strongly in this interview as in the others.

4.2. Cross case analysis

4.2.1 Characteristics

As clarified earlier, there is no official commonly used description of a DIL. Therefore, I asked the interviewees to define what is in their opinion the key characteristics of a DIL. These characteristics are the typical features that make DIL's successful to create new ideas, products, services and solutions. Most of the characteristics of DIL's identified in the theoretical review were mentioned the interviews one way or another. The characteristics will be applied as a guiding framework when analysing the interview findings.

Experiment Environment

In the case of Forum Virium, openness seemed to be one of the most important factors. The driving forces for the innovation in this DIL are sharing and collaborating for the sake of the public wellbeing. The second most important factor mentioned in the interviews was experimenting. It enables conducting tests and trials without the pressure of finding a solution at the first try. Experimenting can also reveal at an early stage that an idea does not work, and that way saves resources that would be spent in normal R&D work. The Accenture and Impact Hub Interviewees pointed out also the prototyping in different forms, from the ones with paper and pen to digital prototypes. This way the open questions whether planned products or services work or not can be solved at the early phase.

A phrase often mentioned was “learning by doing”, meaning that at the same time when you develop a solution, you learn better and more efficient ways to do it. According to all five interview partners, the key characteristic of a DIL is an environment that encourages experiments, tolerates mistakes and is independent of external pressure.

Entrepreneurial and Lean

The interview partner from anonymous DIL particularly pointed out the significance of not having the normal company structures and processes, but rather acting as a start-up company. Leaving the normal organizational structure and processes out, the users of DIL can focus only on essential ones that really bring value.

The interviewee pointed out that in large companies the company organization and processes to be applied when the service or product created in DIL is taken in production use, and that is not the ideal solution. We should find a balance between new innovations and traditional working.

The similar points were also mentioned in both the Accenture and the Virium interviews, meaning that having an environment that is not restricted by normal rules of R&D enables to create innovations more freely.

This characteristic was strongly present in the case of Impact Hub. That's because Impact Hub is more of an incubator or accelerator than the other interviewed companies.

Cross-disciplinary Collaboration

In the case of Forum Virium, team diversity and getting people from different backgrounds to work together is very important. The interviewees believe that innovation labs should have open workspaces like in modern office design because the inspirational environment increases creativity. Also, other interview partners see open workspaces and modern office design as increasing communication and collaboration. The Accenture interviewee also pointed out that co-operation between all parts, the business functions, the persons that know the business, resourcing and the experts of technology that is planned to be used in new product or service. Impact Hub also pointed out co-operation between start-ups and investors.

Nevertheless, these new office worlds are not suitable for all employees and tasks. There are different opinions of open workspaces and their efficiency. The tendency is that the younger generations have a more positive attitude towards open workspaces and the older generations find disadvantages of this type of working environment.

Innovative Methods and Technologies

For anonymous DIL, applying innovation methods, like Co-creation, Design Thinking, DevOps, Agile and Continuous integration is an important part of a DIL to create any modern solutions. The same innovative methods are also applied in all other interviewed DILs, Accenture and Impact Hub use often Service design or Business design or modelling depending on the task that is done in DIL. Forum Virium is also using an own framework, based on the agile principles and it is so-called “Developers Club”, where all needed stakeholders are working together in the form of a continuous workshop.

Customer Orientation

In the case of Forum Virium, customer involvement in the design of product or solution design is another common characteristic mentioned during the interviews. The interviewee from anonymous DIL emphasised the customer journey and user testing, which in his opinion are needed for every successful product and therefore are the core elements of DIL. A mentioned example application was one where all insurance claims can be made digitally with a mobile phone and then forwarded to the accounting department and officer. This enables the company to achieve significant cost savings while providing an excellent customer experience. Customer orientation was mentioned strongest by Accenture due to its nature of commercial DIL where other companies come to develop their ideas.

Table 7 Characteristics mentioned in interviews

Category	Virium Helsinki	Anonymous DIL	Accenture	Impact Hub
Experimental Environment	Freedom for creativity Culture of experiments Error tolerance	Customer Journeys and User Testing Freedom	Proof of concepts Prototyping Digital prototype	Prototyping
Entrepreneurial and Lean	Bottom-up approach	Adapt to change Agile Flexible Entrepreneurial	Start-ups	Start-ups Agile
Crossdisciplinary Collaboration	Openness Cross-functional Balance between Open space and meeting rooms	Open workspace/co-location Co-creation Exchange Cross-functional	Work together Networking Co-working	Work together Networking Co-working Cross-functional
Innovative Methods and Technologies	Piloting Agile Developers Club	Design Thinking DevOps Agile Kanban Continuous delivery UX Design	End-user friendly design Design thinking Service design Business design Architectural design	Agile methods Design Thinking Business Modelling
Customer Orientation	User testing and involvement	Strong customer orientation	Do it with customers	
Other	-	Diverse international		

4.2.2 Competencies

In the interviews, the term digital competencies were not always understood in the same way by the interviewees. Competencies are normally mixed with term skill in everyday discussion. Skill is the ability to do something and competencies is the ability to do something well (Cambridge Dictionary). In professional life, the term competencies are in normal use. During the interviews, there were mentioned common skills like usage of digital interaction and communication, as well as the competencies to use digital solutions for problem-solving. Skills mentioned by interviewees were mobility and flexibility, and the ability to work remotely using digital tools and devices are crucial in today's digital world. A digital mindset and the willingness and ability to change are the basic competencies in order to keep pace with the digital transformation.

In the analysis of the results of the interview, there was an assumption that the users of a DIL have a basic set of skills or competencies that they want to build up in DIL. Using the DigiComp 2.1 framework's main categories we get the five main competencies.

The competencies mentioned in the interviews are shown in the table 8 at the end of chapter 4.2.2.

Information and data literacy

The amount of data collected digitally increases every day. This data can be from almost any source, and collecting, storing and analysing it is one of the competencies that is needed for new products or services. New technologies can help to collect this data and new methods can be used to create solutions that create value for end customers and company business. DIL's have these needed technologies and experts that have knowledge and methods to show and train the users to make a profit of this.

Communication and collaboration

When the knowledge needs to be collected remotely from workers located in another city or abroad, the usage of communication tools for meetings and calls or a quick exchange of ideas is another common practice of a DIL. The usage of chat platforms and virtual communication channels is also part of the modern technology used in DIL that can build up the social- and mobile skills of an employee.

All expertise and knowledge that members of the cross-functional team bring to workgroup need to be shared and that requires social skills. Furthermore, the ability to utilize knowledge coming from the different domains and persons is another aspect which can be promoted in a cross-functional team. The usage of modern tools and applications can assist to develop an analytical approach towards the different topics. The smart solutions and computing power aids to gain more information and in the DIL these resources are usually available.

Digital content creation

Another skill that can be built up in a DIL is end-user and customer-centric development, that seeks what is the real value of product or service for the customers. This focus on customer needs requires that whole organization and business processes to understand end-user behaviour and needs. Normally this is not the expertise of persons working on technical development tasks. For example, a set of developers or coders would normally be interested to have a working set of code and a variety of options in product to make the final product suitable for the broad audience. However, very often only a small section of all options in the product is actively used by the customer, and it is redundant in the long run to invest time, effort and resources to develop these unused functions to a product or service. The skill of pragmatical thinking from the business side can be adapted by the technical side and this way support the development of this competencies.

Safety

This competencies area was not directly mentioned in any of the interviews. This may be due to too narrow number of interviews or by fact that the security-related issues are too sensitive to be discussed in public. Today, companies need to take care of privacy, and the GDPR mentioned in the chapter (2.1.3) requires it in Europe.

Problem-solving

To be able to test and experiment in an innovation lab, users must have basic knowledge of how to use software and hardware. When users of the DIL get more experience and can test their ideas with modern technology, they can build up these competencies. With a trial-and-error approach, they become more familiar with the tools at hand and can do more with them in the future.

In a cross-functional team, all members cannot be an expert in engineering and computer sciences, but a basic understanding of technology is required. This basic knowledge can be enhanced and expanded in the proper environment and collaboratively developing a product. Furthermore, the fact that some team members are only involved in a DIL on a project-basis and afterwards return to their routine tasks, where they can share their experience and best practices, could

indirectly increase the awareness of the external stakeholders on technology and innovative practices.

In normal R&D there are many repeating functions that are usually defined in the company's development processes and the process normally requires to ensure that they are properly conducted. However, in an innovation lab environment, developing a product or service normally requires breaking out of this routine approach and thinking outside the box. This way, the critical thinking and viewpoints of people coming from the business functions, such as operative functions, accounting or law, can be taken into account and enhance the developed solution. This stimulates a mindset which focuses on solutions rather than problems.

In traditional thinking, changes rarely occur daily, but in an innovation lab, the requirements for product or service could change dramatically after testing or prototyping. Meeting these changing requirements needs a given level of tolerance and adaptability. A mindset that does not see these changes as a failure, but rather as a success for finding a non-working approach at an early stage, can be developed in these circumstances. Seeing the product or service structures as non-static and dynamic structures gives more freedom to allow smoother development processes and discussions than normal strict development process.

The source of new innovations today can be not only the traditional R&D department but the whole organization. With the usage of DIL, all members of the company are encouraged to use their imagination and creativity to bring their ideas forward. Out of the box thinking is a key characteristic of DIL that should encourage DIL users to have an innovation mindset. Seeing the potentials in modern technologies and innovations, rather than seeing them as threats, is an attitude that is promoted in a DIL.

Additional skills mentioned in the qualitative research, that have not been mentioned in the theoretical analysis are for example global perspective, using a system thinking, design thinking, considering the scalability of solutions rather than just looking at a local solution, connected thinking and working for synergies between potential partners.

Table 8 Competencies mentioned in interviews

Category	Virium Helsinki	Anonymous DIL	Accenture	Impact Hub
Information and data literacy	Data handling	Digital Literacy	Ability to collect data	
Communication and collaboration	Digital communication Remote connections and independent working	Ability to collaborate and listen	Communication Working Agile ways	Digital communication
Digital content creation	Programming Software development	IT development	Ability to make concrete	
Safety				
Problem solving	Service design Change capability and awareness Customer orientation System Thinking and integration	Change Capability Customer orientation Agile mindset T-Shaped Skills Tools, methods and Competences Design Thinking Technological affinity	Architectural design Best practices End user friendly desing	Digitalize processes Integrate systems

4.3. Summary of Major Findings

Based on this analysis it can be confirmed that digital innovation labs and their characteristics provide an environment for innovation. Digital innovation labs provide all necessary resources, modern surrounding and an opportunity to connect to the different domains for exchange knowledge and collaboration.

The analysis showed that customers' need for improving digital competencies is similar across different types of innovation labs. The greatest needs for improvement seem to be related to problem-solving and it is closely linked to innovation itself.

This leads to the general conclusion that DILs are building up the core digital competencies, necessary to overcome the barriers of digital transformation.

5 DISCUSSION AND CONCLUSION

5.1. Discussion

The analysis revealed the positive relation between the DIL and building of digital competencies. DILs have become greatly used for a reason – they break the constraints of the traditional organization structures and administration responsibilities that normally exist in larger organizations. A DIL should not be seen as an R&D unit with more privileges, there are many factors differentiating it from the classic R&D unit. Getting the business functions and the IT to work together and generate value for the common well-being brings not only economic benefits, but also builds up the path of a digital future. However, during the interviews, some limitations and challenges for DILs were identified.

For Anonymous DIL - a company internal innovation unit - the main limitation was that teams are built up only for a given period, and creating a team spirit to support the exchange of knowledge between the members was often very challenging. They also see limitations for new services when considering that the projects that are done with DIL are built up like start-ups. And these start-ups, however, will later have to face the limitations and control coming from the parent company. Furthermore, the perception of the digital innovation unit as a separate “lab” and the attitude of the parent company's employees could eventually hinder the whole innovation process, if the mission and goals of the DIL are not communicated effectively.

Similar limitations or challenges were also mentioned in the Accenture and Impact Hub interviews. The company culture and organization, old business models and how to change them according to the needs of new digital services or products is a challenge. This change must be accepted and supported in the company from the bottom to the high-level management.

Even though the culture of trial and error is broadly promoted in a DIL, it might not be the same case with the rest of the parent company, and that could lead to a collision between the two parties in case a provided product or service is not functioning as expected.

It can be concluded that the influence of a DIL for digital competencies build-up is strong. However, the promotion of these approaches and mindset to the parent company may become a difficult task. The digital innovation lab can be seen as an instrument for handling the digital transformation and fostering innovation, but also the function of a DIL could sometimes be misunderstood or undervalued, which negatively impacts the potential competencies build-up in the company. On the other hand, the more employees get involved into the projects conducted at a DIL, and the higher the rate of rotation between the employees using DIL, the more likely it balances out these negative effects and promote the mandate of a DIL.

5.2. Answers for research questions

The objective of my thesis was to describe how a company can utilize DIL's to develop its own digital competencies. The purpose of my thesis was to collect information on how and in which area of digital competencies the usage of innovation labs helps the company to develop itself. The Research method was to seek these development areas and development methods through interviews and complement the current theoretical body of literature, by providing an overview of possible correlations between digital competencies and the possibilities that DILs provide to their customers to improve them.

Considering all the challenges that businesses and employees are facing as a result of the ongoing digital transformation, digital competencies have become more and more important. Finding the proper methods and tools to build-up those is a concern not only for the employees, but for the companies as well. Even though the main purpose of an innovation lab is to handle the dynamics of the technological trends by promoting innovations across the whole business, it can also be applied as an instrument to support the building up of digital competencies.

By comprehensive theoretical review, followed by cross-case analysis on different types of digital innovation labs by listing their defining characteristics and digital competencies that users are seeking, the relation between these two can be confirmed.

Research question 1: What digital competencies do companies want to develop with the use of digital innovation labs?

The analysed and categorized competencies that were collected by the interviews shows that companies use digital innovation labs. They are used for both innovation work and building the new or improved competencies that are needed for the creation of the new services or products.

The most competencies are needed for the problem-solving area, including the use of new technologies, Architectural design and best practices. All interviews pointed out the digitalization of communication and how to benefit from it.

Research question 2: How may digital innovation labs support companies to develop these competencies?

The characteristics that were collected through the interviews are the cornerstones of a successful DIL. The methods and technologies that are used; collaboration, customer orientation, practical workspaces, experimenting and lean way of working, differentiate a DIL from typical R&D work that is usually framed by the company's processes. These characteristics promote building up new innovations and new competencies that are needed in digital transformation.

5.3. Limitations of the Research

I made this thesis by interviewing personnel from different types of digital innovation labs. Included were labs from the public and private sector and one that is acting inside a big multinational company. The locations of the labs varied between Finland, Germany and Switzerland. I did not find any big differences between the basic characteristics of the labs or the needs of the customers despite geographical location.

I did not have an opportunity to interview any of the customers of these labs - all requests for an interview were denied or were not answered. The customer interviews could have revealed more viewpoints for customer needs and methods or characteristics of the labs that customers see helping to get the competencies that they want to build up. Now the analysis is done based on the data that is originated only from labs.

There could have been also more interviews with local Finnish labs, but the amount of digital innovation labs is not currently very big in Finland. In the future, there are new labs coming in both to Finland and to the whole of Europe - but we here in Europe are still behind the areas like Silicon Valley and even Asia. The term digital innovation lab is not very familiar in Finland - seeking the possible interviewees was challenging.

5.4. Reliability and validity of research

In qualitative research, good knowledge consists of theory, observations and interviews. (Tuomi & Sarajärvi 2018, 64.) The interviews consist of the interviewees' opinions and their own conclusions which may involve personal bias, and this is typical in qualitative research. The result of the research can be considered reliable when two persons reach the same conclusion or understand the conclusions of a third person (Hirsjärvi & Hurme 2015, 186). This thesis can be considered reliable because all interviewees had similar conclusions in different types of digital innovation labs and in three different countries. During the interviews, the opinions of the respondents were not influenced by the interviewer opinions and the interviewees answered the questions based on their own understanding. Also, the layout of the interview questions was formulated so that they are not guiding the interviewees. Particular attention was paid to objectivity and impartiality in the analysis of interview materials.

The reliability of the thesis is increased by the fact that, the theory collected for the work is in line with the material collected. My thesis uses appropriate references to the original sources.

Validity ensues from the probability that the best possible tools and concepts have been used to research the phenomenon. All researches and situations are unique and cannot be used as a reference as such. Reliability and validity are easier to define in quantitative research than in qualitative research because in qualitative research the knowledge used in the research is collected through interviews. These analyses reflect the researcher's and interviewee's own understanding and opinions. (Hirsjärvi & Hurme 2015, 187-189.)

The subject of the thesis was limited and I do not think this can be generalized to other areas.

5.5. Recommendations for Future Research

My thesis focused on finding out what are the competencies that customers of the digital innovation labs are wanting to build up in the labs, and how the labs help their customers do it.

For future research, it would be interesting to also map the correlation between the competencies area and the known characteristic of the lab that enables or helps to build a certain competencies area. The results of this mapping would also be beneficial to labs, when they plan the projects or programs for the customer.

The second area for future research could be to develop easy practices to estimate the competencies level of the digital innovation lab customers. The JRC DigiComp 2.1 conceptual model framework already has this as the third dimension, but applying it to be used with DIL customers' needs careful planning to get reliable results. The benefits of this for the DIL's would be an easy and fast way to estimate the starting level of their customers and improve the customization of coaching and sparring activities in DIL usage. This could also enable a way to measure how much the competencies were improved during the use of the digital innovation lab.

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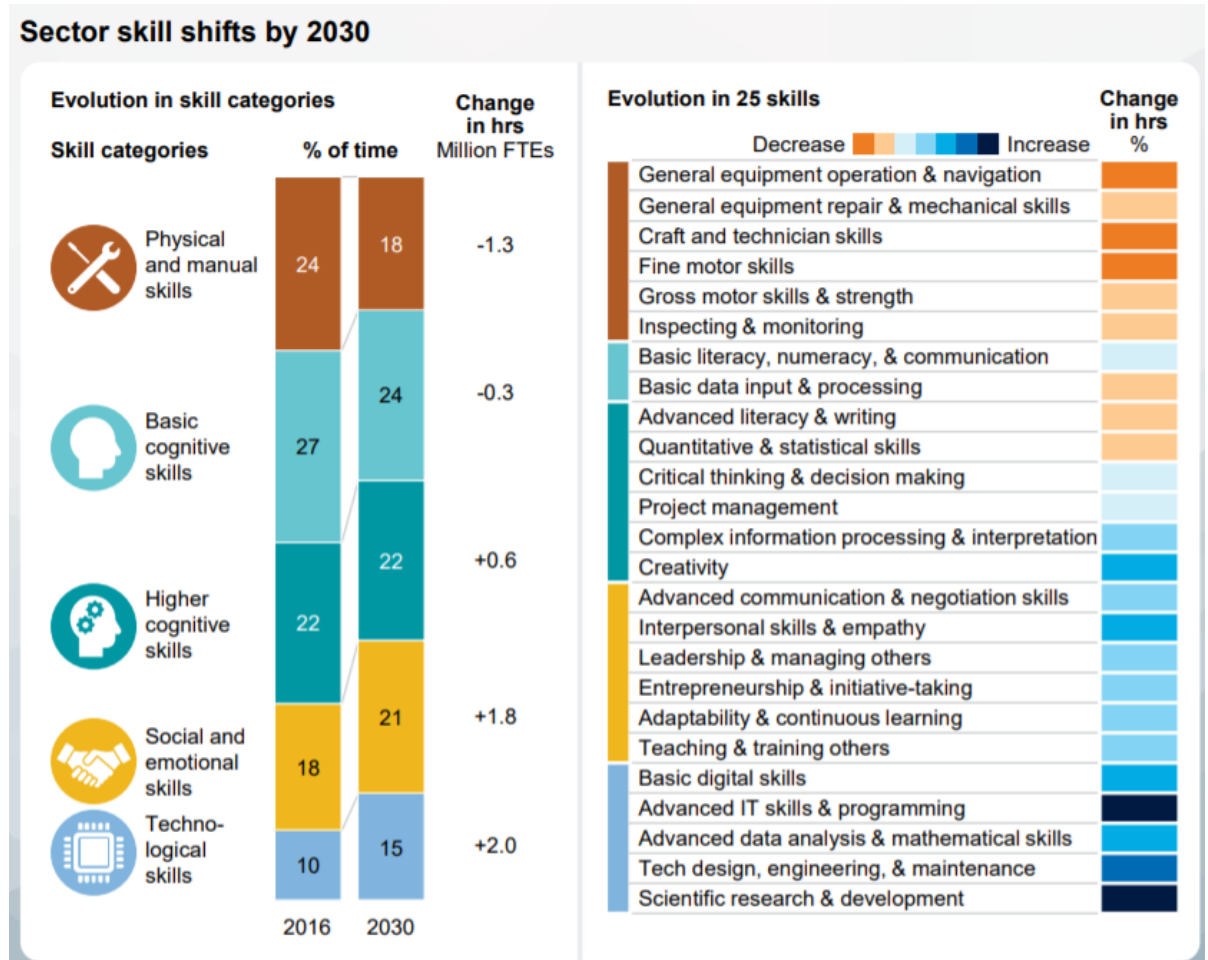
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Interviews

Interview 10.4.2019
Interview 6.5.2019
Interview 5.6.2019
Interview 6.9.2019
Interview 26.9.2019

APPENDICES

Appendix 1. Sector Skill Shifts in 2030 McKinsey Global Institute (2018)



Appendix 2. Hyve Innovation Lab Canvas

Hyve Innovation Lab Canvas

Designed for:

Designed by:

Date:

Version:

The Innovation Lab Canvas

Strategy and Structure	
innovation ambition	core (existing)
innovation topic	adjacent (new to you)
number of innovation topics	to be identified
innovation focus	multiple
strategic innovation trigger	service innovation
	business model innovation
	lean startup thinking
	digital transformation
Process and Execution	
location	Haus der Innovation
lab duration	at company site
continuity	3 months
	repeated
process guidance	fully guided (including innovation services)
branding	semi guided (coaching & sparring)
openness of participation	company branded
	co-branding with HYVE
	new dedicated brand
	lab consulting
	consumer, user & expert integration
	ecosystem-innovation (eg. partners, cross-industry, etc.)
	pop up lab
	ongoing
	virtual
People	
selection process	invitation only
teams	multiple
team competition	non-competitive
education	management level
	company level
Exploitation and Financing	
output implementation	integr. in existing organization and processes
	internal venture
	new startup
	3rd party implementation
payment	project fee based on effect
	membership fee
	license model/share of turnover
	equity model

Version | designed by:
 1.11 | HYVE - the innovation company

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Appendix 3. Interview guide

Interview guide for the research: Digital Innovation Lab: Building up enterprise digital competencies

Research question 1: What digital competencies do companies want to develop with the use of digital innovation labs?

Research question 2: How may digital innovation labs support companies to develop these competencies?

A) Basic information about the organization and the interviewee

- Could you tell me about yourself and your organization?
- What position do you currently have and since when?
- What are your main responsibilities in your current task?
- In what industry your organization works?
- How did you end up in the industry?

B) Questions about digital transformation and innovation laboratories

- What do you think about the digital transformation? How does it affect your organization?
- How would you describe innovation labs?
- What added value do innovation labs bring to the normal product development process?
- What services does your innovation lab offer? (workspaces, interfaces, systems, networking, etc.) Or what is your opinion on what innovation labs should offer?

C) Questions about digital competencies

- In which area of digital competencies do innovation lab users seek normally help? How can an innovation lab help build up these competencies?
- What is your opinion, what are the most important digital competencies that you need in a digital transformation?
- What kind of knowledge is generally required to work innovation lab?
- Do you see any limitations when building up competencies in innovation labs?

D) Questions about the characteristics of innovation laboratories

- What methods and innovative approaches do you currently use? (e.g. Systems Thinking, Design Thinking)
- How innovation labs differ from the R&D departments of big companies?
- How important do you consider the location of innovation lab? How does it affect the efficiency or success of a lab?
- Does the design of lab workspace affect collaboration between teams and individuals?
- What is your opinion the most important feature in innovation labs that promotes creativity?
- Is there anything that you would like to add?