Internet of Things and connected home living

- A case study on how manufacturing firms in the kitchen and furniture industry is implementing and developing IoT products and services

ALEXANDER PERSSON
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Abstract
This thesis provides insight to the dynamics that come with the emergence of IoT in the furniture and kitchen manufacturing industry. The study is empirically grounded in an explorative case study that involves interviews with six manufacturing companies in the different industry sectors. The purpose has been to shed light on how incumbent companies adapt and implement IoT and the study highlight product features, aspects and challenges that companies are investigating and dealing with as they set out to work with IoT and connected products.

The results indicate that companies are viewing IoT as an enabler that better can respond to customer needs and provide users with new experiences. By implementing the concept of IoT companies are currently evaluating how internal knowledge and skillsets correspond to the new technical requirements that the emerging digital setting outlines and by directing internal research they are learning more about IoT and connected products as they proceed. One current major problem is that there are no open protocols that can connect all products regardless of supplier. Nevertheless, implementation of IoT does not solely involve technical aspects and companies are also faced with the dilemma on how to design and develop corresponding commercial processes. To this point early product implementations have arrived on the consumer markets and the future vision is to achieve full integration that imbeds connectivity and interaction among all products in the home.

Key-words: Internet of Things; IoT; blue ocean strategy; dynamic capabilities; changing environments; challenges; business model; kitchen and furniture industry
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Foreword

First, I would like to thank my thesis supervisor Kristina Nyström at the Royal Institute of Technology who has provided me with guidance and valuable feedback during the whole process. I would also like to thank the interviewed companies who have been available and willing to share their knowledge and views with regards to the development of IoT in the kitchen and furniture industry. Finally, my thanks go to my girlfriend, family and friends that supported me during this long process and kept me motivated until the end. Without everyone's input and support I would not have been able to complete my thesis.

Alexander Persson

June, 2017
## Abbreviations

This page shows abbreviations used in the thesis.

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<tr>
<th>Abbreviation</th>
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<td>IoT</td>
<td>Internet of Things</td>
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<tr>
<td>RFID</td>
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<td>IoE</td>
<td>Internet of Everything</td>
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<tr>
<td>P2P</td>
<td>People-to-People</td>
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<td>M2P</td>
<td>Machine-to-People</td>
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<td>M2M</td>
<td>Machine-to-Machine</td>
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<td>RBV</td>
<td>Resource based view of the firm</td>
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<td>R&amp;D</td>
<td>Research and Development</td>
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<td>HQ</td>
<td>Headquarter</td>
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<td>OCF</td>
<td>Open Connectivity Foundation</td>
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1. Introduction

The following chapter serves to introduce the reader to the subject and will include a background, problem formulation as well as purpose and research questions. At the end of the chapter, delimitation and the sustainability aspects of the thesis will be presented.

1.1 Background

Digital transformation is an ongoing development process of digitalization in society that has received a lot of attention in academia as well as in business. The development has gone through many phases and in the last decade Internet was recognized for its empowering role to change economic and social systems (Byung-Keun, 2005). Internet has since then continued to spread and is nowadays considered to be one of the most disruptive technologies in modern history (Ashton 2010; Bajarin 2015). In 2015, 3, 2 billion people worldwide used Internet (ITU, 2015) and in today’s modern society people are constantly surrounded by Internet. Not only does Internet allow people to occasionally surf the web, it has radically transformed the modern world. It has changed the way business is conducted, it has revolutionized educational systems and human learning methods but perhaps more importantly; it has changed the way of human interaction (Tapscott, 2016; Mayer-Schönberger & Cukier, 2013).

By the use of Internet it has become possible to transfer knowledge in ways no one could foresee and society is today full with information and the flows are growing faster and faster. Every day in every waken hour people are surrounded by things that are able to collect, track and store all sort of information on their lives and persons (Mayer-Schönberger & Cukier, 2013). This ultimately raises a lot of unanswered questions and concerns. But if one merely focuses on the positive side, people have recently started to think about and explore how these information flows can become valuable. E.g. how can all this available information be used? What opportunities does it bring? What if things are to connect to one another, what value can be created and extracted from that?

This is where the concept of Internet of Things (IoT) enters the picture. The conceptual idea of IoT is to enable things or objects with connectivity through e.g. RFID tags, sensors, actuators, big data analysis, cloud computing, mobile phones etc. The objects or things can with the above mention features collect information, understand their environment, communicate and report current status. Ultimately, this means that all sorts of things, including goods and appliances can become equipped with small built-in sensors and computers which leave it up to the creative mind to bring new services and applications to the market (Santucci, 2009). In relation to the above mentioned, the definition of IoT is understood as to include all devices and objects whose state can be altered via the Internet, with or without the active involvement of humans.

Different forecasts predict that there will be around 26 billion connected devices in the world by the year 2020 (ABI Research, 2013; Gartner, 2013). The potential economic benefits and the possibilities IoT brings should be clear, not least as processes will become autonomous or
require very little human interaction. Most applications and techniques in IoT will be in the manufacturing and industrial settings and in the consumer-facing subset smartphones will be vital bringing the technology to consumers. Even though IoT still is emerging, the potential of it promises to enable companies to achieve objectives in new and innovative ways (OECD, 2016).

1.2 Problem formulation

When it comes to economic growth and structural transformation in society, technological change is regarded to be the strongest fundamental driver (Dosi, 1984). But even if economic growth is desirable, transformation and adjustment of social and institutional environments in line with technological change can also be painful. Technological and societal changes possess a threat to all companies as it challenges established routines, processes and competences which all are invaluable to current operations. Therefore, in order for companies to successfully respond and adapt to change, they should do so by continuously evaluating their internal capabilities as well as existing business models (Teece, 2007).

The major aspect with regards to IoT is that products in a connected world no longer should be seen as “one-and-done”. Whereas the previous business logic was simple; you make a product, sell it and get the money, final! The business logic of IoT is proposed to be different. In the emerging digital setting, a physical product can be the beginning of a long relationship and a thing may in many cases refer just as much to a service as a physical product. Through software updates and big data analytics it has become possible to reach customers with new features and functionality on a regular basis and with the ability to track objects it becomes possible to respond instantly to customer behavior. Not to mention, as products potentially will become connected with other products this will give rise to services that more efficiently can optimize processes and improve customer experiences. Therefore, in order for companies to successfully enter this new phase, Hui (2014) argues that firms not only must focus their efforts of developing internal core capabilities but also state the importance of growing partnerships. Understanding how others in the business ecosystem make money will be vital for long-term success. (Ibid)

The above stated issues and the proposed challenges that circumstance IoT diffusion becomes more evident looking at the results from an IoT survey that was conducted by Telenor in Sweden in 2014. Around one third out of 100 manufacturing companies responded that transformation of existing business models possess the biggest challenge in implementing IoT as part of their business. At the same time, the vast majority of companies think that IoT will be important and over half of them believe the area to become critical for their organization in five years’ time. And finally as many as six out of ten companies think that IoT will change their whole industry in the same time period. (Telenor, 2014)

Despite the great potential of IoT and the many challenges it possess, the impact it has on incumbent companies has, as far as I am aware, received little attention in the literature. Wurster (2014) point out some barriers that prevent companies from moving ahead with IoT, e.g. the challenge of identifying horizontal needs and opportunities to overcome the market
immaturity problem and problems related to managerial challenges to achieve internal team alignment. In other words how the existing organization can match the new technology with the ongoing objectives of its internal business developers. Westerlund et al. (2014) extended this view by explicitly point out three contemporary challenges; the diversity of objects, the immaturity of the technology and the unstructured ecosystems. The authors further argue that in order to overcome the associated problems, managers must shift their focus from the business model of the firm to ecosystem business models (Ibid).

With this background, it is interesting to investigate how IoT affects incumbent companies in traditional manufacturing industries and in particular focus on companies in the kitchen and furniture industry. The kitchen and furniture industry is interesting because there are plenty of areas in the home where one easily can see how household appliances and furniture together with connectivity and autonomous solutions can help to facilitate everyday life. For instance, just think about an kitchen that autonomously monitor the use of kitchen appliances so that energy consumption levels doesn’t go beyond the threshold or ovens that can turn on Spotify for you when you are about to start cooking. Implementation of IoT products in the household will not only help to spread the technology, the home is potentially one of the places where a large number of end consumers will encounter the technology.

A final factor that makes it even more interesting to focus on firms in the kitchen and furniture industry is that most of the companies have rooted experience and competences in working with non-digital materials such as wood, plastic and textiles etc. This makes it worth investigating how they orientate themselves in a business ecosystem that moves in a direction towards a bigger emphasis on digital and software capabilities. Altogether, this provides the study with a strong argument and a clear goal to investigate the development further.

1.3 Purpose
The purpose of this thesis is to investigate how incumbent companies in the kitchen and furniture manufacturing sector adapt to the emergence of IoT and work to implement the technology in products. The study is explorative and aim to shed light on how implementing IoT in consumer products may transform current practices. The aim is also to map what aspects that are important in order to introduce IoT consumer products on the market and to highlight associated challenges. To be able to fulfill the purpose a theoretical literature review will be presented and semi-structured interviews with representatives for six companies in the kitchen and furniture manufacturing industry will be conducted. The interviews will serve as the foundation for the thesis and the gathered material will be analyzed in order to answer the research questions below.

In order to achieve the purpose the following main question has been formulated:

- How do incumbent companies in the kitchen and furniture manufacturing industry adapt to and implement Internet of Things?

And in order to answer the above a subset of questions will be answered:
• What features are the companies’ currently implementing when developing connected products and solutions?
• What aspects related to IoT do companies in the industry view as important?
• What are the challenges that the companies are facing?

1.4 Delimitation
This thesis is based on and limited to manufacturing companies, explicitly companies in the kitchen and furniture industry. Companies participating in the case study have been selected based on the above mentioned and the additional criterion that they either are in the process of launching IoT products in the consumer market or are planning/interested in doing so in the near future. Moreover, the concept IoT is understood as to include all devices and objects whose state can be altered via the Internet, with or without the active involvement of humans. Finally, with regards to the complex development process and the time, the study should be regarded as a pilot study and analysis and results are to be interpreted as explorative guidelines and recommendations for further research.

1.5 Sustainability aspects
The implications of this thesis is to broaden the understanding of what digital transformation and IoT per se as it evolves may mean and to highlight the effects it might have on current industry settings. The study also contributes with a deeper economic understanding for how the concept of IoT can be utilized within a specific industry and it outlines what companies are considering when implementing and adapting to production of IoT products and services and how the technology can help companies bring new innovations to the market and thereby provide value enhancing solutions in new ways. By identifying features, aspects and challenges that both drive and affect the IoT development on the consumer market, the study will provide the research field with a greater understanding on how the technology influences established settings and what parts that are important to continue monitor in the future.

In relation to the environmental sustainability aspects, the development of IoT is also interesting and important as the spread of the technology, especially at home, can contribute to new innovative solutions that can reduce the energy consumption in the home. By enabling monitoring of the products’ energy use and increasing the transparency of energy consumption to end users, solutions and services can help to contribute to a more environmentally-friendly everyday life at home without the need for consumers to change their habits too much.

1.6 Outline of thesis
The next chapter serves to introduce and provide the reader with an understanding of the concept IoT. In chapter 3 relevant theories and previous research are presented. Chapter 4 outlines the chosen research methodology and discusses its reliability and validity whereas in chapter 5 empirical results are presented. Chapter 6 proceeds to discuss the findings using the theoretical concepts presented in chapter 3. In chapter 7 conclusion and suggestions for future research are presented respectively.
2. Internet of Things

This chapter introduces the concept of Internet of Things. It starts with defining the concept and describing in what ways Internet of Things can become important for businesses. The chapter then proceeds with a theoretical description of the concept and its ecosystem before it ends with a description of applications in the home.

2.1 Internet of Things

“Internet of Things” is a term coined by Kevin Ashton at Procter and Gamble (Ashton, 2010) which refers to the connection of objects and devices to the Internet’s network of networks. In its purest form, IoT is limited to objects and devices that can communicate over the Internet. However, such definition has its drawbacks as it does not account for effects and different properties. “Internet of Everything” (IoE) has therefore been proposed (Cisco, 2013) and opposed to IoT, the term is said to bring together people, process, data and things through network connection of everything. But everything connected to the Internet can be considered a thing, e.g. people cannot communicate via the Internet without the mediation of a thing and as such must all Internet communication occur between things (OECD, 2015).¹

By having at least mentioned the confusion and obstacle upon defining the term, IoT has in recent years become widely spread in society. But visions of smart and communicating objects are not new and already in the beginning of 1990s, Xerox PARC imagined that “specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence” (Weiser, 1991, p.94). Notwithstanding the early anticipated visions and the contemporary attention, many people still today remain uncertain as to what the future will hold; what features will attract most consumers and does demand for full coverage connectivity of products and devices exists at all? (Harwell, 2014).

More optimistic tones can be found in an OECD report on challenges and opportunities that comes with IOT where the authors state that the technology has the potential of facilitating what they refer to as the “Next production revolution”. This evolution is dependent on three key trends; the spread of global value chains, the increasing importance of knowledge-based capital, i.e. software, data, intellectual property and firm-specific skills as well as the continuous development of the digital economy (OECD, 2016). According to the authors, these trends constitute a potential game changer in the way goods and services are produced on a global level. And apart from mere cost savings in production; adoption of the technology is thought to improve firms’ customer relationships, increase speed and agility in decision-making, improve sustainability, increase transparency etc. (Ibid). In this sense, the developments in the IoT domain deliver the promise of not only help individual firms to increase their productivity but also to develop and implement new products and services (Ibid). Following this approach and vision of IoT, the technology can definitely turn out to be a corner stone in tackling the future challenges that society stand in for.

¹The term IoT is interpreted in this thesis to include all devices and objects whose state can be altered via the Internet, with or without the active involvement of humans.
2.1.1 Internet of Things – A brief description

The evolution of IoT is primarily underpinned four main trends in ICT development; big data analysis, the cloud, M2M and the development of sensors (OECD, 2015). Theoretically speaking *things* are to be understood as objects in the physical world while *information* is virtual objects identifiable and integrable into communication networks. While the physical *things* are sensed, actuated and connected is *information* stored, processed and accessed. Bringing *things* and *information* together, devices will be able to communicate with each other (ITU, 2012). Moreover, communication can be facilitated in three ways; through network with a gateway, through network without a gateway or direct communication without a network. The simplified way this works is through connecting machines to one another, letting them exchange information and this is commonly referred to as Machine-to-Machine or M2M (ITU, 2012). See figure 1:

![Figure 1: The technical overview of the Internet of Things (ITU, 2012, p. 3)](image)

2.1.2 Internet of Things – The ecosystem

In order to develop IoT services and build connected products a complex ecosystem consisting of multiple layers, several stakeholders and a collection of components is required (IDC, 2014). The main components include modules and devices, connectivity, platforms and applications and below follows a depiction of each one of them as well as the whole ecosystem.

**Modules and Devices** – IoT is based on devices that essentially uphold the technology’s existence. These devices can e.g. comprise RFID tags and supported with connectivity they work as the linkage between the physical world and the digital counterpart. This part of the ecosystem also verifies that devices have the correct capacity in receiving and sending information (Atzori, et al., 2010).

**Connectivity** – In order for the devices in the ecosystem to create any substantial value, they must be equipped with connectivity. Connectivity can be achieved either through Wi-Fi access or hardwired broadband access, e.g. home networks (Atzori, et al., 2010). The difference between the two types is the type of connectivity. Wi-Fi access offer greater spread whereas hardwire broadband enables higher reliability and lower data traffic and it might be
more suitable in order to build a lot of products, services and applications (Ibid). A central question is therefore what kind of connectivity the ecosystem should rely on.

**Platforms** – In order to read and exchange information, especially in regards to the development of IoT where multiple devices may be installed at different locations, a common platform is needed. For instance, WISPs are powered and read by RFID and has therefore been used to measure and visualize quantities in certain environments like lighting and temperature (Atzori, et al., 2010). Any gathered information is normally located and stored in “the cloud” in order to enable mobile access (IDC, 2014).

**Applications** – Refer to the many services that the technology potentially can create. At this stage it’s very difficult to anticipate how many applications and solutions IoT will comprise. But diffusion of the technology is likely to increase in the near future and so will the spread of applications. It is through the development of the many applications that the full potential IoT eventually will come to life (Atzori, et al., 2010).

Having outlined the four main components forming the ecosystem, tools to access collected data from devices to analyze information should be added in order to know what applications and services to build (Atzori, et al., 2010). And as information is stored a safety element must be imbedded to prevent leakage and infringement (IDC, 2014). Therefore, adding analytics and security to the main components, a simple depiction of what constitute an IoT ecosystem is completed. For illustration, see figure 2:

![IoT Services & Solutions](image)

**Figure 2: A simplified illustration of IoT ecosystem.**

### 2.2 Internet of Things – Applications in the home

The many future applications and services that can be built with IoT technology in the home are understood as endless. However, until this point most home devices and products are built using proprietary platforms which stop them from interconnecting with products and devices on different platforms. Therefore, the current stage in relation to IoT and the connected home is best understood as a home made up of devices that connect products with smart devices such as smartphones or tablets where users can view product status and give certain
commands. But the devices are not smart on their own and they generally exist within a walled-garden created by the supplier which limits the products from communicating with other connected products. In the future, speaking about a smart connected home, it will on the other hand refer to an ecosystem made up of interactions in which information is generated, shared and where actions are taken based on the information. In such an ecosystem all the devices and services will essentially communicate and interact using the same language (OCF, 2017).
3. **Theoretical Framework**

*This chapter outlines and revises previous research and theories that the study uses and it covers the theory of: Blue Ocean Strategy, Core Capabilities & Core Rigidities and Dynamic Capabilities. The combined theories provide a stable base for investigating the impact of IoT in the kitchen and furniture industry.*

3.1 **Blue Ocean Strategy**

Blue Ocean Strategy is a theory outlined by Chan Kim & Mauborgne (2005). The underlying idea behind the theory is that companies can succeed through the creation of blue oceans of undiscovered market space in contrast to what the authors refer to as red oceans in which many competitors fight over dominance. The analogy that the authors are using is that an ocean full of competition ultimately will turn red with blood and the authors assert that by moving towards new and undiscovered market space, companies can create value while also unlock new demand which will turn current market competition irrelevant (Ibid).

By the use of the metaphor of red and blue oceans, the authors refer to the whole market universe where red oceans represent all the existing industries (Chan Kim & Mauborgne, 2005). In red oceans, industry boundaries are established defined and accepted and the competitive rules are set. Companies in such business landscape try to outperform rivals in order to gain a greater share of customer demand but as the market space already is crowded, profits and growth opportunities are diminishing. On the contrary, blue oceans relate to industries/markets that don’t exist today. In blue oceans, demand is to be created instead than fought over. In such a setting there are huge opportunities for rapid and profitable growth and competition is not yet imposing problems since the setting still is to be developed (Ibid).

The cornerstone which the Blue Ocean Strategy is based on is the concept of value innovation, which refers to the simultaneous pursuit of differentiation and low cost and that thereby creates value for the company (Chan Kim & Mauborgne, 2005). The aim of value innovation is not to compete but rather make current competition irrelevant by changing the playground. Any strategic move should raise and create value while also reduce or eliminate features that are less valued on the current market. By assuming that structure and market boundaries only are contemporary the theory states that extra demand not only exists but it is also to a big extent untapped. The problem is merely how to discover and create the demand. And once market structures are changed, so are also the rules of the game and by expanding the demand side of the economy by exploring new opportunities can new wealth be created (Ibid).

3.2 **Core Capabilities & Core Rigidities**

In order for companies to successfully compete in the market they are required to have a combination of capabilities, e.g. multiple resources and competences that distinguishes them from the rest. And since competitive environments not are static, survival and success depends upon how companies can manage the transformation of core capabilities. In line with this view Leonard-Barton (1992, p.111) states that “capabilities are considered core if they differentiate the company strategically”. 

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Leonard-Barton (1992) further describes what constitutes knowledge-based core capabilities. According to the author, core capabilities are understood as a knowledge-set consisting of four interrelated dimensions that provides competitive advantage. The dimensions are *Skills and Knowledge, Technical Systems, Managerial Systems* and *Values and Norms* (Ibid). The first dimension refers to knowledge and skills that people inside the firm have and they encompass both firm-specific techniques and scientific understanding. The second dimension is referred to knowledge embedded in technical systems that results from years of accumulating, codifying and structuring the knowledge that people inside the organization have. The third dimension involves managerial systems and represents formal and informal ways to create and control knowledge. Interconnected through these three dimensions are value and norms which distinguishes the means to collect and ways to control knowledge inside the organization. E.g. this involves how formal degrees are valued in contrast to work experience or whether the organization pursues individual empowerment or relies on strong management hierarchies (Ibid). See figure 3:

![Skills and Knowledge base](image1)

![Technical Systems](image2)

![Managerial Systems](image3)

![Values and Norms](image4)

**Figure 3: The four dimensions of a Core Capability (Leonard-Barton, 1992, p. 114)**

Turning the attention to why and how core capabilities turn into core rigidities, it’s important to underline that developing capabilities involves processes that are long and complex. Accumulation of decisions and events, organizational beliefs and repetition of best practices are all factors that drive success. Internal core capabilities are as a result slowly developed and often tied to the first products or technologies that the organization engaged in. It also means that core capabilities over time can become institutionalized inside the organization and “taken-for-granted” (Leonard-Barton, 1992). The indirect effect of such institutionalization of core capabilities is that the same factors that were vital for early success potentially can have an inhibiting role on the firm further on. To withstand this problem organizational flexibility is needed; otherwise due to the correlation with past performance core capabilities may turn into rigidities and become innovative obstacles (Ibid).

Another author describing the evolution of core capabilities turning into core rigidities is Miller (1992) by referring to the mythological tale of Icarus. The tale depicts the path from
corporate success into decline and highlights the paradox where early strong assets eventually lead to failure. The main reason for this to happen is that early success lead firms to excessive specialization and overconfidence which can create a culture where only the dominant learning style is permitted and valued. In this sense, drivers such as “galvanizing the corporate culture” may on the contrary lead to failure if the organization overemphasize just one core capability and forget other aspects (Ibid).

Miller (1992) particularly point out two interrelated processes that enhance the trajectory of core capabilities turning into core rigidities. These are “configuration” and “momentum” and the former refers to structures, policies and routines on single core themes with specific objectives to reach whereas the latter suppresses all variants of configurations except the ones chosen. Together these processes escalate and the result is that “the powerful get more powerful” (Miller, 1992, p. 27). Moreover, these processes contribute to an intolerant corporate culture that is avoidant to challenges and opportunities derived from outside. By e.g. overemphasizing the importance of a specific department due to past accomplishments, the organization can become less attractive for potential new recruits with different skillsets. The potential outcome of this is an even more prestigious and self-reinforcing department which may hamper the flexibility inside the firm as a whole (Ibid).

### 3.3 Dynamic Capabilities

The term Dynamic Capability has become widely recognized and the framework depicts how firms ideally manage to deal with changes in the external environment. It builds upon RBV but with the difference that dynamic capabilities are viewed as complex combinations of resources that determine what firms can do whereas RBV identifies resources as assets (tangible or intangible) that organizations own or control (Grant, 2010). This implies that while RBV static depicts firms’ competitive environment, dynamic capabilities are incorporating the evolutionary nature of resources and capabilities. Despite the wide recognition in the literature there is still no congruent definition of what dynamic capabilities explicitly are.

In broad terms dynamic capabilities stress how companies by manipulating existing internal and external firm-specific competences can address change. Consequently the term dynamic refers to a firm’s capacity of renewing itself in order to encounter new environments and technology. And in order for a firm to sustain as environment changes it must have the internal ability to respond accordingly. Therefore, the term capability stresses the strategic role of adapting, integrating and reconfiguring organizational skills, resources and competences to confront new environments.

In line with the above stated, Teece who is commonly known as the person coining the term defines dynamic capabilities as a “firm’s ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments” (Teece et al., 1997, p.516). According to the author’s belief, competitive advantage evolves through managerial and organizational processes which are formed by firms’ current asset position and available paths (Ibid). Processes are routines and patterns in current practice and learning while the
asset position refers to the withholding of e.g. technology, intellectual property, external supplier relationships and customer base etc. Available paths on the other hand are the strategic alternatives that the firm can choose from. Together these elements constitute the core of the organization and determine its know-how and capabilities (Ibid). But also culture and experience are firm-specific elements that take time to build and cannot be acquired on the market. This means that dynamic capabilities to a certain degree also depend upon the existing organizational culture. This especially highlights the need for companies to cultivate flexible structures starting from managers down to employees in order to implement fast internal adaptation (Steiber, 2014).

In addition to what Teece (1997) states, Eisenhardt & Martin (2000) argue that dynamic capabilities exhibit different features in two types of markets; moderately dynamic and high velocity markets. They state that in moderate dynamic markets change occur frequently but follows predictable and linear paths. Companies in these kinds of markets therefore rely more on existing knowledge and processes and activities are designed following a problem solving approach. In high velocity markets on the other hand, change is non-linear, far less predictable and industry structures are ambiguous and shifting. As a result the internal focus on developing the right capabilities is to find rapid ways of developing situation specific new knowledge. Further, the authors define dynamic capabilities as “the firms processes to integrate, reconfigure, gain and release resources – to match and even create market change” (Eisenhardt & Martin, 2000, p.1107)

An author who presents a somewhat opposing view on how to view and understand dynamic capabilities is Winter (2003). The author asserts that one should distinguish between short and long term objectives in the capability hierarchy. In doing so, companies can handle change without relying on dynamic capabilities by means the author refers to as “ad-hoc problem solving”. The reason for that is that since dynamic and learning capabilities are in themselves linked together and competence destroying, those companies that invest in routinizing processes and response to it may become disadvantaged to more flexible companies that instead invested in learning capabilities (Ibid).

In an attempt to concretize the different commonalities, minimize the congruence related to the concept and structure a framework, Wang & Ahmed (2007) propose that instead of viewing dynamic capabilities as processes, they should rather be understood as embedded in processes. Building on this view, three main factors to what distinguishes dynamic capabilities are identified; adaptive capability, absorptive capability and innovative capability (Ibid). By adaptive capabilities are understood a company’s ability to identify and exploit emergent opportunities by balancing long- and short term objectives with strategic flexibility. Absorptive capability refers to the skill of using newly acquired knowledge and implementing it with already existing organizational knowledge. The innovative capability determines how well the company can create new products/services and enter new markets with new specific behavior and processes.
Thus far, the above developing concept of dynamic capabilities has presenting organizations capacities of handling rapidly external environments. However, as have been pointed out by Helfat et al. (2011), the line of what distinguishes the previous dynamic capabilities framework as dynamic is still not clear. The authors state that since the world always is changing, it is necessary to assess the extent, nature, and speed of change that a certain capability enables. Therefore, capabilities that promote economically significant change should be considered dynamic even if change appears slow or undramatic at first (Ibid). Further, the authors argue that dynamic capabilities not are restricted to fast-paced environments or what is perceived as radical change and they do so by providing an example looking at Starbucks and Walmart. These two companies proliferation occurred in a gradual fashion in a rather quiet external environment but eventually irrevocably altered the scope of firm resources as well as the ecosystems of whole industries (Ibid). Therefore, when speaking about dynamic capabilities the authors mean that it is essential to be aware of perspectives and biases as these may determine how much change is observed. What appears to be dynamic may change as the observer’s perspective changes (Ibid).

Finally, it’s evident to understand that dynamic capabilities also pose relevance when technological shifts are highly complex (Teece, 2007). This presumes shifts where combinations of multiple inventions are needed to create new products or services. Under these circumstances it is not sufficient for companies to focus on process optimization or economies of scale to be successful but companies are required to continuously discover and realize internal and external opportunities (Ibid).

### 3.3.1 Three dimensions of Dynamic Capabilities

Extending his view on the concept and proposing a structured framework with specific determining features, Teece (2007) suggests three generic types of dynamic capabilities; Sensing and Seizing opportunities and threats in the environment by Reconfiguring and Transforming the existing asset structure. And for each type of capability four micro foundations are identified. These are suggested activities that companies should engage in order to respond to and manage change. Essentially it is enough for companies to develop one micro foundation under each type of activity but companies usually respond better to change the more activities they engage in (Ibid).

By sensing is understood the need for the company to apply its existing knowledge base or develop needed learning processes in order to constantly scan, search and explore changes and opportunities across various markets. The first micro foundations under this activity consist of creating processes to direct internal R&D and select new technologies. The second is to monitor developments in general science and technology that happen outside the company and its specific industry/market in the outside world. The third micro foundation refers to developing processes that are able to tap innovation from suppliers along the value chain. Finally, in terms of sensing, sometimes customers themselves are the ones that bring about change by identifying new needs and opportunities. Therefore, the fourth micro foundation is about developing processes that identifies new market segments, changing customer needs and customer driven innovation (Ibid). See figure 4:
Once firms recognize that change may be underway, it must be addressed and seized through processes, actions and developments. The first micro foundation under this activity therefore involves portraying a corresponding business model that concretizes eventual new emerging properties such as value propositions, products/services or revenue models etc. (Teece, 2007). The second and third micro foundations on the other hand refer to the establishment of vertical and horizontal boundaries for new activities together with interrelated decision making protocols (Ibid). In order to complete and fully seize change; the organization must create loyalty and commitment to any new activities. Important for this to be achieved is to convince managers in all stages about the benefits, so that they can demonstrate leadership and effectively communicate and implement the culture, value and norms throughout all stages of operations (Ibid). See figure 5:

After change has been sensed as well as seized, internal renewal and reconfiguration may be required. E.g. in rapidly changing environments the core value within the company reside in its ability to reconfigure strategy by accomplishing necessary internal and external transformations. The first micro foundation under this activity consists of decentralization and
adoption of loosely coupled structures that embrace open innovation, integration and coordination of skills throughout the whole organization (Teece, 2007). The second micro foundation involves co-specialization, implying developing operations so that asset combinations are value enhancing (ibid). The third micro foundation is about developing internal governance structures in order to achieve organizational alignment (Ibid). Finally, the last micro foundation under this activity refers to knowledge management. This includes processes to enhance new learning and to transfer knowledge along different stages and departments to achieve overall integration of new competence in the organization (Ibid). See figure 6:

Figure 6: Transforming capabilities (Teece, 2007, p. 1340)
4. Methodology

This chapter outlines the research approach together with an explanation on how the case study was conducted and how data was collected. At the end of the chapter the reliability and validity of the research is discussed.

4.1 Research approach

This thesis uses a case study based on an explorative research approach. By explorative research it’s understood to study a phenomenon that previously not has been studied more clearly and it involves gathering data without prior expectations and to analyze the findings thereafter. A case study is an empirical study where a current problem is investigated in its real context. Since the area of investigation modestly been researched before, the case study approach was chosen as it generates detailed empirics and captures complex reality settings as well as it allows for discovery of new dimensions and developments within a specific area. By having designed the study in this way it allows for separation of theoretical explanations from individual observation to proclamations of general patterns (Collis & Hussey, 2014). Furthermore, this study should be regarded an illustrative case study since the aim is to illustrate how the emergence of IoT may impact on dynamics in the kitchen and furniture industry by answering the main research questions starting with how (Ibid).

4.1.1 Data collection and interviews

An important aspect in planning research is to plan collection of data. This means that one must figure out where, when and how to collect it (Collis & Hussey, 2014). As this study is based on qualitative findings it means that primary data has been collected from interviews with well selected respondents whereas other data has been gathered from articles, reports and previous research.

In order to better understand the IoT development in the industry seven companies have been interviewed in the study. The first interview was conducted with the digital technical consulting team at a specialized innovation test center in the Italian furniture industry. The purpose of the first interview and study visit was twofold; first it served to broaden the researchers understanding of product development processes in the furniture industry. Secondly it served to get some general inputs on challenges that the emergence of IoT possess. The other interviews have been conducted with managers and employees working directly in connection to IoT and/or connected product development at manufacturing companies in the industry.

The aim in selecting participating companies has been trying to get as much inputs and information as possible since the phenomenon still is emerging and not yet well spread. This means that companies have been selected based on two criterions; the selected companies must be manufacturers of consumer products in the kitchen and furniture industry and they should either be in the process of launching IoT products on the consumer market or at least be planning to do so in the near future. This implies that companies of different size, geographical locations, with different market positions that are in different phases of working with IoT have been approached. At the same time, it is important to note that in the process of
sampling participating companies many approached actors have declined to participate in the research. Some of the companies have specified that they do not yet work with IoT products while others didn’t state a reason to why they declined to participate. The fact that many companies declined to participate has obviously influenced the interview sample and it may also have implications on the results. Moreover, during all the interviews with the companies that did participate features that firms in the sector currently are implementing as well as important aspects and challenges related to the technology has been identified. These will in the following chapter be outlined explicitly. See table 1 on page 18 for full list of interviewed companies.

Moreover, in common for all the interviews are that they were designed as semi-structured interviews with open questions and they were recorded with the approval of the interviewee. In a semi-structured interview a guide of questions that should be covered is used but the interviewer can also ask complementary questions in order to receive adequate answers. The benefit from using this technique resides in the fact that the interviewer can ask for more detailed information when it’s desirable (Collis & Hussey, 2014). In this research, the semi-structured open questions have at the end of the interviews been supplemented with a number of structured questions in order to receive measurable information as well.

Finally, by using interviews as the sole source of evidence it’s important to be aware that they both have positive and negative attributes. On the up side, interviews are targeted and thereby help to focus directly on the topic and they are also insightful as they provide perceived causal inferences. On the down side, the weaknesses come from the fact that the research fully relies on other people’s words. This implies that situations where the respondent tells the interviewer what is believed to be appropriate or wanted can occur (Yin, 2003).
<table>
<thead>
<tr>
<th>Company name</th>
<th>Company description</th>
<th>The interview</th>
<th>Connection to IoT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bosch Home Appliances (BSH)</td>
<td>The company is one of the world’s leading producers of domestic appliances including products such as refrigerators, dishwashers, laundry and cooking machines as well as smaller appliances like food mixers and coffee machines.</td>
<td>Telephone interview with the Sr. product manager for Home Connect. The interview lasted approximately 30 minutes.</td>
<td>BSH is involved in the development of “Home Connect” that is a product which enables communication and control among various household appliances.</td>
</tr>
<tr>
<td>Cosmob S.p.A</td>
<td>Cosmob S.p.A is a specialized furniture test center located in the furniture district in Pesaro, Italy. The company supports other companies in developing competitiveness by providing digital solutions and technology services in terms of quality, R&amp;D and design.</td>
<td>Face-to-face interview with a technical consultant at the Digital Fablab department. The Interview lasted approximately 45 minutes.</td>
<td>The company is involved in a project with Morfeus S.p.A and the University of Ancona investigating how to embed sensors into mattresses.</td>
</tr>
<tr>
<td>Company X</td>
<td>The company is a leading manufacturer of household appliances and is operating worldwide. The company portfolio consists of multiple brands.</td>
<td>Telephone interview with the manager for connectivity &amp; strategy. The interview lasted approximately 45 minutes.</td>
<td>The company is about to launch connected products on the consumer market.</td>
</tr>
<tr>
<td>Gaggenau</td>
<td>The company is a global manufacturer and distributor of embedded kitchen appliances such as ovens, coffee machines, hoods, refrigerators, and dishwashers.</td>
<td>Telephone interview with the brand manager for Scandinavia. The interview lasted approximately 30 minutes.</td>
<td>Since 2017 the company is step by step integrating “Home Connect” in their products.</td>
</tr>
<tr>
<td>IKEA</td>
<td>IKEA is a multinational furniture company founded in Sweden. The company offers a wide range of design and functional home furnishing products. The ambition is to offer low prices so that many people can afford buying functional design.</td>
<td>Telephone interview with employee involved in product development at IKEA Home Smart Lighting. The interview lasted approximately 30 minutes.</td>
<td>Since 2014 IKEA has been working with connectivity under “IKEA Home Smart”. The company is currently designing smart lighting and the first products have just been launched on the consumer market.</td>
</tr>
<tr>
<td>Morfeus S.p.A</td>
<td>Morfeus S.p.A is a mattress manufacturer with HQ in Pesaro, Italy. The company is also manufacturing topper, quilts, pillows, bed frames and other products for a good sleep.</td>
<td>Face-to-face interview with project manager. The interview lasted approximately 45 minutes.</td>
<td>The company is together with Cosmob S.p.A and the University of Ancona investigating how to imbed sensors in mattresses.</td>
</tr>
<tr>
<td>Nobia</td>
<td>Nobia is one of Europe’s leading kitchen specialists and the company brand portfolio comprises approximately 20 brands, both national and regional ones.</td>
<td>Telephone interview with the manager for Innovation &amp; product development. The interview lasted approximately 30 minutes.</td>
<td>Nobia is investigating how to use connectivity to develop smart kitchen solutions.</td>
</tr>
</tbody>
</table>

**Table 1: Interviews conducted organized by company.**
4.2 Reliability and Validity

In research reliability is measured by its repeatability (Collis & Hussey, 2014). In this study, the research has been dependent on specific settings provided such as interview respondents but foremost by developments in the area of investigation and therefore would it be difficult to repeat it. At the same time, this should not be a huge problem as reliability in qualitative research is measured by the repeatability of the analysis which implies that certain rules of classification and interpretation must be followed (Uusitalo, 1999 in Mertanen, 2015).

Validity of research on the other hand refers to the extent indicators correctly measures the target (Collis & Hussey, 2014). In qualitative research this can be considered easier to achieve than reliability, e.g. due to the flexibility in the interview situation and by the use of semi-structured interview methods. In this study one of the respondents requested to participate anonymously but it shouldn’t possess any problems related to the validity of the results. Rather anonymous respondents may increase the validity as they may have feel more open and willing to provide complete and honest answers (Yin, 2003). Moreover, as this thesis is conducted with companies in a new and developing industry setting, the strategic decisions that the companies make in relation to any IoT initiatives may have impact on their competitiveness in the proceeding development. Thereby there is a possibility that the interviewees withhold critical information and this could influence on the results and potentially decrease the validity of the research.

In relation to the sample of interviewed companies and due to the fact that approached interviewees are representatives of companies that currently operate in the area of investigation, bias may occur when interviewing them on how they perceive the development of IoT in the industry. As the selected companies in this research does not fully reflect the whole industry this could impact on the validity of the results. As the interviewees represent a part of the industry that work with connected product development they might have subjective perspectives of the future developments different from parties that are not currently working with IoT. This could imply that interviewees give more positive answers about the future of IoT in the industry. Being aware of such bias when analyzing the results from the interviews is important as answers can tend to be over optimistic. Moreover, there is also the possibility of the occurrence of research bias which occurs when the researches is looking for evidence that confirm and interpret results that are in line with prior expectations (Grüne-Yanoff, 2016). This means that while approaching and interviewing the companies, the researcher can tend to look for answers that confirm certain ideas.

Finally, this study investigates how firms in the kitchen and furniture manufacturing industry adapt to and implement IoT. Even if results from qualitative research can be extended to other situations, the focus of this study is to understand the impact in this specific industry and results should therefore at most be understood as directives in other settings. If someone would replicate this research in a new but similar situation using the same method, then the findings in this study should reflect those findings and this would establish validity and reliability in this research.
5. Empirical Evidence

In this chapter results from the conducted semi-structured interviews are presented. The chapter begins with a brief introduction to the empirical results and then follows by a presentation of how each of the manufacturing companies view and work with IoT products. The chapter finishes with an overall depiction of aspects and challenges related to IoT.

5.1 Introduction to empirical evidence

In order to get a better understanding of the current IoT developments in terms of connected home products and solutions interviews have been conducted with six manufacturing companies. Three of the companies are manufacturers of household appliances whereas the other three companies are involved in production of kitchen solutions and design, home lighting and sleeping solutions. Throughout the interviews the companies’ have pointed out how they work to implement IoT as well as aspects and challenges related to IoT. Some of these are similar for all companies whereas others are company specific. In the following subsections these will be outlined for each company.

5.2 Bosch Home Appliances (BSH)

5.2.1 Implementing IoT

According to the interviewee the market for connected household appliances and solutions is maturing and several companies have started to present connected products and solutions. The company itself has recently started to implement a product called Home Connect that provides appliances such as ovens, dishwashers and coffee machines with connectivity over Wi-Fi access points. The connected features besides new displays and experiences that the company is offering their customers are remote monitoring & control, contacts to customer service, online purchases of accessories, culinary advices and digital instruction manuals. By having introduced Home Connect the company wishes to achieve full home integration including products and appliances from all brands in the future.

5.2.2 Important aspects implementing IoT

The most important aspect of IoT is to achieve full integration and thereby provide customers with solutions that respond to their true needs. As was highlighted by the interviewee; people don’t really ask for solutions to start the oven with a remote control but the true benefits from connectivity rather reside in having all products in the home interacting and working together. User-experience is in this sense understood as having seamless connectivity among appliances that can help to solve daily routines. As a mean to achieve full integration growing partnerships are considered to be an important aspect. As the company has implemented Home Connect it has also partnered with and become part of a network consisting of many companies including: Amazon Alexa, Amazon DRS, Busch-Jaeger, Diehl, IFTTT, Kochhaus and Tielsa etc. whom all have implemented Home Connect in their products.

Besides growing partnerships the price is also outlined as an important aspect in order to drive IoT initiatives further. According to the interviewee there is still an existing discrepancy between the kind of solutions customers think of and the ones that the company is working on
and the high prices stop customers from understanding the development. One ongoing objective that the company is working on is therefore trying to convey customers about connected products and spread the understanding and interest for connected home solutions.

5.2.3 Main challenges implementing IoT
As the company has implemented Home Connect and started to work with connected products it has entered a new experimental phase where the interviewee stated that commercial developments possess bigger challenges than the technical ones. According to the interviewee the company has the necessary competences to build connected products and develop connected solutions. In starting to work with IoT all internal departments have to learn about the field at first, including the technical divisions, but it isn’t too difficult to develop new technical competences and acquire software developers to do R&D where it’s needed.

A bigger challenge is related to the commercial and organizational developments that the new environment sets out. For instance, working with software and connectivity will incur faster changes and more frequent launches as products continuously can be updated. In relation to that customer relationships will also change and existing sales processes will have to transform. E.g. the company has before been used to produce marketing materials once or twice a year but with connected appliances the company stands in front of more frequent updates. Therefore, processes and practices must be developed to assure that e.g. marketing divisions are able to catch up with the speed of product developments. Altogether the interviewee stated that the synergies from developing connected products are expanding and breaking traditional organizational borders and the company needs to deal with it. As a response, the company has set up a completely new division working solely with connectivity. The division’s main objective is to push for business development and pass through new logic in various operational stages that better correspond to the new setting.

Finally, a major stated challenge for the overall further development in the industry is the issue related to open protocols in order to achieve full home integration.

5.3 Company X

5.3.1 Implementing IoT
Similarly to the interviewee at BSH also the interviewee at Company X view a market for connected household appliances that slowly is maturing. The component on the market that still is lacking though is a common focus among actors to develop connected products around customers that enhance overall user-experience. The company itself has yet not launched any connected products on the market but in implementing IoT the company’s approach is to deliver products, services and accessories that will enhance user-experience. Although the company still is waiting for its first product launch it has built connected products for a while and according to the interviewee it has the necessary competences to develop connected appliances. The factor that currently stops the company from launching products on the consumer market is the lack of standardized protocols that connect all things. Creating a product that can be controlled via an external remote control that only communicates one-to-one and to build 100 single handled connected gadgets is not interesting for the company.
5.3.2 Important aspects implementing IoT

According to the interviewee, IoT should primarily be understood from its ability to connect things in everyday that solve daily problems and provide users with convenience and new experiences. The company’s customers don’t care about the technology per se but what they want are help to solve their daily routines. Therefore, developing connected products is more than anything about creating a home where users are served according to their needs.

In order to develop services and solutions that truly enhance user-experience and solve customer needs, the company view growing partnerships to be a key aspect to drive IoT initiatives further. As the company is entering a new digital sphere where it works with connected products partnerships is also beneficial in the sense that collaboration with e.g. software companies imply that not necessary all skills must reside inside the company. Therefore, the company has initiated collaboration with various stakeholders including digital tech. companies. To push the developments of IoT further another collaborative initiative that is taken by the company is to actively participate in the OCF framework together with many other technology partners with the aim to enhance the development of open protocols so that devices can communicate and interact regardless of manufacturer, operating system or chip.

Another important aspect related to the developments of IoT is that customer relationships will evolve in significantly different ways. With connected products, the company will be able to build flexible, intimate and long-term customer relations and not only handle customer service issues. Traditionally most household appliances such as refrigerators are sold when customers either move into or renovate their homes and unless there are complaints concerning product functionality, the products generally last 5-10 years and the relationship ends at the initial purchase. With connected products the company will be able to provide continuous services such as online diagnosis and also create completely new services with other parties that are interested in collaboration. Finally, the price of the technology and product security is also aspects that will be important in order to spread the technology and make it commonly accepted among customers.

5.3.3 Main challenges implementing IoT

As mentioned earlier, the factor that currently stops the company from launching products on the market is the lack of open protocols and this is also considered to be the main challenge. Another challenge is related to the company’s existing business model which will need to go through big changes if the company is to introduce IoT products on the market. Household appliances have certain life expectancies and this must be taken into account when looking at the revenue model and in understanding how and which features to develop over time and how to collect money from designing after sales services. Moreover, to face the organizational challenges that come with IoT, the company has as a part of its digitization strategy set up a global division that focuses solely on connectivity and user-experience. The main objective of this division is to expand the focus on connectivity throughout the organization so that all markets and regions implement the general idea of connectivity in a similar way. I.e. the division works to make sure that there are focus groups apparent in all markets and regions.
5.4 Gaggenau

5.4.1 Implementing IoT
In line with the two above manufacturing companies of household appliances also Gaggenau views an awakening interest from consumers in connectivity and in larger projects the technology is becoming a “must-have” for the suppliers. The company has similar to BSH started to integrate Home Connect in appliances launched this year and the product range is progressively becoming equipped with connectivity. The connected features that the company is implementing and offering their customers are remote monitoring & control, contact to customer service, online purchases of accessories, culinary advices and digital instruction manuals.

5.4.2 Important aspects implementing IoT
According to the interview the key aspect in driving IoT initiatives further should be understood from the possibility it set out to create convenience at home and deliver user-experience. Therefore it is also important that products are easy to set up, install and get started with. A second aspect that is important in order to drive IoT developments further is the price. Until this point the trajectory of IoT products and solutions has rather been a “push” from the industry instead of a “pull” from consumers and according to the interviewee a higher willingness from customers to pay for connected solutions would drive the developments much faster. A third aspect is that products and solutions must be safe and not open for hackers. Convincing customers that products and services do not override personal integrity will be vital to make them more interested in connected home solutions.

5.4.3 Main challenges implementing IoT
The challenge in implementing IoT according to the interviewee is to find the consumer needs and true benefits in each appliance. Another challenge is that there are no standard protocols that combine products from all brands.

5.5 IKEA

5.5.1 Implementing IoT
The company started to investigate in connectivity in recent years and the product segment that the company has started to elaborate on is smart lighting. According to the interviewee smart lightings have existed on the consumer market for a while and IKEA is not the first company to implement the technology. Before the company started to investigate in smart lighting, it could see that smart lighting products were not adopted by many people. One reason to that was that it for customers has been difficult to understand the benefits of smart lighting products. Therefore, the gap that IKEA wishes to fill is to make smart lighting easier to understand, easier to use and at prices that allow customers to invest in the technology.

The company launched its first products on specific markets earlier this year and the features that the company has introduced are remote controlled lighting and solutions that involve the possibility to adapt the light strength and color to different activities. The products are so far built on existing protocols and works as one-to-one communication with user interface on
smartphones or tablets. The company aim is to expand and launch products on all global markets and parallel to this the company is developing new features and expanding the connected product range.

5.5.2 Important aspects implementing IoT
As the company has started to work with connected products the focus has from the beginning been to build upon company values, strengths and existing practices rather than to think of the technology as something radically new. Therefore, the most important aspect in working with IoT implies pursuing IKEAs general principles which are; home decoration and home furnishing solutions incorporating simple products that are affordable and easy to buy, assemble and use. Besides this the interviewee stated that in order to drive IoT initiatives further, a lower price of the technology will help to facilitate the understanding and make connected solutions adopted and accepted among customers. Another important aspect is product security. Making sure that connected products are secure will be evident in maintaining confidence in existing customer relationships but also in conveying customer to invest time and money in connected home solutions.

5.5.3 Main challenges implementing IoT
As it comes to the requirements that working with connectivity sets out, the interviewee stated that the company together with its partners has the necessary competences, skills and resources to develop connected smart lighting. But the IoT developments have imposed organizational challenges and forced the company to transform some parts of operations. A big challenge has been related to going from previously developed "dead" products that look the same today as after 10 years to products that can be constantly updated. The company nowadays also works with software and that has been challenging in developing the right skills. The introduction of IoT has also led to expanded internal teams and new partnerships which have imposed challenges to get new processes aligned. But in general whereas other companies who launched smart lighting before have focused on developing radically new functions has IKEA rather made efforts to maintain established focus areas and production and commercial processes, like e.g. work with current suppliers and not direct work to develop after sales services.

A big future challenge although it doesn’t possess any problems to the current phase is how to overcome the difficulties of standardizing the technology. This will be crucial in order to achieve full integration and to develop fully smart home solutions.

5.6 Morfeus S.p.A

5.6.1 Implementing IoT
As far as the interviewee is aware, the company is the only mattress manufacturer in Europe that investigates on how to imbed connected accelerometer sensors in mattresses but similar features can be seen in other industries. So far the company has not launched any products and the research project is divided into two development stages. The initial stage focuses on implementing accelerometer sensors that e.g. can monitor the movement of the body when being asleep, the different phases and the deepness of the sleep as well as other factor such as
allergens, humidity and lighting and to correlate these with the overall sleeping quality. The first features will involve one-to-one communication between the mattress and the smartphone or tablet so that users can be provided with tips on how to improve the sleep. The second stage of the project is to develop the sensor system so that mattresses autonomously can interact with other connected objects in the home such as air condition, thermostat heaters, the TV and lamps and thereby the company wishes to turn mattresses into future remote controls in “the smart connected home”.

5.6.2 Important aspects implementing IoT
According to the interviewee the most interesting aspect for the development in the furniture sector is home integration and to develop connected homes that answer to peoples lifestyles. Therefore, the purpose in working with connectivity is to build features and create functionality that provide users with flexible response to their needs and increased user-experience. Another important aspect related to connected mattresses and full home integration is changing customer relationships and the company will become able to provide customers with updated product features years after the first sale. For the further development of IoT in the industry the interviewee also stated that a lower price for the technology will be important to get customers onboard.

5.6.3 Main challenges implementing IoT
The major challenge that the company faces is the requirement of skills and knowledge to work with digital products. The company has currently no division working with digital product development and is therefore seeking ways to gain such knowledge. The company is currently collaborating with the digital Fablab team at Cosmob S.p.A to develop and acquire knowledge in application development, sensor programing and data analytics. A second challenge with the project is related to the commercial aspects of it. According to the interviewee, the company is still in the very early phase investigating any commercial aspects and at this point there is no clear depiction on how to develop commercial processes. But as the company with the introduction of sensors will start to provide customers with products that can be continuously updated and improved they will need to think of how re-design revenue streams and how to price the initial sale. In the future a big challenge is how to overcome the problem of open protocols so that all products from all brands can interact and homes can become fully integrated.

5.7 Nobia

5.7.1 Implementing IoT
The company has recently started to investigate in IoT and is still in a very early development phase where it not yet is clear what a future introduction of IoT will mean. Most of the related work so far is related to formulate an appropriate IoT strategy and define future steps. The features of connectivity that the company is thinking of are related to the design of future after sales services and delivery. For instance, one outlined path could be to work closer with restaurants, food companies and/or food packaging companies to deliver customer solutions.
5.7.2 **Important aspects implementing IoT**

According to the interviewee, the most important aspect of the IoT is how to use connectivity to develop and design solutions that truly correspond to customer needs. And in order to achieve this, the interviewee emphasized the importance of growing partnerships and especially growing the right kind of partnerships. As an introduction of IoT will offer endless of possible solutions it will be essential to find the right path among the many opportunities so that connected solutions add significant value, otherwise is the technology just going to be expensive. Another important aspect in the direction towards connected kitchens is that existing customer relationships will change and the company will be able to build more intimate and long lasting relations with its customers which can help the company to facilitate services that truly reflect what customer need.

5.7.3 **Main challenges implementing IoT**

As the company has started to explore connected solutions it has transformed its vision emphasizing bigger focus on user-experience and services. But so far the business model has not been adapted and it will be a challenge to get commercial processes right. A more contemporary challenge that the company is facing is the technical requirements that the emerging environment sets out. The company has historically been working with wood materials and the inherited skills and know-how are to a large extent interrelated to that. The company therefore currently lacks the necessary competences in working with software solutions.

5.8 **Concluding remarks**

From the interviews it’s clear that the market slowly is changing and the industry is still in an early and somewhat unstructured phase. The majority of the companies state that working with connected solutions and IoT is complex and most of them would like to gain more information in order to proceed. It can also be seen that the companies are in very different stages working with IoT and connected products and this is manifested by the fact that IKEA, Gaggenau and BSH have launched initial connected products whereas Nobia and Morfeus S.p.A on the contrary still are in the research stage. Even though the companies are in different stages working with IoT, the findings point to similar aspects of IoT that the companies think are important. Figure 7 summarize the main aspects related to implementation of IoT and the development of connected products.

![Diagram](image)

*Figure 7: Important aspects for the development of connected products in the home living sector.*
It is also shown that entering a phase working with IoT product development sets out new requirements and involves challenges, both external and internal. Figure 8 summarize the main challenges related to implementation of IoT and the development of connected products.

![Figure 8: Main Challenges that the companies are facing.](image)

- Standardization of technology
- Commercial developments
- Organizational challenges
6. Discussion

This chapter discusses the relevance of the results that were obtained during the research. This includes findings from interviews and their interrelation with outlined theories.

6.1 Blue Ocean Strategy

The emergence of IoT into the kitchen and furniture industry is an exciting phenomenon that contributes with new industry dynamics. From the empirical evidence it can be seen that the work with IoT and the development of connected products and solutions represents an experimental phase that is new and the companies are still learning about it. What they initially have become aware of is a complex new environment which requires small steps to be taken and the companies are gradually exploring new territories and discovering new opportunities. In line with Chan Kim & Mauborgne (2005) it can be understood that the companies with the development of connected products are trying to change the current rules of the game in the industry by creating new demand and market space by redefining the value offering of furniture and kitchen products and provide customers with completely new experiences. This is e.g. manifested by Morfeus S.p.A and their future idea of transforming the mattress into an autonomous remote control in the home. By changing the value proposition and the idea of what traditionally constitute a mattress the company will not solely compete with other mattress manufacturers by following already established rules of competition but they are rather striving to leap ahead and compete in a market space that not yet is defined. In terms of connected household appliances and smart lightning the features that the companies are working on can be interpreted in a similar manner. However, as the companies are in different and still early phases working with IoT the general understanding of what such future market space and competition will look like is as a whole still not clear.

Overlooking the current market stage it can be seen that most customers still are unaware of the value that IoT has to offer in terms of connected home products and solutions. Traditional products and home solutions are still dominant and the initial connected products and features that have been launched have not yet fully succeeded to awaken new demand and a new playground has until this point not yet been fully established. At the same time, the distinctive potential of IoT and the value innovation stemming out of having connected products that are differentiated from traditional ones which potentially could come to create a new market space and change the existing rules of competition should primarily be understood from achieving full home integration. This implies that all sorts of home products should be able to interact and communicate with each other but the big obstacle to this is that there currently are no open protocols that connect all things.

Interestingly, in contrast to what the theory states it is found that most connected home products so far mainly have entered the markets as high priced innovations and doesn’t explicitly involve a strategy involving lower costs. The technology is still expensive and the prices of connected products are high so the initial product implementations and features that
are entering the markets are aimed at the upper end market segments with customers that have a higher willingness to pay.

6.2 Dynamic capabilities
From the empirical evidence it is clear that the companies are sensing the threat as well as the opportunities with IoT. All of the companies have identified IoT as an enabler that will facilitate response to customer needs and provide users with enhanced experiences. In order to consolidate current positions the companies have started to direct internal R&D and to look around inside and outside their own sectors to form an idea of the changing environment. From the empirical evidence it is also found that the companies are adapting to the new landscape by balancing long and short term strategical objectives. Early product implementations and features are arriving on the consumer markets and in the meanwhile the different companies are thinking about a future stage where full home integration will be possible.

It is also clear from the empirical evidence that the distinct companies are bounded by their current asset positions and available paths. This means that they are constrained by the resources and strategical choices they have available and this has been manifested by the different initiatives that the companies have taken. In terms of IKEA for which a part of the company’s competitive advantage can be understood to reside in established company core values, principles and the business model which emphasizes simple furniture solutions and low prices, the company agenda in relation to IoT has rather been to tweak and add small features instead of completely transform commercial side aspects and provide customers with e.g. connected after sales services.

The current resources and the available paths the companies have are also manifested with regards to Nobia and Morfeus S.p.A but in a slightly different manner. What these two companies primarily have identified is that they don’t yet have necessary digital competences to meet the requirements that the emerging setting sets out. Therefore their initial focus in adapting to IoT is primarily related to supplementing current skillsets and competences with digital capabilities. For Morfeus S.p.A this has meant seeking collaboration with already established partners in the Pesaro furniture cluster where they themselves are active in order to develop necessary software, sensor programming and data analysis capabilities. The choice to work with already known companies in Pesaro's furniture cluster can be seen as a natural and obvious one but it involves a potential risk as well. The outcome will depend on how well the actors within the cluster can take advantage of established synergies related to furniture production while acquiring external and digital knowledge and competences at the same rate as the outside world. On the contrary to Morfeus S.p.A, Nobia is still evaluating its current position and thinking of what available options it has to acquire the necessary skillsets and knowledge.

In order to seize the changing environment ahead of them, both Morfeus S.p.A and Nobia have initially started to think about what IoT can mean and particularly in relation to what future business prospects are. Thereby they have also started to think of how to portray
corresponding business models and what changes this can incur. But for the most part the two companies have just begun to think of IoT related changes and as they will acquire the necessary digital knowledge that correspond to the new outset it will be essential for them in order to fully seize and transform to the changing environment to address active practical work changes by implement new and reconfigure established processes, practices and actions as well.

On the contrary, for the companies whom state to have the necessary competences to work with digital components and connected products it is shown that they also have reached further in order to seize and transform to the changing environment. Both Company X and BSH have e.g. put together new divisions that exclusively focus on connectivity. Thereby, the companies have initiated active work to enhance learning and spread internal knowledge about what eventual IoT related changes will mean to the organization as a whole. With these new divisions they have also started to actively investigate and reconfigure changing commercial side aspects as well as building loyalty related to those. Also IKEA has begun to seize changes in order to adjust for the new setting and the company has re-defined its enterprise boundaries. The company has e.g. started to work with software and has thereby both expanded internal teams as well as grown new partners. As the above companies also have begun to build and launch early connected products they have started to transform and adapt production processes and thus begun co-specializing.

In addition to the above and in line with Helfat et al. (2011) capabilities that promote economically significant change should be considered dynamic even if initiatives first appear undramatic. In my opinion, this is how one should understand and interpret the work and the common initiatives that mainly the household appliances companies have taken together with e.g. digital tech. companies to push IoT developments forward. Although these initiatives and their benefits not are fully visible today, the initiatives should be understood as capability building and dynamic as the companies are constructing new structures and strategically positioning themselves in a new ecosystem that is beginning to take form.

6.3 Core capabilities & Core rigidities
As all the companies have inherited competences and capabilities working with non-digital materials have they as they have started to work with IoT expanded their knowledge base by starting to work with e.g. sensor programing and software solutions. Although it not is possible to distinguish such patterns based on the findings in this thesis and it should be verified with further studies, one should be aware that there is an inherent risk that new divisions utilizing knowledge in working with IoT can start to compete for resources with established entities working with traditional product development. If it happens this may have undesired effects. To withstand the danger and not end up in a situation where different departments become competitive and self-reinforcing; emphasis on organizational culture that enhances openness and flexibility will be important in the ongoing development. How well the companies will succeed will depend on how well top management can anchor the vision and idea of working with IoT to all involved parties and division managers.
6.4 Final reflection

Finally, a personal reflection related to the companies’ ambitions and visions of future delivery of user-experience is that it in my opinion has become possible to view an initial contour of a logic which emphasizes common efforts, co-creation and collaboration. Not only visible from the joint efforts taken to push IoT developments ahead but it can also be understood from how the companies have started to look at partnerships as a way to co-create and co-design services to consumers. However, it should also be clear that as one starts to speak in terms of “the smart connected home” where objects seamlessly can interact with each other; this will imply and require a higher level of collaboration, cooperation and co-creation than what can be seen now. For the time being, it will be interesting to see if and how the companies will proceed in this matter.
7. Conclusion & Future research

This chapter presents conclusion as well as recommendations for future research.

7.1 Conclusion

The purpose of this thesis was to investigate how manufacturing companies producing household appliances, kitchen design and furniture’s are working to implement IoT technology and develop connected products. To fulfill the purpose a main question “How do incumbent companies in the kitchen and furniture manufacturing industry adapt to and implement Internet of Things?” was formulated together with a subset of research questions. These have been operationalized in the context of an explorative case study and in the following will they be answered.

- What features are the companies’ currently implementing when developing connected products and solutions?

The product features that the companies currently are implementing involve imbedded sensor networks, monitoring and remote controlling. At the same time, the one feature that all companies ultimately strive to achieve is full home integration that involves connectivity and interaction including all products regardless of brand.

- What aspects related to IoT do companies in the industry view as important?

The research has identified five aspects that the companies view as important in relation to IoT and each aspect will below briefly be described.

User-experience – The companies are solely investigating in IoT and connected products from its ability to solve daily routines and respond to customer needs at home with the ultimate goal of providing users with enhanced experiences. The solutions and products that the companies are investigating in are therefore related to already existing focus areas and home trends whereas the technology per se merely is understood as an enabler.

Partnerships – The significance of partnerships has been identified as a way for companies in the future to co-develop solutions and services and partnerships will be essential in order to achieve full integration and to develop the user-experience that the companies ultimately wish to achieve. Growing partnerships have also been regarded as important in order to drive the development in standardizing the technology further and as a way to acquire necessary digital competences.

Customer relationships – With the introduction of IoT and the development of connected products the companies will be able through software and feature updates to stay in continuous contact with end users even years after the first sale. This adds a new dynamic in the existing customer relationship in which the companies see a potential but not yet are sure how to fully cooperate with.
**Price** – The price will be vital to drive up the speed of the developments of connected home products and solutions as well as make the technology more broadly accepted and understood by customers.

**Product security** – One major factor in order to diffuse the acceptance for connected home products and solutions is to assure customers that they are safe and secure. Therefore, efforts convincing but foremost proving to customers that products do not override personal integrity and are secure will be important in order to get them interested in connected solutions.

- **What are the challenges that the companies are facing?**

As the companies have started to investigate in IoT and connectivity different challenges have become apparent to them. Not only external factors that are holding the market development back but the companies are also facing internal impediments to overcome. The research has identified three main challenges and each area will briefly be described below.

**Standardization of technology** - The factor that currently prevents connected products entering the consumer market on a full scale is the problem related to standardization of the technology. Currently there are no open protocols that connect all products regardless of brands and supplier and the proprietary means that customers face by having to buy all products from a single supplier is stopping them from investing in connected home solutions.

**Commercial developments** – One benefit as well as difficulty in working with connected products opposed to traditional ones is that they can be improved over time. This is something that should be reflected and taken into account when commercial processes are being developed and the companies are currently thinking about how to e.g. transform and re-design sales processes and revenue models. The majority of the companies are also still faced with the obstacle of understanding what kind of value enhancing future features and solutions they can and should offer to their customers and how to collect money from these.

**Organizational challenges** - The distinct companies are faced with different organizational obstacles. For the companies who don’t have the necessary digital skills to work in the digital domain they are currently looking for ways on how to achieve those. On the other hand, for the companies who do have the technical skills and competences necessary already the common challenge is related to spread the understanding what the entry into IoT will mean to the company as a whole and to make new processes aligned with established ones.

- **How do incumbent companies in the kitchen and furniture manufacturing industry adapt to and implement Internet of Things?**

With the emergence of IoT new dynamics are entering the industry and the companies have started to think about what product connectivity will mean and how they can create new demand and compete in new market spaces by providing customers with new user-experiences. By directing internal research and taking explorative initiatives the companies learn more about the technology as they proceed. In implementing the concept of IoT, the
companies have started to investigate new product features and functionalities as well as started to re-evaluate how internal knowledge and skillsets correspond to the technical requirements that the new setting outlines. Nevertheless, implementation of IoT is not solely technical and the companies have thus started to think about how to re-design business models and commercial processes that respond to the aspects of building connected products. So far even if a direct adaption not is fully made through all industry sectors, early implementations involving products that can interact one-to-one are arriving on the consumer markets. Meanwhile the future goal is to achieve full integration that imbeds connectivity and interaction among all products in the home.

7.2 Future research

The emergence of connected products and solutions in the kitchen and furniture industry is still a new phenomenon and there is definitely a reason for further investigation in the area. The study only includes seven companies whereas six of them are manufacturers. In this matter it would be of great interest to investigate the development further involving more companies, since differences between companies and subsectors are likely to be found. It would be interesting to carry out a similar study in the future when the IoT ecosystem as well as the industry landscape has become more developed. Furthermore, it would also be interesting to turn the scope around and investigate how digital tech. companies that are starting to work with home solutions view their entry into the industry. How do they perceive the IoT ecosystem? And what aspects in business development are they regarding to be important as they start to develop connected home solutions?

Finally, this study focuses on manufacturing companies in the industry that currently are working on and investigating the development of connected products and solutions. There are still many companies in the industry that not yet have started to work with connected products and IoT. It would be interesting to investigate what causes them to refrain. What factors and aspects would be important for them to start? And how do they regard future industry developments?
8. References


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Appendix

Interview questions

1. What is your connection to the development of IoT consumer facing products?

2. How do you work with IoT consumer facing products today? Do you have any ongoing projects and how do you coordinate that work?

3. According to your own believe, what is happening on the market at the moment? Is the market ready for the launch of IoT products?

4. What features of IoT technology are you currently investigating and in what ways do you perceive IoT technology as valuable?

5. What factors do you perceive as important in order to successfully introduce IoT consumer facing products on the market?

6. What do you see as the biggest challenges in adapting and implementing IoT technology to production of consumer facing products?

7. Do you think that anything is missing in order to drive IoT initiatives further in terms of bringing products to the market? If so, what would that be?

8. What are the conditions you see to be necessary to develop IoT products on full scale? Do you believe that you have those conditions and skills required existing in your organization? If not, how are you working to achieve those conditions?

9. How do you perceive the opportunities and threats that the transition to IoT may implicate, particularly in terms of the shift in skills and competences?

10. What is your vision for “connected home living”? How do you look at the future?
Short answer questions:

1. On a range 1-5, how would you define your market environment today? (1 – rapidly changing; 5 – moderately dynamic)

2. On a range 1-5, what is your organizational focus today? (1 – innovation; 5 – efficiency)

3. On a range 1-5, how big is your focus on implementing IoT technology in your production today? (1 – very high; 5 – low)

4. On a range 1-5, how complex would you say that implementation of IoT in consumer products is? (1 – Not at all complex; 5 – Very complex)

5. Do you think that a shift to production of IoT consumer facing products will introduce changes with regards to your existing business model?

   1 – No changes
   2 – Only small changes
   3 – Don’t know
   4 – Some changes
   5 – Big changes

6. Do you think that a shift to production of IoT products will introduce challenges to your current production processes?

   1 – No problems
   2 – Only small challenges
   3 – Don’t know
   4 – Some challenges
   5 – Big challenges

7. Do you think that a shift to production of IoT products will introduce challenges to your current supply chain?

   1 – No problems
   2 – Only small challenges
   3 – Don’t know
   4 – Some challenges
   5 – Big challenges

8. Do you expect trial with IoT products to be easy to execute in the production process?

   1 – No problems
   2 – Only small challenges
   3 – Don’t know
   4 – Some challenges
   5 – Big challenges
9. According to your knowledge, do current IoT technological solutions have sufficient characteristics to be used in your products? Yes or No.

10. If not, what are the lacking characteristics?

11. Rank the following characteristics in preference as to develop consumer facing products incorporating IoT technology? (1 – most important; 5,6 – least important)

1 – User-experience
2 – Standardization of technology
3 – Customer relationships
4 – Partnerships
5 – Product security
6 – Other (which?)

12. How would you rank your existing organizational knowledge in the domain of making products implementing IoT technology?

1 - Very good
2 - Good
3 - Average
4 - Less than average
5 - Low

13. Would you need to develop further knowledge about possible IoT solutions before considering launching products on the market?

1 - No need
2 - Not really
3 - Indifferent
4 - Yes, some additional knowledge
5 - Yes, I would like to know a lot more

14. What is your prediction for the next 3-5 years with regards to the development of IoT consumer facing products in “home living” domain?

1 – IoT products will replace the traditional products completely on the market
2 – IoT products will complement traditional products on the market
3 – IoT products will gain a market share over 10%
4 – IoT products will gain a market share less than 10%
5 – IoT products will not compete with traditional products on the market