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Internet of Things (IoT) Business Opportunities – Value Propositions for Customers

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Abstract

The objective of this study is to better understand the IoT business landscape and opportunities. One intention is to identify the needs of companies in IoT and how they capture value. Another intention is to identify partners and competitors and how companies help each other create value in the IoT ecosystem.

The conceptual framework was based on value propositions, value creation and capture as well as Business Model generation according to Grönroos, Vargo & Lusch, Anderson et al. and Osterwalder, respectively.

The study was carried out using inductive qualitative methods. Data were gathered with qualitative research based on inputs from five IoT case companies as well as field observation data from various workshops and seminars.

The findings suggested that a change of mindset is required; that data management is very important in IoT; that there is a lack of willingness to invest in IoT; and that there may be a lack of knowledge and skills among staff. The findings also indicated that in IoT value can be captured not just during sales but more importantly after sales, and that this can be done with many non-traditional methods. In addition, there is not one dominant business model in IoT. Furthermore, the EU holds an important role in shaping the future of IoT.

In conclusion, this research opens up a better understanding of the IoT business opportunities and landscape through the different ways that value can be created and captured in IoT. Knowing how to create value in IoT and when to capture it gives companies an opportunity to provide better value propositions to their customers.

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Terminology

ARPANET Advanced Research Projects Agency Network

B2B Business to Business

B2B2C Business to Business to Customer

B2C Business to Customer

B2G2C Business to Government to Customer

BM Business model describes the rationale of how an organization creates, delivers, and captures value

BTLE Bluetooth Low Energy

CAGR Compound Annual Growth Rate - is a business and investing specific term for the geometric progression ratio that provides a constant rate of return over the time period

CTO Chief Technology (or Technical) Officer

CVP Customer Value Proposition

EU European Union

GDP Gross Domestic Product

ICT Information and Communications Technology

Internet A global computer network providing a variety of information and communication facilities, consisting of interconnected networks using standardized communication protocols

IoT   Internet of Things

ITU International Telecommunication Union

M2M Machine to Machine

R&D Research & Development

RFID Radio-Frequency Identification

SME Small and Midsize Enterprises

WSN Wireless Sensor Network is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions

1 Introduction

This study was inspired by the new technology Internet of Things, or IoT for short, and the challenges of its Business Models (BMs). IoT refers to the concept of connected devices: everyday mundane devices (e.g. streetlamps, cars, fridges, microwaves, handheld devices, and thermostats) that are equipped with sensors, actuators, unique identifications and communication modules that make them smart and allow them to be connected to communication networks. Smart devices can transmit and receive data; hence, some can be controlled remotely. For example a person can tell the oven to warm up before she comes home from work through an app in her mobile phone. The attractiveness of opportunities this emerging technology brings and the untapped market it holds is immensely interesting to all kinds of researches and businesses. Many already pursue the market or are venturing into it quickly. This means they need to seek new opportunities or change their business concepts. As Osterwalder (2010) would put it, a BM that make sense in today's environment might be old-fashioned or even obsolete tomorrow. We all have to improve our understanding of a model's environment and how it might evolve. However, this study is more about generating new insights, knowing one's own business model as well as customer understanding rather than generating new BMs. Furthermore, this research focuses on the core of any business model: customers' needs. The study is done for a global company that has existed for decades. The company is venturing into a new business area that has not been traditionally in its portfolio. For this reason, the study seeks to understand the best approach for the company to understand *value* in IoT and capture it in order to expand their business in the area.

1.1 Sponsor Company Background

This study is sponsored by a global Information and Communications Technology (ICT) company that is providing equipment, software and services to mobile and fixed network operators all over the globe. The company wishes to remain anonymous and therefore will be called Company X from now on. In the rapidly changing environment of communication technology, it is the company's vision to be the prime driver in an all communicating world.

Company X was founded in the late 19th century, and it has seen stock market crashes, world wars, and rapidly changing markets and technology. Through the decades, this company has transitioned from traditional telegraphs to mobile telephony and onwards to faster mobile data networks. Nowadays the company offers cloud solutions and technology that enables mobile

operators to deliver consistently high performance voice and data coverage and capacity in the broadest range of enterprise buildings and public venues. Company X employs over 100k people worldwide.

Company X is making the Networked Society a reality where anything that can benefit from being connected is connected. This study focuses on a part of that business area, mainly the IoT. The company sees that expansion beyond the traditional telecom sphere as a natural path for the future seeing that they already supply to half of the world's operators; they use that to venture into new opportunities in the digital services ecosystem. This study aims to support Company X in identifying values for the target customers of IoT in various market segments. The target segments of the company have traditionally been the mobile operators and in some part enterprises and public sectors.

Background of the Study

Company X has a research organization in Finland, which is involved in many national and international development projects; EU funded projects, as well as technologically innovative projects with companies in vertical industries, start-ups, SMEs and universities. The research and development group is also participating in an IoT program which is a Tekes funded project. Tekes is a Finnish funding agency for innovation. The program focuses on four things: establishing a competitive IoT ecosystem; creating IoT business enablers; improving Finland's global IoT visibility; and impacting IoT technology evolution and standardization (www.digile.fi). The study was initiated within the project related to IoT ecosystem. The program has collaborations both nationally and internationally in order to define the IoT ecosystem and its players. The study gained international perspectives through various viewpoints of foreign partners during seminars and conference. The research activities for this study were performed during the period March 2013 to October 2013; exploratory research was done, data was gathered through interviews and from several workshops and meetings.

1.2   Research Problem, Goals and Objectives

This study is motivated by the fact that IoT is a rising concept, but not yet widely understood by the public. Combined with the strongly technical focus of Company X, there could be more focus on a business mindset since the company is pre-dominated by technical personnel. Consequently, the understanding of the business model and value to customers is very frag-

mented. Being faced with the challenges of IoT, there appears to be a clear need for a better understanding of the IoT business model as well as its domain.

The initial research issue of this study was derived from discussions with experts and the country manager of Company X, who is also responsible for the vertical market sales. His main concerns regarding IoT were about the future outlook of business. It is unclear which market segment to enter and how the company should position itself in the market to be competitive in IoT. How it can expand its current services or products towards IoT field. I essentially took these ideas and combined them with the general concerns of experts in the IoT field with whom I had discussions during the various workshops. Their concerns were regarding deployment strategies; the cost of IoT services and its effect on business and consumers – meaning basically, who should eventually pay for the new services; and what the ecosystem might look like for particular segments. The research problems are therefore defined based on these inputs and can be summarized into two parts: the business opportunity and the business landscape.

These following are the two main objectives and their supporting sub-questions:

1. To better understand the IoT business opportunities through value propositions
   a. What are the needs of different companies pertaining to IoT or its products and services?
   b. How can companies capture the value in the IoT ecosystem?

2. To better understand what the business landscape looks like for IoT at the moment
   a. Who are the partners and who are the competitors?
   b. What businesses are there in the IoT ecosystem?
   c. How can the different companies within the IoT ecosystem help each other create value?

The international context of the research comes from the consortium partners and benchmarking of international companies derived for both objectives. This study is relevant in that sense that although IoT is emerging and is slowly creeping into people's lives - hence changes the way they live and think - there is no major market pull. This means customers are not yet demanding for the technology. This study therefore aims to shed some light on the value propositions for IoT.

Scope of the Study

Company X is a local branch of a global company. The research problem is specifically investigated for the local company, which commissioned the thesis. Nevertheless, the current study makes use of secondary data produced by the global company. As such, the results and findings presented in this study may be beneficial to other branches of Company X as well.

The customer segments that the study looks into are not limited to Company X. When looking into needs and value proposition of IoT, the study will explore all customer segments in the IoT market. This is due to two things: 1. Company X is B2B focused, whereas IoT is B2B2C or B2G2C focused. Therefore, in order to understand the whole business value chain, there is also a need to understand the end-customers, which can be in any segment. 2. In order to open up possibilities and think out-of-the-box, IoT in general is investigated, not just IoT possibilities inside one segment.

This study will explain and define IoT, its economic prospects and the reasons why Company X is motivated to pursue this technology. The thesis will not be discussing any technically related challenges of IoT e.g. wireless protocols, infrastructure, etc. However, the business related challenges will be discussed. This study will also compare how IoT is seen in Finland versus other countries.

1.3 Economic Context of IoT

This section briefly introduces the potential impact of IoT for business and consequently clarifies why companies need to understand IoT business. Many companies see an opportunity in IoT. According to Deloitte, IoT has the potential to offer business value that goes beyond operational cost savings. Providers in the IoT ecosystem have a largely unexplored opportunity to develop compelling IoT solutions, that might transform the business by exploring how the ability to collect and analyse disparate data, in real-time and across time. These developments will play out within and across enterprises, offering opportunities for sustained value creation and even disruption for those who can imagine possibilities beyond the incremental. (Deloitte 2014.) One opportunity that IoT clearly enables is miscellaneous measurements using different sensors. In turn, this will produce extremely large data sets that may be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions. This is known as Big Data. The emerging of Big Data entails the facilitation of it, which means the collecting, retrieval and accessing of data remotely. Cloud

computing system emerges for this purpose. It means that data is stored in servers but is connected to the Internet so that it is accessible by web-based tools and applications. New BMs transpose, improving business processes and reducing costs in the resulting information network. Siemens transforms big data into smart data and subsequently optimises their products. "We can now recognise the value within our data more quickly and efficiently," said Dr Michael May, head of technology field business analytics and monitoring at Siemens (Siemens 2014). Some companies are forecasting the potential of IoT and big data: Gartner, an information technology research and advisory company, says that by 2020 the IoT will have grown to over 26 billion units; IDC, the International Data Corporation, puts it close to 30 billion, with an industry value of around $8.9 trillion; and Cisco reckons 50 billion by 2050, with a value of $14.4 trillion by 2023. (Next big thing 2014)

According to the IoT index report on 2013 by The Economist Intelligence Unit:

- Three-quarters of companies (75%) are either actively exploring the IoT or already using it

- The majority opinion (61%) among senior executives is that companies slow to integrate the IoT into their business will fall behind the competition

- Three years from now, almost all senior executives (96%) expect their business to be using the IoT in some respect

However, while IoT is currently the big idea, there is still very little knowledge as to where the technology leads. Is it just a technology hype, or is there real value being created? IoT is not just hype in an isolated industry, but everyone is looking for new opportunities to enter the IoT ecosystem: healthcare, building and home, infrastructure, retail, transport to mention a few. According to STL Partners, who specialises in business model innovation in the Telecoms-Media-Technology sector, there is definitely a need for improving economics of delivery, and increasing technical capabilities is forcing companies to think about innovation in IoT. Let us see the economic rationales of the fastest progressing areas in the North American market (STL Partners): in US healthcare there is an urgent need to be more efficient, as now it is bankrupting the economy by spending 17% of the country's GDP on health, which accounts for 47% of the world's total healthcare spending; there is a widespread innovation in the automotive industry, driven by car makers' desperate need for new sources of differentiation and revenues (from in-life servicing); in heavy industries, it estimated that a 1% improvement in productivity equals a 20-30% improvement in profitability, so there is clear incentives in what GE (General Electric) CEO Jeffrey Immelt calls the Industrial Internet too.

Other examples are clothing/wearables (e.g. Google Glass), connected media and tracking items. With new opportunities come new challenges. The opportunities that Telecom and ICT companies, like Company X, see are in the impact of IoT value chain, which has emphasis on all levels pertaining to their business areas: software, data and applications. For instance, if there are hardware suppliers, there is bound to be hardware integrators, and network access application, middle software, applications supplier, etc. For all levels, business opportunities are created. Figure 1 shows an illustrated example of a value chain where above mentioned sectors can be seen in sequential order. It demonstrates that more and more players will emerge to address the IoT market in every level of business, which will naturally increase competition.
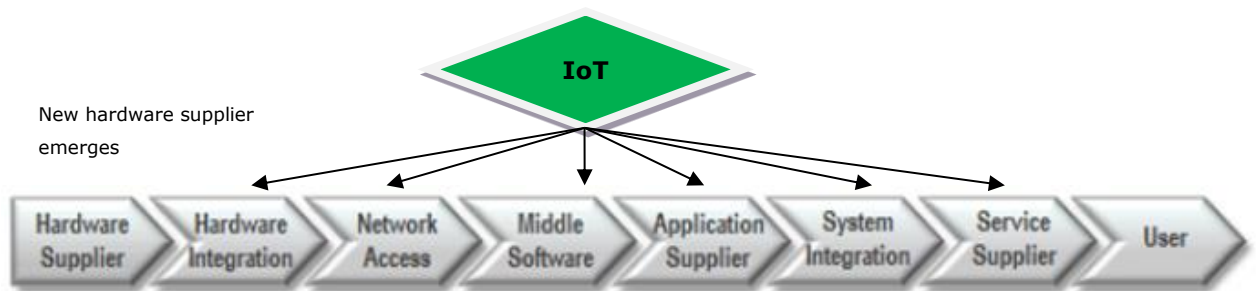
Figure 1. The impact of IoT on future market value chain (Source: STL Partners)

The idea of IoT is to enable connection without much human intervention, and therefore connectivity is seen as one important aspect in order for IoT to work. The potential for IoT is therefore seen as very high for wireless network providers as well.
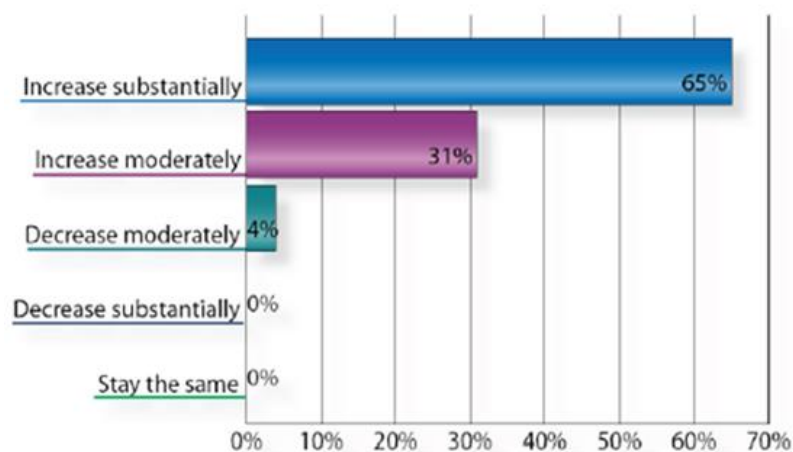
Figure 2. Expected network traffic for connected devices. (Source: Beecham Research)

Beecham Research, a technology market research, analysis and consulting firm, did a survey on IoT and one of the questions asked to market players was to what extent they expected the level of network traffic to/from their connected devices and products to change during the

next 5 years. Figure 2 shows that virtually all respondents expected this network traffic to increase. This reflects the expectation of a huge increase in the amount of data predicted to be generated by connected devices.

1.4   Structure of this Study

This first part outlines the study, after which the actual theories behind customer value, value creation, value capture and IoT are introduced. Therefore, chapter 2 reviews and analyzes relevant literature for each topic separately. At the end of chapter 2, the conceptual framework is drawn to show the relationships of the key concepts from the literature review to the research questions.

Chapter 3 clarifies the research methodology. It explains the choice of exploratory study as a research approach and describes the methods, strategy, techniques and procedures used. Furthermore, the data collection and data analysis methods are justified.

Chapter 4 presents the research findings derived from the interviews and the observations according to the methodology described previously. First the findings from the interviews are presented and analyzed towards the research objectives, and then findings from the observations are presented and explored further.

After the findings are discussed, chapter 5 gives recommendations and suggests possible actions for implementation. Chapter 6 concludes this thesis, including further research suggestions based on the study. It also presents the assessment of the business value of the study.

2 Literature Review

The initial IoT theories for this study and its investigation were derived from Company X, the IoT consortium and the Internet. There are not so many existing theories that cover a holistic view of IoT, and those that do exist are basically sourcing back to one another. IoT concepts and technologies are currently developing in a very fast pace. What remains the same in all levels, company and research, is the fact that none has yet come up with an ideal business model. This suggests that there are yet many open factors and obstacles to overcome. Theories suggest that the readiness for IoT differs greatly in different geographical locations, which also links to the different needs of the consumers.

In this chapter of literature review we discuss the marketing aspects and the central position of the customers in the business model. In order to aim to understand the opportunities and challenges of an IoT business, we will start by looking into the value that IoT firms offer the customers. We will consider concepts such as customer value, value proposition, value creation and value capture.

2.1 Significance of Customer Value and Value Creation

The importance of customer value has become more obvious in the past decades in research as well as in practice. The definition of marketing has been revised to include more intangible resources - for instance the concept of customer value, co-creating value and relationships. There have been important discussions in the literature about the emerging service dominant logic and the shift in perspectives for marketing. (Vargo & Lusch 2004.) It is observed that there are two sides to value creation: the value for the customer and financial value for the firm. These two perspectives for creating value are interrelated in that sense that the firm's goal is to bring itself financial value through engaging the customer. (Grönroos 2011.) In this thesis we will only consider the value created for the customer, i.e., the customer value generated by a company's product or service as perceived by the customer to fulfill their goals and desires.

What customers perceive as value varies a lot from each other. For one this can be cost savings or getting low prices, for another it is what they get in return for what they give. One efficient way of defining customer value is through the attributes of the offering. In that context the attributes are consequences of the usage of an offering in reality. The consequences

can be perceived positively, i.e. benefits (gain) or negatively, i.e. the sacrifices (monetary or non-monetary costs or pain) to the customer of obtaining the benefits. This is to say that customer value is created once the customer perceives the gain being greater than the pain. On the other hand, creating value not only encompasses customer value but also provides competitive advantage, which is reflected in the firm's value proposition. Understanding the way the customers consider and appreciate a service or product is crucial to achieving competitive advantage. There are different dimensions in customer perceived value that play a role in identifying value propositions. Propositions can reflect on the following dimensions: economic (reduced price, efficiency), functional (focused on solutions), emotional (customer experience, interaction based, customer participation) and symbolic value (brand awareness, history). (Rintamäki & Kuusela 2007.)

In the past two decades, markets have redefined the basis of competitive advantage and shifted from structural characteristics such as market power and economies of scale towards capabilities. This enables businesses to be sustainable by consistently delivering superior value to their customers. (Rintamäki & Kuusela 2007, Grönroos 2011.) The three ways which Anderson et al. (2006) define customer value propositions comprises not only value propositions based on benefits but also more dimensions that aim at competitive advantage such as points of parity and points of difference from the competitive offerings. Points of parity are elements with the same performance or functionality as those of the next best alternative, while points of difference are elements that make the supplier's offering either superior or inferior to the next best alternative.

Co-creating Value

Vargo & Lusch (2004) introduced a change in perspective on how customer value is regarded and stated that service is the fundamental basis of value. The goods-centered view has gone out of fashion and cannot keep a company sustainable as competition becomes more intense. The revised approach to marketing considers a service-centered view. The differentiating point between the two views where value is concerned is that the goods-centered perspective does not involve consumers during production. On the other hand, when talking about services, the goal is to recognize that the consumer is always a co-producer so companies strive to increase consumer involvement in order for the offering to better fit his or her needs. Service-centered thinking points to opportunities for expanding the market by assisting the customer in the process of adapting the offering to their needs and create value. Value is not de-

termined at the end of the process only but during every step of it. Consequently, company resources must have certain competence to make this happen. They need to be developed in order to apply the relevant knowledge and skills to provide the desired benefit to the customer. This also implies that the value is uniquely determined by the customer. Hence value is created by the user and there cannot be value without the customer incorporating the company offering into his or her life. Value is said to be recognized or emerge when the customer experiences the service, or uses the products, also known as value-in-use. (Vargo & Lusch 2004, Grönroos 2011, Grönroos and Voima 2011.) Grönroos (2011) additionally argues however, that not all parts of value-in-use are part of value creation for the customer. He states that the two perspectives contradict each other because value for customers is either created in the customer's sphere by the user as value-in-use, or by both the provider and the user in an all-encompassing value-creating process. Adding another aspect to this, there is also the point after the value creation process and before the value-in-use. At this junction, the customer sees the expected value. This is essentially the swaying point where the customers' willingness to pay depends on what they see as value. After that, once the customer buys the goods, their experience with the purchased goods accumulates, which is the value-in-use. Figure 3 illustrates this process and differences of perspectives.
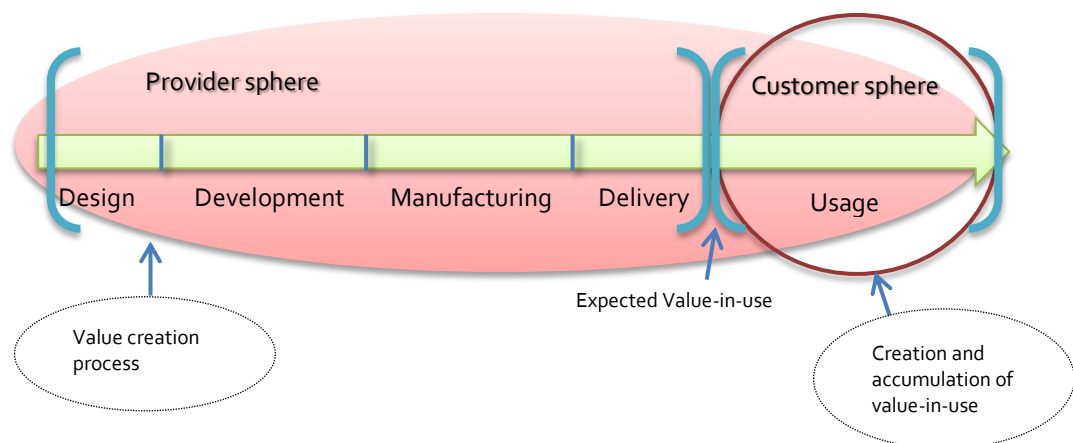
Figure 3. Value creation as all-encompassing process or as value-in-use
(Source: Grönroos 2011)

The changes in society and the market alter the role of the consumer. More than before consumers are able to access information on what they are buying; globalization takes competition on a different level when consumers can choose from a range of prices and functionality across geographic borders; networking allows individuals and companies alike to share ideas and feelings about products and services. These various reasons entail on companies a more

out-of-the-box thinking and a renewed perspective on creating value. Companies now seek to interact with customers more and at an earlier stage in the life-cycle of the offering. This interaction is referred to as co-creation of value. Consumers want to have more influence on every part of the business system. (Prahalad and Ramaswamy 2004.) Value co-creation can be defined as personalized interactions that are meaningful and sensitive to a specific customer. Grönroos (2008) also stated that a firm, without interaction with its customers, can only provide value propositions; however, it gets opportunities to actively and directly participate in value fulfillment for its customers through value co-creation. (Prahalad and Ramaswamy 2004, Grönroos 2008.)

Value Creation and Capture in IoT

The IoT market requires a change in mindset more than before when thinking about capturing value. IoT companies like Xively and ThingWorx believe in increasing revenue streams through value capture. They also see the changes in BM due to the shift in value creation. The nature of IoT presents challenges to customers particularly after the initial product sales. These could include data storage, security, connectivity, etc. Below in Figure 4 is a table that shows the differences in the traditional mindset and the IoT mindset when it comes to value creation and capture, which is an important aspect to understand in order to revise or generate new BM and pursue business opportunities in IoT.

		TRADITIONAL PRODUCT MINDSET	INTERNET OF THINGS MINDSET
VALUE CREATION	Customer needs	Solve for existing needs and lifestyle in a reactive manner	Address real-time and emergent needs in a predictive manner
	Offering	Stand alone product that becomes obsolete over time	Product refreshes through over-the-air updates and has synergy value
	Role of data	Single point data is used for future product requirements	Information convergence creates the experience for current products and enables services
VALUE CAPTURE	Path to profit	Sell the next product or device	Enable recurring revenue
	Control points	Potentially includes commodity advantages, IP ownership, & brand	Adds personalization and context; network effects between products
	Capability development	Leverage core competencies, existing resources & processes	Understand how other ecosystem partners make money

Figure 4. Mindset change when creating and capturing value in IoT (Source: HBR.com)

The center of any business model is value creation. This means performing activities that add value to the company's products or services thereby inspiring customers' willingness to pay. Products in the IoT world do not correspond to the traditional market pattern of identifying needs and supplying well-engineered solutions. The experience of customer value in IoT can really be followed throughout its life cycle due to the ability to track products in use and respond to customer behavior. So value creation here continues after the initial sales. Effective forecasting and optimization of processes can be done thanks to connected devices. Companies are very attracted to the generation of recurring revenues. These are new possible themes for IoT value creation. To satisfy customer needs in IoT means forecasting, real-time data management and preventive maintenance. Offerings are integrated and have synergy value. The role of data becomes more relevant as information is converged to enable more services. (Smart Design 2014.)

2.2 What is Internet of Things?

Internet of Things, or IoT for short, is not a new concept. The term itself was first coined by Kevin Ashton in 1999 (RFID Journal). In 2005, the International Telecommunication Union (ITU) envisioned the new dimension of connectivity for ICT: anytime & anyplace connectivity (on the move and with any gadget) for anyone to having connectivity for anything (human to thing, thing to thing) (ITU 2005). In the past years, when observing the reactions of different industries, it seems that the whole idea of IoT has not been quite realistic to them, which lead them to believe that it is a mere hype. However, ITU and some small businesses that have managed to introduce sensors to different equipment, view the emerging IoT as something evolving from the combination of visions and technology advancements as well as the next evolution of Internet. The whole idea of IoT is the high impact it has on users and their everyday-life as well as behavior. This is also the reason why IoT products and services seek social or buyer acceptance. The effects of IoT will be visible for the private user in all aspects of their lives: at work, at home and socially. (Atzori et al. 2010.)

IoT is defined differently by different research communities which lead readers to have real difficulty grasping the meaning of IoT. Additionally, it is not easy to get a big picture of IoT because different standardization bodies, industries, researches and business alliances tend to add their own perspectives to the concept depending on their interests and approaches. One good way to look at IoT and later understand its ecosystem is to view it from this merged per-

spective of the different entities mentioned. Based on the survey from Atzori et al, (2010), IoT could be divided into three different converged dimensions depending on the different visions: (1) The dimension of "Things": comprises of visions pointing towards e.g. key chains, portable medical devices, watches, etc.; (2) "Internet" oriented dimension: referring to the web, connections and communications; and (3) "Semantic" oriented dimension: the technology to store, sort, collect, search and interpret the data generated by all the connected devices. (Atzori et al. 2010.) To further elaborate, there are different categories of "things". According to Grizzly Analytics (2013), the things can be divided into everyday objects, such as books, wallets, mail carts, etc.; connected sensors, like water sensors for leaks, temperature sensors, motions sensors; and connected appliances e.g. fridge, coffee machine, air conditioner. Sensors may have existed online for a long time, but the idea of IoT would be mass scale. (Grizzly Analytics 2013.) When talking about IoT, we refer to the connectivity of objects or devices without human mediation. Although there are many literatures that can be confusing because they refer to IoT from different aspects, they are still all linked to IoT. Therefore, there may be examples sourced in this thesis that refer to other names; we shall understand that as IoT in general, unless specified separately.

IoT – Past & Present

One can say that the existence of Internet had made possible many things. In the case of IoT, many even consider it being the next step in the Internet evolution. Without the Internet, the concept of IoT would probably not exist. Companies like Cisco and people like Kopetz (2011) believe that IoT is the next wave of the Internet. In Kopetz's (2011) work, he described the Internet as growing exponentially over the past 50 years from a small research network to a worldwide pervasive network that services more than a billion users. He also indicated that because of the cost reduction on electronic device prices combined with miniaturization it is possible to expand the things towards Internet in a new dimension. The small electronic device, a computational component that is attached to a physical thing, bridges the gap between the physical world and the information world. (Kopetz 2011.)

Cisco looks back on Internet even further. The first design on Internet was called Advanced Research Projects Agency Network (ARPANET) or the Web as we refer to it now. It was mainly used then by academia for research purposes. As can be seen there are a few milestones that paved the way for IoT and enabled the technology to be set in motion. Figure 5 below shows some important milestones for IoT according to several sources. Some sites are citing the history further back but I choose to start considering the milestones from when

ARPANET was conceived as it is one of the major innovations that brought forth the Internet, which eventually leads to IoT.

Year	Milestone
1969	ARPANET
1989	Birth of the Internet. Tim Berners-Lee proposes the World Wide Web.
1999	The IoT term is coined by Kevin Ashton.
2010	Machine-to-Machine (M2M) Platforms emerged.

Figure 5. Milestones for IoT

(Source: postscapes.com, iotworldview.com, Cisco IBSG)

Looking at the chart in Figure 5, it can be seen that it took roughly twenty years for the World Wide Web (www) to be born regardless of the underlying technology existing much earlier. After that, another ten years before it was realized that "things" can be made smart and connected. With the emerging of M2M platforms, Industrial Internet became popular. It refers to the integration of complex physical machinery with networked sensors and software.

There are normally risks associated with transformative early trends and the Hype Cycle helps strategists and planners assess those risk levels, as well as maturity and hype. What can be said about the IoT hype? Well, it is interesting to see that in 2011, Gartner, who tracks specific technologies and their progress through "technology triggers" to "plateau of productivity", added IoT onto their list for the first time, see Figure 6. IoT was placed into Gartner's Hype Cycle just at the edge of the "Peak of inflated expectations" stage. This essentially denotes that at this stage IoT has gone pass R&D; IoT companies have been through the first round of venture capital funding; and have released first generation products. Early adapters would now be investigating the technology before mass media hype begins. "Big Data" also entered the picture at the same time. These were still at the technology trigger points, and they expected mainstream adoption to be between 5 to 10 years for IoT. M2M on the other hand is rapidly becoming unfashionable. (Gartner 2011.)
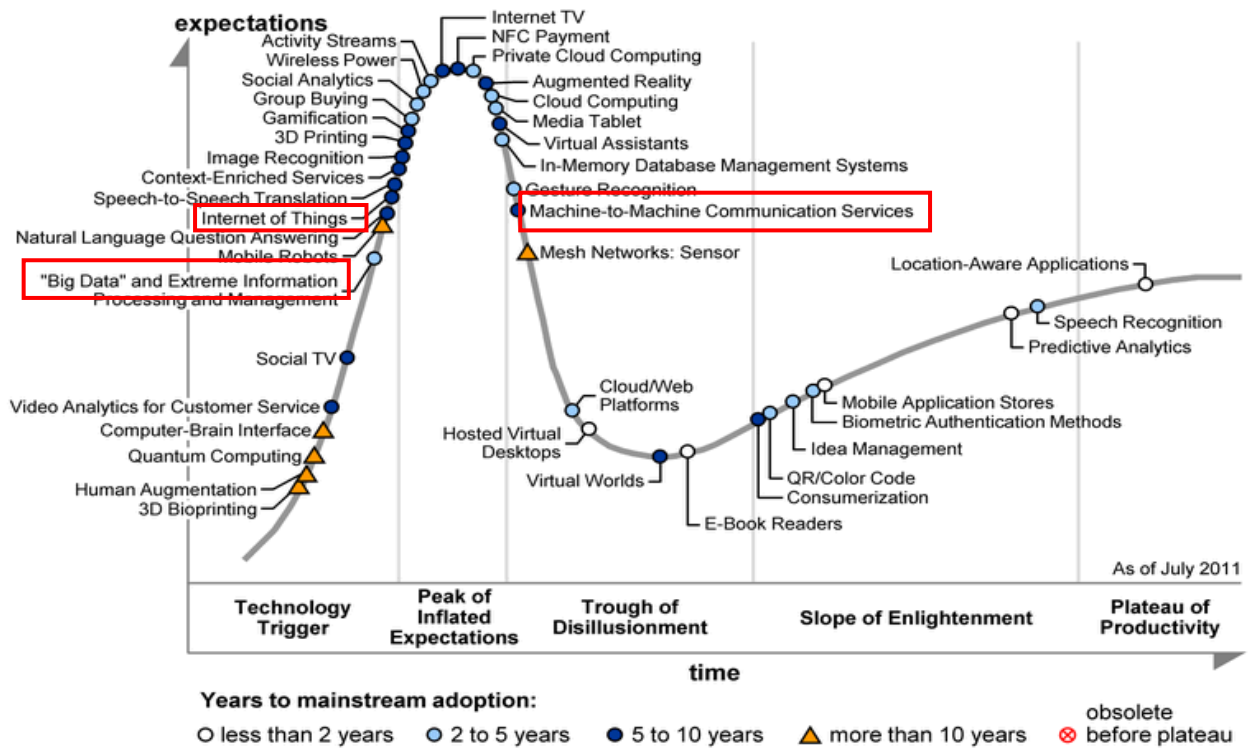
Figure 6. The hype cycle for emerging technologies in 2011

This year, in 2014, IoT reached the "peak of inflated expectations", while "Big Data" has moved on to the stage of "trough of disillusionment", meaning it has not lived up to its inflated expectations during the Hype Cycle. (Gartner 2014.) Figure 7 below shows where IoT, Big Data and M2M are after three years from 2011.
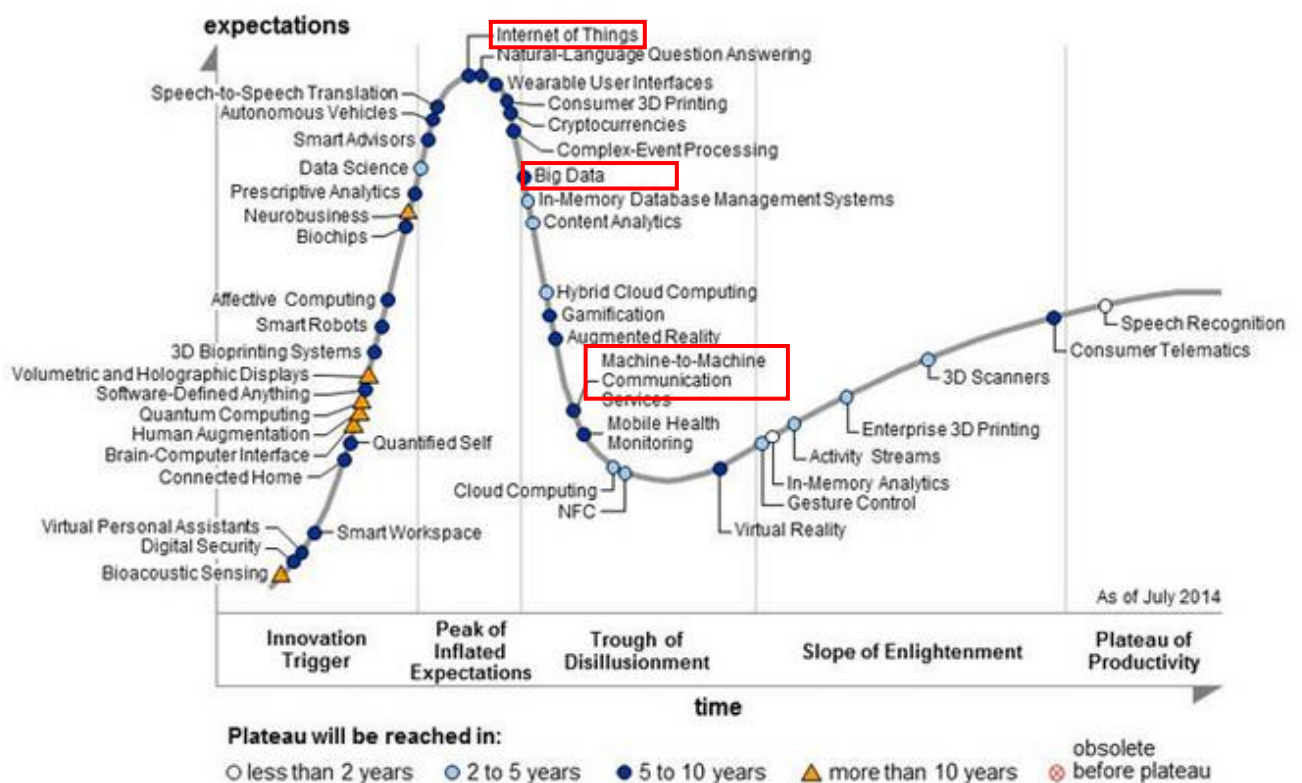
Figure 7. The hype cycle for emerging technologies in 2014

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IoT Ecosystem

The environment of a business can be referred to as the business ecosystem which is a strategic planning model whereby a network of suppliers, distributors, competitors and customers all work through competition and cooperation to advance sales of products/services (www.businessdictionary.com). Mazhelis et al, (2011), defines the IoT ecosystem according to the perspectives of Moore 1996, Iansiti & Levien 2004, and Talvitie 2011. Moore (1996) believes that an ecosystem comprises of coevolving businesses, by competing and cooperating with each other, based on innovation. On the other hand, Talivitie (2011) and Iansiti & Levien (2004) argue that the business ecosystem is formed around a specific "core". The core could be anything from platform, processes, to standards that are used and available to all members of the ecosystem, thus enabling them to have higher level of productivity and innovativeness to create new products and services.
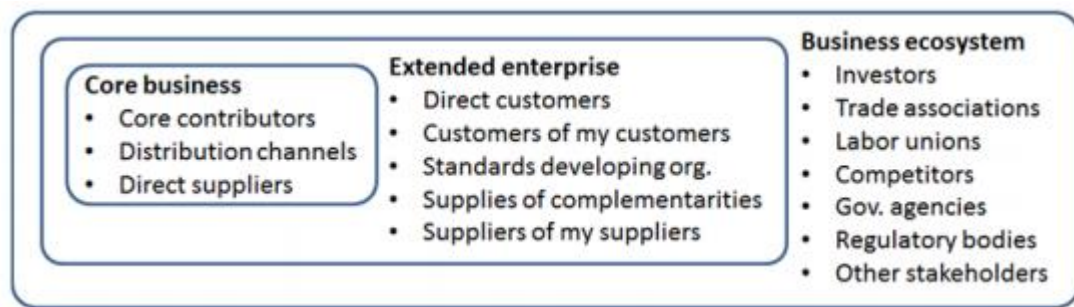
Figure 8. The general actors in a business ecosystem (Source: Mazhelis et al. 2011)

In Figure 8, Mazhelis et al, (2011) visualize general actors in a business ecosystem: the core business shown as the companies delivering goods and services, surrounded by their customers, suppliers as well as market intermediaries, the business ecosystem includes the owners and stakeholders of the core, the regulatory bodies and competitors. The topology of an ecosystem can be a hub-centered star structure, where there is one important firm and the rest smaller ones or a mesh-like structure, comprising of small and medium sized firms. (Moore 1996, Iansiti & Levien 2004.)

Based on IoT's characteristic of interconnection, Mazhelis et al. (2011) defines the IoT ecosystem core with the focus on

- the connected devices and gateways, including both hardware platforms,
- the connectivity between devices and the Internet,
- the application services,
- the supporting services, needed for provisioning, assurance and billing

The core can be formed of hardware and software products; platforms or standards that focus on the connected devices; and the core connectivity assets on top of those as well as the application services and its supporting services.

Thus, Mazhelis et al. (2011) defined the IoT business ecosystem as follows:

> "as a special type of business ecosystem which is comprised of the community of interacting companies and individuals along with their socio-economic environment, where the companies are competing and cooperating by utilizing a common set of core assets related to the interconnection of the physical world of things with the virtual world of Internet."

IoT Landscape

The big picture often helps in understanding where to place what. And in IoT seeing the landscape is very helpful in orientating one's thoughts on how much competition currently exists.
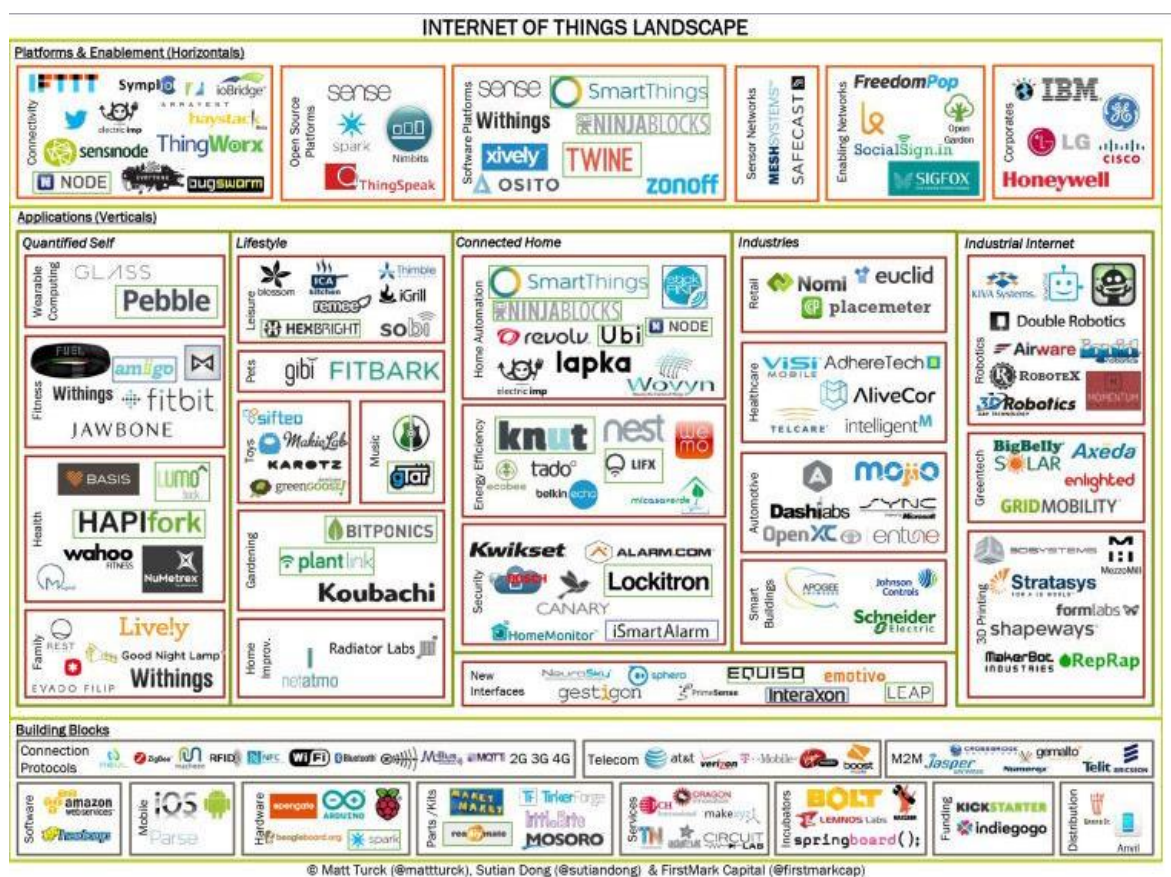
Figure 9. The IoT Landscape (Source: Techcrunch, 2013)

Figure 9 shows the current IoT landscape presenting different businesses and the IoT application areas where they are allotted. Each of the companies has their own ecosystem. Some may be more successful than others, and some are still struggling. What they do have in common though is the ever changing IoT landscape as new business hit the market and alters its dy-

namics. The landscape shows how fragmented IoT ecosystem really is. The players in the evolving vendor ecosystems that are emerging to enable IoT consist of a wide variety of startups, established firms and larger corporations. The chart is only to demonstrate the current landscape, but might change drastically in the future depending on the interactions between the companies as they evolve. The landscape can be divided into three broad areas from bottom to top: the **building blocks** can be essentially understood as the communication technology that enables connectivity for different devices (Connection protocols, Telecom, M2M); the **vertical applications** are a common set of resources used by IoT developers on which to build IoT applications (Industry specific companies, Industrial Internet, connected home), businesses in the vertical market are focused on needs of specific industry, offering services and products to a single niche; and the **horizontal market** (open source platforms) are a common set of resources used by IoT developers on which to build IoT applications, which are application platforms. (TechCrunch 2013.)

Technology, Societal and Cultural Trends

There is currently one clear trend in IoT that would enable business today to evolve and improve. This is the transition from M2M to IoT, which essentially means that we are moving from a world of data collection to data usage. This is a distinction between IoT and M2M, it hinges partially on the sophistication around the usage of data. IoT is a technology that facilitates the automatized use of data generated by non-traditional end-point devices. Data is relayed through a network to an application that translates the events into meaningful information. Both IoT and M2M solutions are deployed in the same sectors such as automotive/transportation, smart homes, energy/utility, security/surveillance, public safety, financial services, retail, healthcare, industrial and warehousing/distribution. (Analysys Mason 2013b.) According to Analysys Mason's (2013a) report, there are three key changes that have driven the transition from M2M towards IoT; they are mainly the changes in the global business world, the social world and the communications world. The changes in the business world can be seen in Figure 10, where the developed economy has very slow growth compared to the emerging economies, which is growing 2-3 times as much.
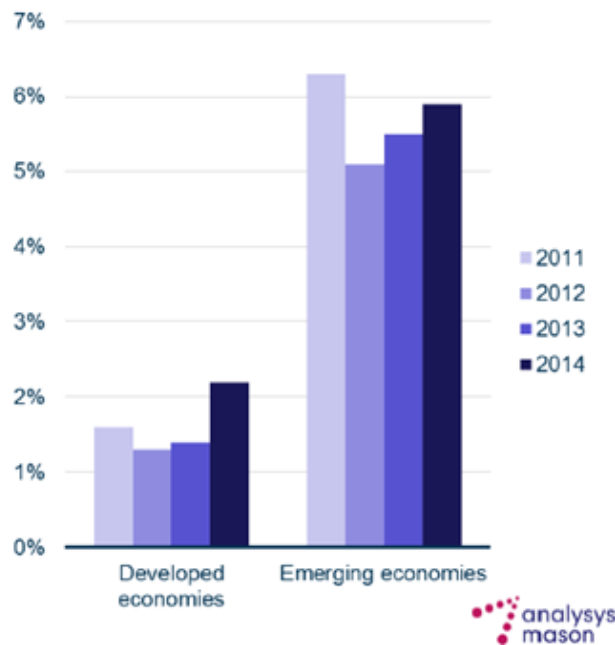
Figure 10. The global business world changes (Source: Analysys Mason, 2013)

This essentially means that the enterprises in all industry sectors in the developed markets must refocus on innovation and operational excellence. Nowadays information about us is everywhere and mobile apps have opened our eyes. It changes the way we live, communicate and share our lives compared to many years back.
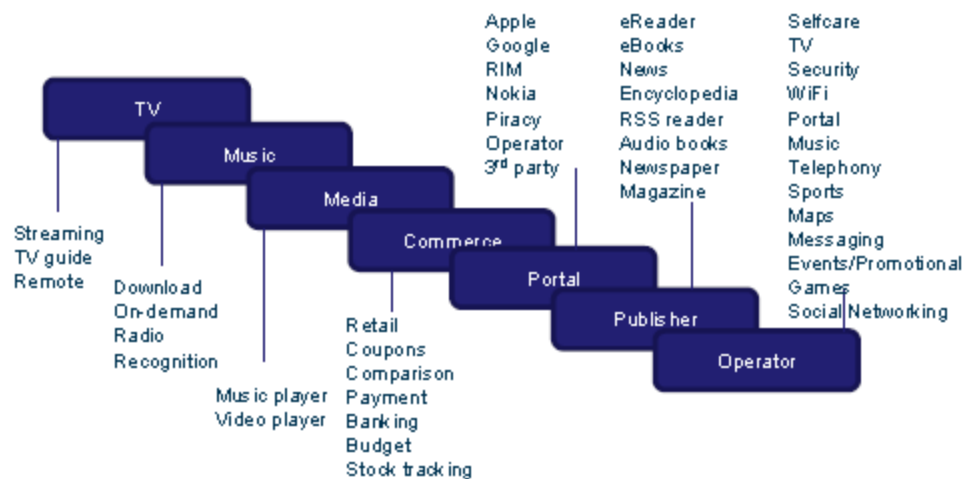
Figure 11. Social world changes (Source: Analysys Mason 2013)

Figure 11 above shows how much technological changes have happened. E.g. a TV that used to just project pictures and sounds can now be interactive and stream data.
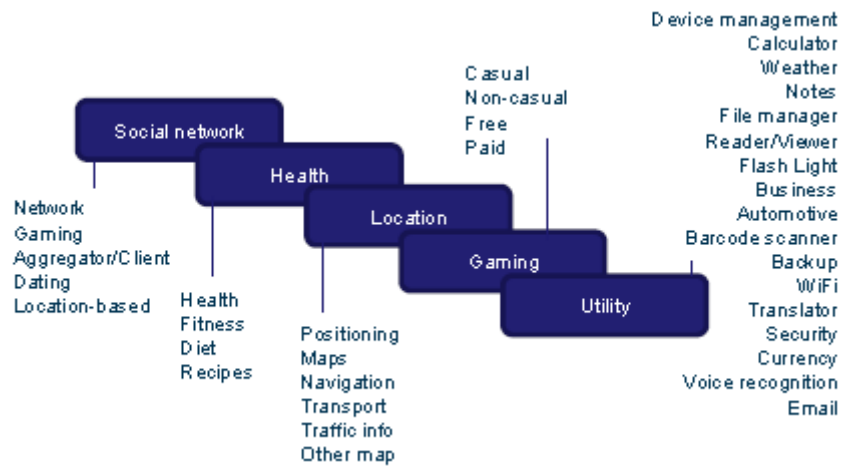
Figure 12. Social world changes – integration of data (Source: Analysys Mason 2013)

Enterprises recognize this trend and they can easily combine data from multiple sources to create tremendous business insights, as seen in Figure 12.

Figure 13 shows the Compound Annual Growth Rate (CAGR), which is a geometric progression ratio that provides a constant rate of return over the time period, for M2M/IoT communication devices versus the total traditional devices. Essentially, the year-to-year growth rate of investments in M2M/IoT is much larger compared to the traditional device connections.
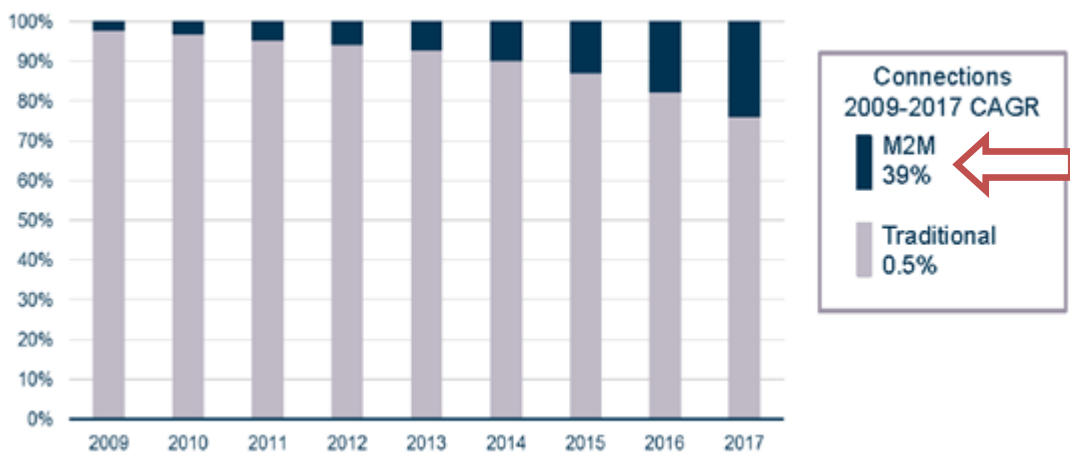
Figure 13. Communication changes (Source: Analysys Mason 2013)

These three key changes entail the evolution from M2M towards IoT. This transition also splits the two technologies to focus on separate customer target. In Figure 14. below, it can be seen clearly that M2M has industrial focus and IoT has consumer focus. We can say that the box "M2M Now" is where all these changes mentioned are recognized, a point where consumer lifestyles are taken into account and given more focus. Currently, there is a fine line between M2M and IoT, however M2M trajectory leads towards Industrial Internet and has a more business-to-business (B2B) focus, whereas IoT is more business-to-customer (B2C).
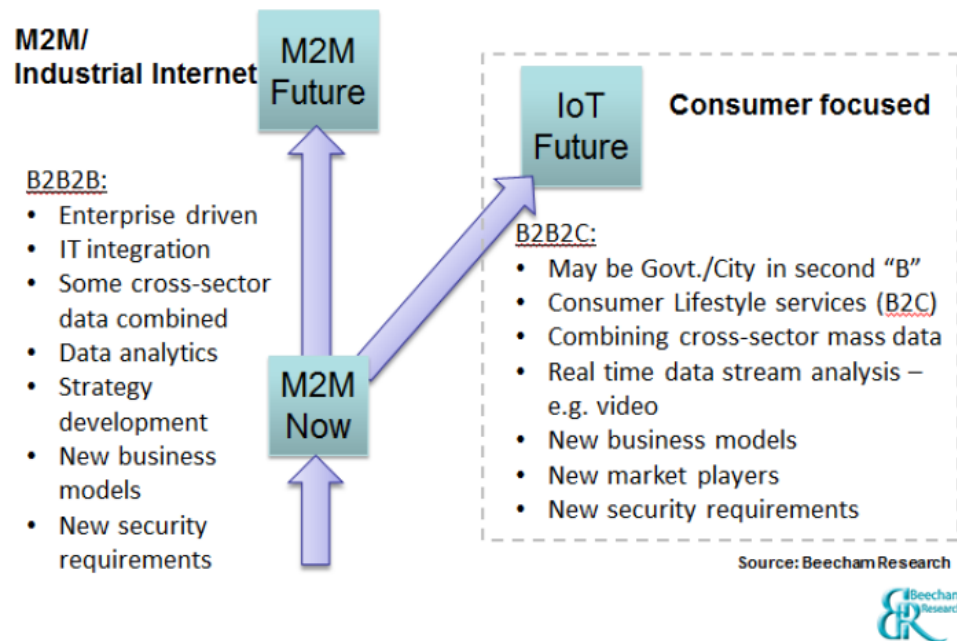
Figure 14. Transition from M2M towards IoT (Source: Beecham Research)

Transformation Impact on the IoT Ecosystems

Since this transition from solutions with M2M-approach to IoT-approach, one needs to identify the characteristics that highlight this change. A good method is to consider the M2M and IoT supply chain.

		M2M world	IoT world
Hardware	Chipset or SIM Modem and module Equipment	Custom devices, unintelligent terminals, high costs	Intelligent devices, processing power, power management
Connectivity	Connectivity Device platform	Hybrid network, non-differentiated tariffs	Mobile ubiquity, quality focused, global roaming
Applications	Application platform Application Systems integration	Customised, limited data analytics, varied platforms	Cloud applications, virtualisation, common platforms

Figure 15. M2M and IoT supply chains (Source: Analysys Mason 2013b)

All the three layers: hardware, connectivity and application layers of the supply chain will be affected as seen in Figure 15. The M2M hardware has been specialized and expensive, and had low processing power. When it comes to IoT, the hardware is expected to become more powerful, with increased processing capabilities and intelligence. Connectivity in M2M has been provided over a mix of fixed and mobile networks. IoT takes advantage of the mobile ubiquity and increased network quality and speed. There is anticipation on increased focus on service-level agreements associated with connectivity and the value-added services surrounding it. Applications in M2M have been customized, services-heavy deployments. Enterprises have had minimal data analytics capabilities and the usage of data flowing off M2M devices have not been use to full extent. IoT introduces cloud applications enabled by virtualization to make application deployment across common platforms feasible. Enterprises are anticipated to start using more data aggregation and analytic tools to drive cost savings and product/service innovation. They will be able to 'mash-up' data including geo-location, usage data, climate data and scientific data to provide new insights and information. This transformation in each of the three layers of the IoT/M2M supply chain will enable a series of changes in the industry during the next 5–7 years. New applications developments will accelerate and will change the way things are tracked, monitored and protected. The applications forecasted to increase include home energy management, predictive maintenance, surveillance and interactive advertising to mention a few. Another development involves home and automobiles. Machine-based intelligence coupled with ever-faster processing power and connectivity will make homes and automobiles epicenters of application-rich interactions. New partnerships in various forms will emerge between technology and equipment vendors; communications pro-

viders; application vendors; and services companies. IoT is going to encourage businesses to change BM and keep an open mind. It will encourage equipment vendors to offer software and services, services companies to price their offerings in new ways and manufacturers to change their supply chain dynamics. (Analysys Mason 2013b.)

Regulatory Trends

There are some regulatory mandates that carry influence on IoT business. Below in Figure 16 is a non-exhaustive list that gives some ideas on the rules that may affect the IoT BM and consequently sway customer demands.

Mandate	What it is
European Union: 80% smart meter penetration by 2020	To optimize the use of energy. The original 80% target was decreased to 72% penetration. (Source: http://www.metering.com/smart-meters-eu-will-miss-80-rollout-deadline-says-commission/)
European Union: e-call in new cars by 2015. (Procedure of these legislative acts by the European Parliament and the Council is still ongoing, the deadlines for implementation will most likely be the end of 2017 or early 2018.)	In case of a crash, an eCall-equipped car automatically calls the nearest emergency center. Even if no passenger is able to speak, e.g. due to injuries, a 'Minimum Set of Data' is sent, which includes the exact location of the crash site. (Source: http://ec.europa.eu/digital-agenda/en/ecall-time-saved-lives-saved)
USA – Smart meter adoption targets	The increased activities are centered on smart meters (Advanced Metering Infrastructure), data privacy issues; opt out policies and regulations promoting net metering and distributed generation programs. It is supported by the disbursement of almost $4.5 billion of American Recovery and Reinvestment Act funding targeted specifically to smart grid initiatives. (Source: http://www.eia.gov/analysis/studies/electricity/)
Brazil and Turkey reducing taxes on M2M SIM cards	Explicit legal and administrative barriers are being removed. (Source: https://machinaresearch.com/news/press-release-regulation-will-increasingly-disrupt-the-iot-landscape-survey/)
EU's General Data Protection Regulation	The key issues are regarding data ownership and sovereignty as well as the "right to be forgotten". (Source: https://machinaresearch.com/news/press-release-regulation-will-increasingly-disrupt-the-iot-landscape-survey/)
Some countries have requirements for SIMs	SIMs must be registered to particular person or legal entity at the point of activation. This removes some flexibility in selling pre-activated off-the-shelf M2M devices. (Source:

Figure 16. Regulatory Mandates affecting IoT

2.3 Value Propositions and IoT Market Segmentation

In the recent years Customer Value Proposition (CVP) has become one of the most used terms in the business markets. What is meant by value proposition? There is no agreement as to neither what it is comprised of, nor what makes a value proposition convincing. Companies may suggest benefits to customers and claims of cost savings, but it is not believable without any proof. (Anderson et al. 2006.) According to Barnes et al. (2009), value propositions answer the questions such as whether a company is in the right business or not and if it is pursuing the right sales opportunities. Furthermore, the company must know whether it has the correct suppliers. They also stated that it is important for value propositions to be related to a specific market segment, as it is in that context that those propositions have the most meaning. One of the first steps that Barnes et al. (2009), introduced in their value proposition builder is the knowledge of the market. This input to the value proposition process requires that the company analyses and identifies the market segments or target customers for whom the solution has the potential to deliver value. When looking at the literature for IoT, we can see that it presents challenges to companies and researchers alike as to what considerations to take when looking into the IoT market segment. There seems to be a few ways to present this. The IoT market segmentation can either show the broad marketing strategies as well as the subsets of consumers to target, or it can show geographies like the one considered by Marketsandmarkets.com (2014), a competitive intelligence and market research firm.

Teich (2014), the CTO of Moor Insights & Strategy, takes into account behavioral tensions in describing the segment: needs for existence vs. experience, and input from industrial vs. human. The differentiated behavior defines a class of IoT devices and services see Figure 17. This way of segmenting shows how IoT system can target the different human needs in order to enhance and improve them. It is a good input to understanding what value propositions companies should think about. Grönroos (2011) described value propositions as what the
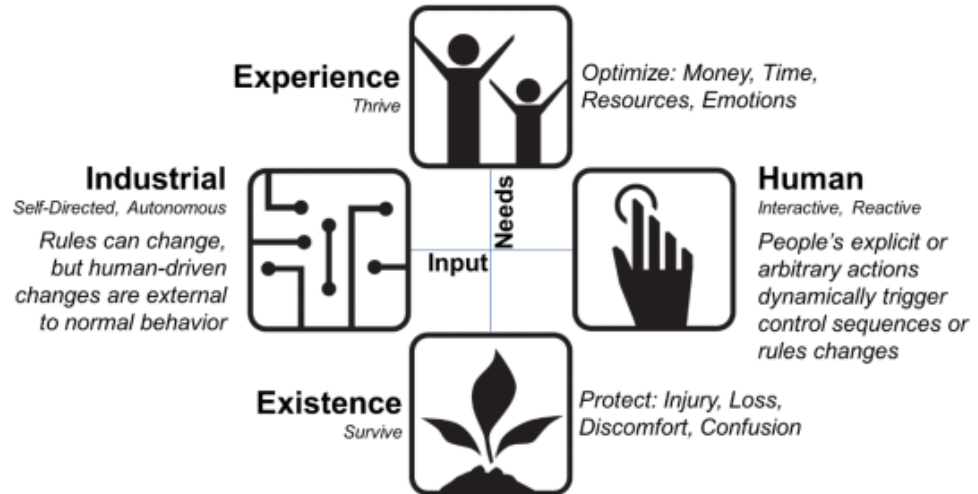
Figure 17. IoT Behavioral Tensions (Source: Moor Insights & Strategy)

market promises as potential value. Lusch et al, (2010) considered value proposition to offer a connection between competences and relationships and should be revised in response to the changing customer. In the research by Rintamäki & Kuusela (2007), they described two distinct perspectives to customer's perceived value and value proposition from the firms. The customer's view, which is essentially the subjective assessment of value due to the consequence of utilising a product or service, whether positive or negative, which leads to the ultimate decision to buy the offering. On the other hand, the company's perspective which is to capture those buying motives of the customer in a value proposition, making it a strategic issue in areas such as market segmentation and service development, hence, linking the customer and company in the marketing concept.

To continue with IoT market segmentation, we look at the IoT sector map from Beecham Research, in order to see a broader view of the industries and sectors. In Figure 18 a rather complex looking view of the IoT market segmentation is shown, which is divided into nine key service sectors. These service sectors representing different industries are from left to right, in the inmost semicircle: (1) Buildings, (2) Energy, (3) Consumer & Home, (4) Healthcare & Life Science, (5) Industrial, (6) Transportation, (7) Retail, (8) Security/Public Sector and (9) IT & Networks. Each sector is divided further into a number of market segments, respectively. The markets are segmented according to industry, as this is the most logical way to look at it. The horizontal market would naturally be serving across the pie.
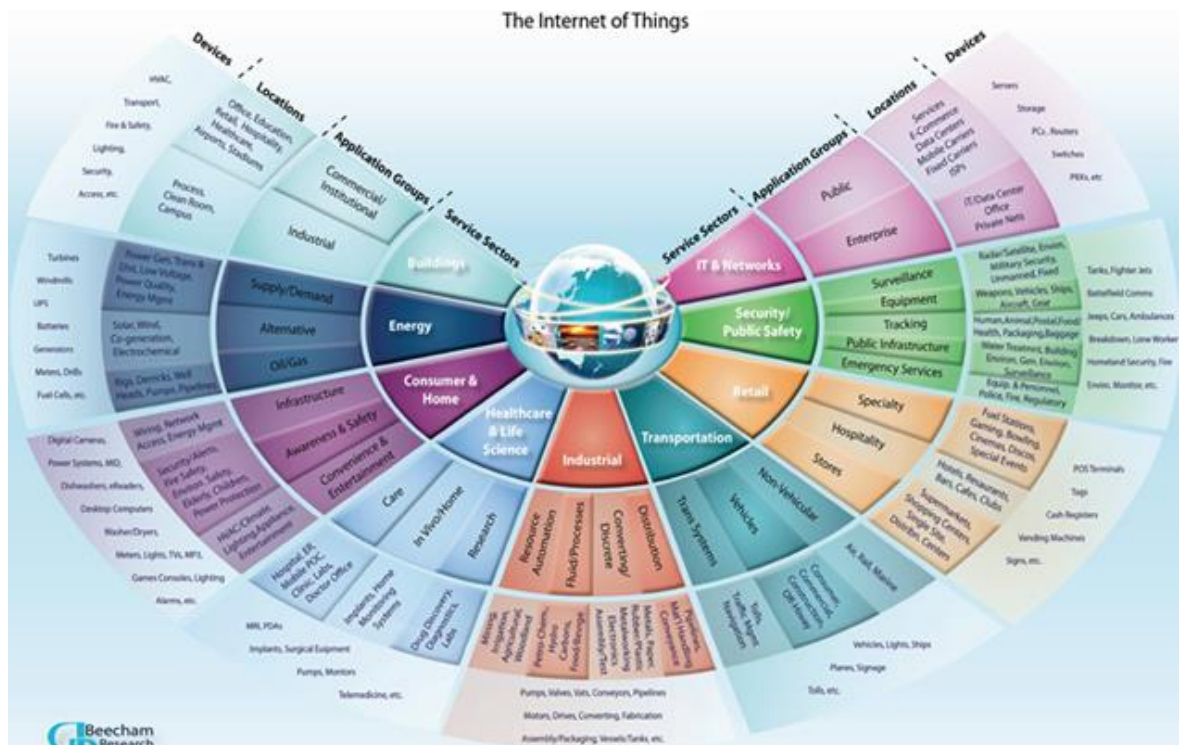
Figure 18. The IoT sectors (Source: Beecham Research)

Then let us have a look at one of the sectors and take that as an example for elaborating the rest of the semicircle. E.g. sector (3), which is the Consumer & Home, is divers and rapidly changing at present and is divided into three market segments: Infrastructure, Awareness & Safety, and Convenience & Entertainment, also known as application group as seen in Figure 19. The "locations" indicate what is included in the different application group e.g. included in
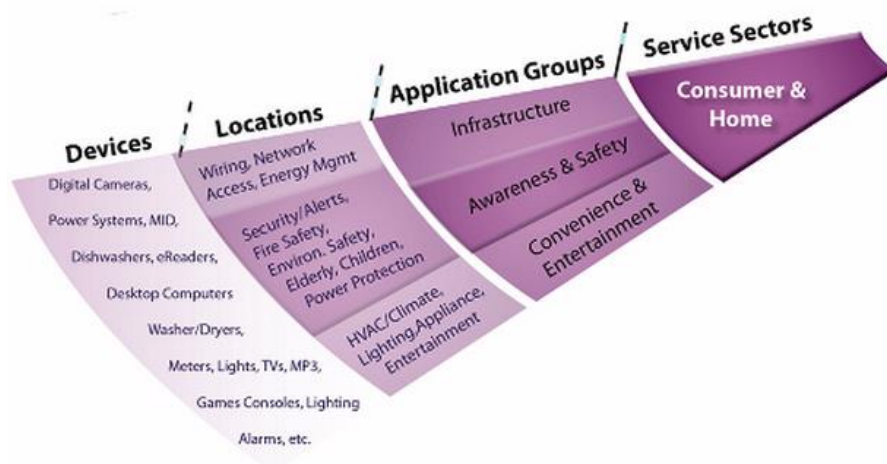
Figure 19. The Consumer & Home market segment (Source: Beecham Research)

Infrastructure is wiring, network access and energy management, which is essentially indicating the how different things are used. And finally Devices are means to deliver services to the end user and they are the interface towards the indicated applications e.g. washers/dryers are ap-

pliances to make life more convenient; TV and games on the other hand are entertainment to end users. This market segmentation shows clearly a path to what target markets a company should aim for depending on the products and services they offer.

Example of IoT Companies and their Value to Customers

There are a vast amount of IoT companies out there; most of them are still searching for the right business model to implement. However, there are a selected few that are making the international news headlines. The table below includes some examples, non-exhaustive, of companies benchmarked from various sources that are currently paving the way. The companies are categorized as 'State of the Art', meaning they incorporate the newest ideas and features; 'Big companies', that are large-sized or employ more than 500 staff; and 'Rising stars', those companies that are growing and gaining importance quickly. All these examples have more or less established ecosystems. One rather common feature to all of these companies is the 'Partnership' and 'Crowdsourcing' ecosystem. The value offered by the different BMs is also mentioned.

Category	Company name/ Business area	IoT Ecosystem	How / Value offered (Business Model)
State of the Art	**Tindie** (Source:www.tindie.com) This is a unique platform for IoT hardware makers. Tindie is a marketplace, as a way for makers to bring their creations to market. In a year and a half, over 1,900 products have been listed by over 400 maker businesses.	Open Hardware, partnership	Much like a software platform, they link makers together e.g. to complement each other's creations. They provide a market place in order to sell that hardware. They allow people to form a community to exchange ideas. The main business is however the marketplace. But the value a maker gets by joining is networking and expansion. This business model is a multisided platform, where value is created by facilitating interactions between different groups.
	ThingWorx (Source:www.ThingWorx.com) The ThingWorx platform provides a complete application design, runtime, and intelligence environment, allowing organizations to rapidly create M2M applications and innovative solutions.	Cloud Service, partnership	ThingWorx focuses on the end data rather than how the data is collected. With a cloud management system, it allows its customers to integrate and transform the created data. The ease of use of their platform is enabled by key characteristics such as mashup (two or more application working together), searchable, ease to compose and crowdsourcing (by using social networks to allow collaboration).
	Cooking Hacks (Source: http://www.cooking-	Hardware, crowdsourcing	A model similar to Tindie in a way that they are an online retail store.

	hacks.com/) Is a hardware division of Libelium. They focus on teaching individuals to do-it-yourself (DIY) .		They bring the IoT to everyone by making electronics affordable, easy to learn and fun. The difference is that they take the "cooking" approach where projects are described with step-by-step instructions. They sell hardware in kits, much like for crafts.
Rising stars	**Libelium** (Source:www.libelium.com) Libelium delivers a powerful, modular, easy to program open source sensor platform for the IoT. The platform enables system integrators to implement reliable IoT solutions with minimum time to market.	Horizontal Platform / Hardware, Software, partnership, community	Their business model is like "the long tail' approach where they focus on offering a large number of niche products. It has low inventory costs and strong platforms to make niche content readily available. Their most significant product is the Waspmote Sensor platform. Like building LEGO blocks, Libelium allows their customers /partners (the system integrators) to utilize their platform for building products/services to serve end users. They have a horizontal approach to market. The partnerships also suggest a sort of 'multi-sided business model'. This combination puts them in a strong position to access bigger accounts.
	Xively (Source: www.xively.com) Is a division of LogMeIn Inc that focuses on IoT.	Cloud services, Partnership	This company's business model is mainly service and consulting as well as data sending and receiving through their platform. They provide tools and help individuals as well as companies to build and manage connected applications and products, thus offering them a faster way to go to market.
	NEST – a Google acquired company (Source: www.nest.com) Nest is a company that manufactures thermostat and smoke alarms.	Home Automation	The company offers products that have sensors, Wi-Fi enabled, self-learning and programmable.
Big companies	**ARM** (Source: www.arm.com) ARM is the world's leading semiconductor intellectual property (IP) supplier.	Partnership: Silicon, Cloud, Device, Community	ARM's business model is based on licensing the core technology to different partners. In IoT they address the common needs like drivers, device security, and provisioning for devices. They also aim at the common needs of network connectivity. Their solution's value propositions target challenges of fragmentation, standards for connectivity and faster time to market, to mention a few.
	Bosch (Source: www.Bosch.com)	Hardware, Software	They connect **all their things** to Internet, and extend their offerings with apps and services

Bosch produces millions of products for consumers, provides automotive technology, energy and building technology and industrial technology.		through their software platforms. Bosch aims to explore new BMs in the open space such as Freemium, Open innovation, Value capturing and Proximity marketing to drive their IoT ventures. These BM have been deemed successful in the Internet space.
Google (Source: www.google.com) Google is a global technology company focused on connecting people with information.	Internet platform	It has acquired several IoT related companies in the past few years: Google acquired Nest Labs; which kept its name. Nest Labs acquired DropCam in June 2014; in 2013 it acquired Waze, which offers a community based traffic and navigation apps used by drivers for real-time traffic and road info; it also acquired several other robotics, AI, and computer vision companies.

Figure 20. Examples of successful IoT companies

Tindie, ThingWorx and Cooking Hacks are categorized as State of the Art because of their unique offerings that addresses the new challenges in IoT. Tindie offers 'makers', who can be normal people which have the interest in making gadgets with IoT functionality. They need a space to trade and grow as well as learn. Tindie offers them a marketplace, hence addressing both their need to explore and expand. There has been M2M platform in the market e.g. Eclipse, that focus on node communication and the web. ThingWorx brings a new solution in that sense that they focus on what to do with the data after it has been connected. Addressing clearly challenges one step further.

2.4   IoT Business Challenges

According to the survey of the Economist Intelligence Unit, (2013), there are several obstacles arising from the increased usage of IoT. Furthermore, there is low interest on investing in IoT, despite of the wide interest. There is a lack of employee and management IoT skills and knowledge. IoT specific skills are needed for the next stage of development e.g. when firms move from research stage towards planning they need to have people with IoT technology competence. When it comes to sales and marketing employees will need to be able to sell the benefits of the IoT in terms that consumers can understand. It is difficult for firms to identify IoT applications for existing products and services or have commitment without the knowledge and skills of employees and management. The same goes for spotting products and

services that do not have an obvious IoT element to them. The gap is addressed by hiring IoT talent, consultants and moving executives up the IoT learning curve. Successful IoT rollouts require interconnected networks of products and services, but few senior executives currently expect their business to become more co-operative with competitors as a result of IoT. This observation will hinder interconnectivity and does not promote interoperability between organizations. As a result, with the high number of predicted smart object to hit the market in a few years, there is a risk that IoT will become heavy on "objects" and light on interconnectivity.

One of the major challenges is that IoT will generate an explosive amount of data. Firms need to be prepared for this. It is not just about storing, securing and analyzing the data but also how they manage the commercial sharing of the data as the IoT becomes a platform for trading information. In addition, firms will need talented IoT people to recognize new revenue streams emerging from the data. Additional challenges lie in the immaturity of industry standards around the IoT and high costs of required investment in IoT infrastructure.

The unclear business model for IoT is something that firms see as an obstacle. Many firms are trying the waters with existing Internet BM such as Freemium and Mass Customization. However, like everything new, nobody can see this at an early stage. It will not be until several years when the market takes off that an obvious model will emerge. Compare this to the Internet: Google and Amazon were not immediately forged at its birth but decades later. (Economist Intelligence Unit 2013, www.forbes.com.)

Privacy issues are a challenge that firms need to tackle. 100% defense of perimeter may be impossible, but IoT solution providers and enterprises need to work together to develop security that strengthens and protects break points and also enables rapid detection and mitigation of security breaches. (Deloitte 2014.)

To briefly summarize this section, what were discussed here were the main business challenges pertaining to IoT that may hinder its deployment. These are the need for skilled IoT personnel in salesforce and management; immature standardizations; lack of interconnectivity and interoperability; the lack of a dominant business model in IoT; and security issues. In order to mitigate the risks when proceeding forward, companies should be aware of these challenges and assess their own capabilities in these areas.

2.5   Conceptual Framework

This section introduces the relevant concepts and their relationship discovered from the literature review that guides the study and help answer the research questions. The study ideas were primarily based on the actual open questions from the sponsor company and the possibilities seen to pursue the research project. After the initial exploratory research based on expert opinions and some literature review, I analyzed the business model framework by Osterwalder (2010) in order to reflect on some of the ideas. To serve our purpose, the main focus of this study is to explore the Value Proposition, one of the nine building blocks described by Osterwalder's business canvas. By that we mean the value that seeks to solve customer problems and satisfy customer needs (Osterwalder, 2010). That is not the whole framework for the study however: the Empathy Map was also used to get a deeper understanding of different customer insights to value. This map was used as a part of Osterwalder's business model generation. Finally, the marketing concepts of customer value, value creation & co-creation, as well as value propositions from various literature sources that were cited in the literature review also form a part of the marketing value framework e.g. Grönroos 2011, Grönroos 2008, Vargo & Lusch 2004, Rintamäki & Kuusela 2007, Anderson et al. 2006.

I also came across the term *business ecosystem* in this research and have explained it reflecting the ideas of Mazhelis et al, (2011) with the perspectives of Moore J. F. (1996), Iansiti & Levien (2004), and Talvitie (2011). The ecosystem can be defined to each business or service area. The findings discovered in the study will be discussed with respect to the value creation and proposition concepts as well as concepts related to BM.

Figure 21 below summarizes the conceptual framework that is used to guide the data collection and analysis. It shows the relationships of the key concepts discussed in the literature review and the key points of the research questions. In an IoT landscape each company has its own ecosystem in which the company interacts. Within that ecosystem there are many actors, including customers and competitors, who may also be partners. The relationships between these competitors and partners determine how they create value for their common customers. They also dictate the way value can be captured. Each company has its own strategy for doing business within the ecosystem, which is reflected in its business model.
The center of the business model, and also the focus of this study, revolves around the value propositions. The rectangle in the middle of the picture is divided into two parts:

- the lower part shows the relationship between the company and its customers and the value proposition that it explores in its business model based on the *needs*, *pains* and *gains* of its customers;
- the upper blue triangle shows the relationship between the company, its partners and competitors as well as the customers they commonly serve within the IoT ecosystem. Their relationship determines the way they create and capture value.

The link between the value proposition and capturing value is the ability of the company to influence the customers' willingness to pay for their offering based on the *benefit* the customers perceive.
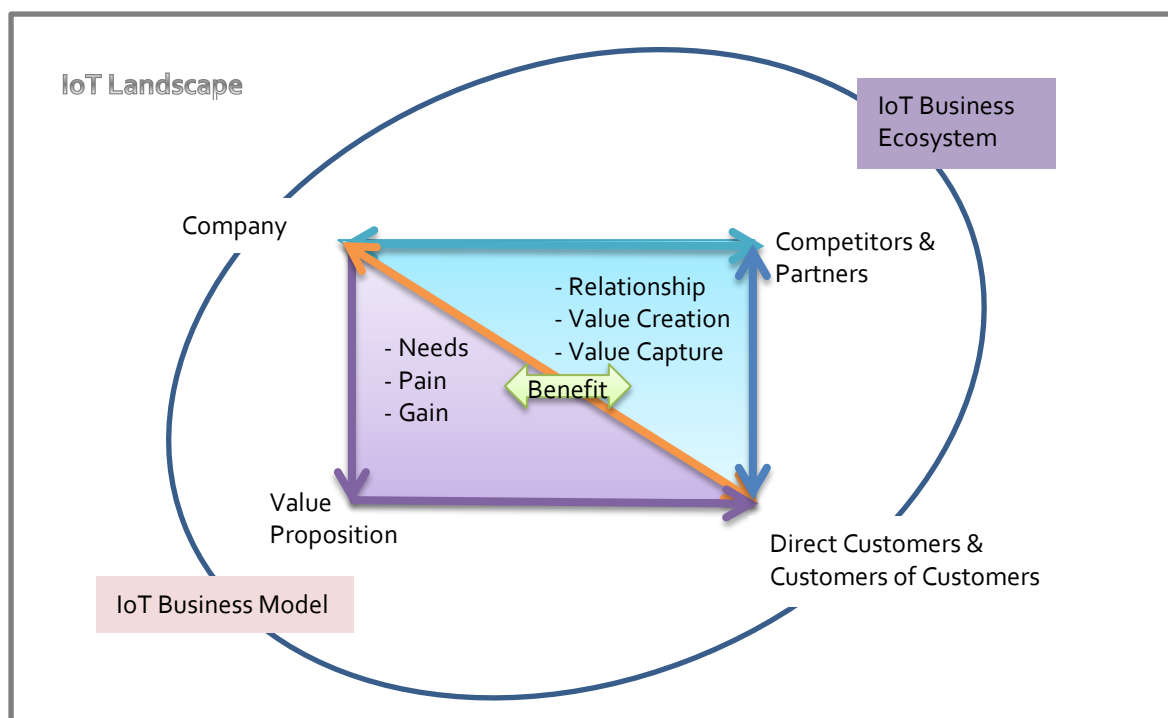
Figure 21. The conceptual framework of the study (Van Leemput, E. 2014)

3   Research Methodology

In this chapter we discuss the research design of this study. We will go through the research philosophy, research approach, strategies and so on leading to the data collection and analysis. This will let us determine the various methods and procedures through which I, as the researcher, create a relationship between the research objectives and the questions. It also explains my principles, beliefs and values that guided the conducting of this research. (Saunders & Lewis. 2012, 104-107.)

Ontology

Ontology is known as the researcher's view of the nature of reality. As the researcher, it is important for me to understand what assumptions I make about the world around me through the knowledge of my own values and beliefs. These unstated conventions will determine the actions I take in the study and the approach to which I will collect data. (Saunders et al. 2009, 110-119, Saunders & Lewis. 2012, 104-109.)

In this study I have an interest in understanding the social world of the research subjects. One of the objectives of the study is to understand the customer needs for IoT, and by that we mean to see how IoT affects the customers. I empathize with the customer, or end user, in this perspective because the technology changes people's social interactions and everyone's lives is therefore affected. In this case, I take a customer stance and have a personal interest in learning the value and risks related to the technology offered. On the other hand, I can also relate to the company as a business. Here, I mean the marketing and customer relations part of the company, where people interact with each other to understand the customer need (demand) and what the company offers (supply). By understanding the customers, the company is able to strategically take actions to enhance their business and thrive to be sustainable. From this perspective, it is difficult for me as the researcher to be impartial.

Based on this it can be determined which two aspects of ontology is better suited for this study. Objectivism argues that social entities exist in reality without any link to the social actors within them, which assumes that it does not matter what the social actors do. (Saunders et al. 2009.110.) That argument can however be ruled out because I would like to think that people involved can change how companies are run and how they see their customers. My involvement and assumptions for the study indicates that I, as the researcher, have a subjective perspective, which may change over time. Subjectivism is a view that has to do with accepting

perceptions and consequent actions of social actors in forming a social phenomenon. Furthermore, admitting that the social phenomenon is in constant state of revision and development due to the nature of continual process of social interactions. (Saunders et al. 2009.111.)

Epistemology

By the term Epistemology, Saunders et al. (2009.112-116), refers to what the researcher considers as acceptable knowledge in this field of study. Essentially it is the information which the researcher considers to be valuable and important enough to be taken into account in this study. This research was conducted with face-to-face interviews, which allows me more room for interpretation of the data gained, because I can probe further and build on the interviewee's responses. This same idea goes for the observations and workshops; I have better and prolonged contact with the people involved which enable me to get a more thorough view.

There are four options of research philosophies that I can choose from; positivism, realism, interpretivism and pragmatic. We can shortly characterize these philosophies; both positivism and realism relates to scientific enquiry. While positivism is concerned with cause and effect, realism believes in what you see is what you get philosophy (direct realism), as well as senses showing us reality as the truth (critical realism). Both realism views argue therefore that objects have an existence independent of the human mind. Interpretivism on the other hand is a philosophy that allows the researcher to interpret the meaning given to a certain matter rather than the matter itself. This also brings my values, as the researcher, into perspective, which we can elaborate with Axiology in the next section. Understanding the social world of the research subject from their point of view is a key character for this way of thinking. (Saunders & Lewis. 2012.104-107.) Pragmatism reasoning lies on the research questions and objectives itself. This means that the most important determinant of my view of reality, the assumptions I make, as well as my values as the researcher, is more likely to be guided by what is possible. (Saunders et al.2009.109.)

For this study, I, as the researcher, would need to decide on what knowledge is acceptable. For instance should I focus on facts and details or feelings and attitudes? Based on the four thinking above, this research would be leaning highly towards interpretivism. This viewpoint understands the deeper meanings of what has been said. (Saunders et al. 2009.121.) Besides the face-to-face interviews, I also followed interactions and observed the values as well as perspectives of different actors involved in the project. The observation part of the study involved me partaking in activities for a period of eight months. During this time I have been

able to observe and study interactions between different social entities within their natural environment. This experience gives me the opportunity to grasp the deeper concerns of the party involved from their own view points.

Axiology

Axiology refers to the values of the researcher and how it is reflected in the research project as well as how it will affect the end result of the study. I can excerpt my own values to the study through making judgments on the research and how to go about doing it. Naturally, my values are visible in every step of the research. The choices that one makes as a researcher is reflected in the whole process of the research project, from designing the study to the means of conducting it. For this research, I always keep in mind my own values throughout the progress of the study. Also I have been involved in the research itself as an active participant and an observer, which indicates this research is value bound. (Saunders et al. 2009.116-117,119.)

It is important therefore, that I myself, as the researcher, be as objective as possible and ethical in my value judgments. The main thing is to be honest to yourself as well as fellow researchers. And understand that the researcher values have potential to influence on how one draws conclusions for this study. (Saunders et al. 2009.118.)

3.1   Research Process

The research work was conducted between March 2013 and November 2013. The idea and opportunity to conduct the study presented itself when I got involved in a project from the R&D department in Company X. This involvement meant access to information and meeting relevant people for the study. The project focused on an emerging technology which was new and exciting, and that of course presented its own challenges. However, it was an obvious choice and starting point to run a study. The topic was initially unclear however, to narrow down the broader view, I engaged in unofficial discussions through different channels and occasions; meetings, workshops, conferences, and the supervisor from the company side. Further information was then gathered through exploring available literature.

Some challenges in the process at this stage that are perhaps worth mentioning were the difficulty in getting a big picture and focus on the underlying problem. One thing was clear; there was a need for further investigation of the phenomenon. The research project in which I was involved in has efforts to study different aspects of IoT concept; from theory to application. I

was fortunate to be involved in the ecosystem work package, which largely contributed to getting the right people for the interviews in this study. The business model was also in use to analyze new opportunities. But it is used with different level of competence, the broadness of the model itself makes it challenging to study. I decided on particularly focusing on one of the building blocks of the business model, mainly the value proposition block because it is the core of the business model. The value proposition is what a company needs to focus on in order to differentiate themselves from others, whether the offerings and products are the same. It caters to specific requirements of the customer. (Osterwalder & Pigneur. 2010.22) This is particularly true for the chosen topic, IoT, because it is a relatively new concept, which has untapped potentials. Reilly (2003) defines further what we mean by value in this context; buyers have their own interpretation of their needs, wants, desires, objectives, and constraints, and they make purchasing decisions based on those.

Altogether there were five case interviews. The persons were selected for the interviews firstly based on their involvement in IoT and their company's business strategies, secondly their accessibility either by direct approach or through someone the researcher knows. Four of the companies were based in Finland and one in Spain. Due to the IoT concept being relatively new and strategically sensitive information may be disclosed, it was agreed in the beginning of the interviews that the identities of both companies and interviewees would not be revealed. They are small and medium sized companies. We can describe each case shortly however, to get a better idea of what the companies do to understand their relevance in the study. And since there are no company names, we can also indicate the role of the person interviewed at the time. The interviews were conducted with variable intervals, but some time was anyhow left between interviews in order to transcribe and improve questions.

Case company 1:
This company focused on IoT right from the beginning, having acquired their business from another company less than five years ago. They specialize in public transport information management and traffic light priorities. They and their partners provide and maintain solutions for collecting, analyzing and processing real-time traffic data. In addition to their products, they are also involved in various national and international research projects related to intelligent transport systems and logistics. The person interviewed in this company was their Business Development Director.

Case company 2:

This second company was also established within the past five years. However, the founders have had many years of experience in the ICT field. They offer high quality sensor-based ICT solutions for different industries e.g. health care. They are focused on clean technology to promote sustainable development. Their solutions are based on a sensor network, wireless terminals, as well as efficient 4G telecommunications. The health care services are designed to support patients' institutional and home rehabilitation and are tablet-based communication solutions. The person interviewed in this company was the CEO and founder.

Case company 3:

This third company is focused on information security consulting. What they do is advice, build, develop and inspect their customers' information security capabilities as an independent advisor. They essentially aim to ensure continuity for their customer's business and Internet services by anticipating and preventing information security-related risks. Their interest and target within IoT is Industrial Internet. They offer consultation for prevention of industrial espionage and cyber threats. Additionally, they also offer security options for network architecture in migration from old production systems into a new one. The person interviewed in this company was a Director and Head of Software Development business.

Case company 4:

The fourth company is a Spanish based company that focuses on modular and easy to program open source sensor platform as well as wireless sensor network. They have a community of over a couple of thousands developers internationally. The company offers intelligent sensor platforms, which are composed of open source software and are known for their robustness, their ability to easily incorporate tens of different sensors, and their ability to operate over long distances. The solutions can be used for a variety of functions; anything from detecting fires or monitoring crops, to evaluating air quality, measuring water consumption, or creating parking systems that let the driver know when spaces become available. The unique capabilities of the sensors are that they can be configured differently and once put together; they create an intelligent network capable of transmitting information long-distance, regardless of the physical environment. The person interviewed for this company was one of their co-founders.

Case company 5:

This case is a more established company with international business. The interview however was with their Finnish headquarters. They have about five branches distributed into different areas in Finland. The company in Finland is a leading supplier of smart power generation solutions for power plants and they offer marine solutions. Besides powering ships, in the marine industry they offer design, engines, generating sets, reduction gears, propulsion equipment, automation and power distribution systems. They are mostly into Industrial Internet or M2M e.g. monitoring and sensing in shipments and logistics. The person interviewed here is a Solution Architect in the Customer Operations Systems.

The interviews were mainly recorded by Dictaphone and afterwards transcribed into written format. Exceptionally one of the interviews was done via email due to location and possibility constraints. All interviews except one were in English. The interview done in Finnish was transcribed then translated. The duration of the interviews varied between 20-40 minutes, which also included some free comments in the end of the interview. One of the face-to-face interview contained slide shows as well and an in-depth introduction to the company, which gave very good and meaningful insights. I have met and talked to four of the five persons interviewed in different occasions prior to the interview. Some of them multiple times and therefore there was no barrier for discussing this topic. And this allowed me to go straight to the point in the interviews for these cases. The interviewee in case five is someone that I reached through personal contact. The interview for this case naturally came with full introduction of the topic and the purpose of the interview. The location for the interviews varied according to the company premises where they were held in meeting rooms.

In addition to interviews there were also workshops and seminars held during the research period, which the researcher participated in. The workshops were interactive and consisted of participants from both companies and universities nationally. The topics for the workshops were mainly regarding the IoT ecosystem and its development and how participants viewed their roles in them. The workshops were also sequential, meaning the development work continued in multiple workshops. But there were also new ones, e.g. Smart City topics, which gave a different perspective to observation, as Smart City is one application area which IoT is projected for. These fieldworks were documented by written notes. Conferences and seminars were mostly internationally oriented. Participants in those were company representatives and researchers internationally. The topics were on the broader IoT concepts encompassing dif-

ferent aspects of IoT and its challenges. Besides getting information through their specific speeches, I also had the chance to unofficially interview many of the experts in the field.

Data collected through qualitative interviews normally result in non-standardized data, which will need to be prepared and classified into categories. (Saunders et al.2009.482) The recorded audio files during the interviews were transcribed, or converted into text, and I then went through all of them manually highlighting important points pertaining to the objectives. After which the transcript were coded with the aid of Nvivo tool, this means the processing was done electronically in oppose to having labeled the transcripts, cutting them and gluing them back in groups manually. It is just a matter of preference; the tool does the same thing. After labeling the entries the data was categorized and analyzed. The notes from the fieldwork were summarized.

3.2   Research Method

The research approach best suited for this study would be inductive, bearing in mind the purpose of the study, and the methods that are best suited to explore the emerging area in this study. Inductive approach lets you first understand the nature of the problem. By analyzing the data collected, I can then make sense of the problem. In an inductive approach, formulation of the theory comes afterwards when the data is analyzed. It considers the consequences of people's actions based on the way they perceived the phenomena. The flexible methodology of an inductive approach allows for alternative explanations of what is going on. The focus of this study is concerned with a specific context at which events take place, therefore through inductive research; a small sample of subjects is studied through conducting of interviews. Inductive research is further characterized by the researcher being part of the research process. In this study, that holds true as I have been all the time involved in the process through observations and active participation in different events. There is also less concern for generalization of outcome in this case. (Saunders et al. 2009.124-127.)

Strategy

In this study, the changes happening in society due to technological advances that affects the way people live, work and socialize leads to gradual change in consumer needs and behavior. While the technology itself is not new, and the companies have a certain understanding of the phenomenon, it also changes the way products are being marketed, social acceptance is becoming more emphasized. The study is concerned with how those consumer needs are con-

sidered and taken into account by companies, consequently, the way that companies can thrive with the new phenomenon in the long run. This is an exploratory study, which focuses on seeking new insights to a certain phenomenon and assesses topics in new light. An exploratory research is suitable for when the phenomenon or a part of it is not so well understood yet. (Saunders & Lewis.2012.110.) Further considerations for the exploratory research are that the topic may be more or less understood. The quality of an exploratory study depends much on the researcher's skills to observe, collect information and construct explanation. (Ghauri & Gronhaug.2010.56.)

Techniques and Procedures

This research has been accumulated by combining information attained from a range of primary and secondary research sources. In addition to analyzing official corporate announcements, media reports, and industry statements, I sought opinions from leading industry players and research groups within the IoT consortium and during seminars to derive an unbiased, accurate and objective mix of market trends, forecasts and the future prospects of the IoT industry.

The study collects primary data through case interviews and observation data from interviews as well as fieldwork (workshops and seminars). The case interviews are qualitative research interviews and conducted with semi-structured methods. This interview method is suitable when the researcher is unsure of the answers given by respondents. Furthermore, in a semi-structured interview I can ask the questions in any order needed depending on the situation, alternatively some questions may be omitted if not needed or questions are added to find out further details, e.g. to check the researcher's own understanding. (Saunders & Lewis.2012.151.)

The second part of the primary data collecting mentioned was observation, which can be a rewarding and enlightening part of research and adds richness to the research data. By means of observation, the researcher is able to discover meanings that people attach to their actions. (Saunders et al.2009.288.) To elaborate on the meaning of observation in this study, we refer to the term used interchangeably with it, 'fieldwork'. In this context, fieldwork means any data collection that happens in the field or at a research site. This way of doing observation also requires that the researcher is aware of the context, values and background of the site being studied. While collecting data for this study, I was involved in the project that is researching the topic, therefore I was able to join a number of activities which allows me to have pro-

longed engagement with different involved parties. Consequently, the roles that different people play within the research site become clear. (Saven-Baden & Major.2013.339.)

The approach best describing the fieldwork done for this study would be Insider fieldwork which essentially refers to the researcher investigation in the contexts in which they work. An advantage considered for this approach is that I gain considerable knowledge compared to an outsider view. However, I also have to be aware of the downside which is blurring of boundaries between researchers and subjects of research. Additionally, the difficulties of having insider knowledge may affect the outcome with missing information, false assumptions or misinterpretation of data. (Saven-Baden & Major.2013.343.) I have been wary of the challenges of this type of approach and the research setting is normally a professional one, meaning every participant in workshops or seminars either represent a company or university. Furthermore, the purpose of the fieldwork is to observe what people actually do and say when they are in the context of the study, without being in their actual role in the company. The good thing about doing insider observation, which opened up many doors, was the fact that it was an overt fieldwork. This means that the parties involved are aware that I am also doing the study while participating in the activities as a company representative. Requesting for information as well as getting participants to agree to interviews was much simplified. (Saven-Baden & Major.2013.344.)

The secondary data is collected through Internet search. The use of secondary data as a method to help answer the questions and objectives can save time and resources since I do not need to collect the data myself, analyze nor interpret them. Hence, there can be more effort on theoretical aims and the actual issues. The surveys most useful for the topic of this study were derived from market research and published reports, e.g. Beecham research, Gartner, Analysis Mason. When accessing and using secondary market research I need to be mindful of the data being collected. The data may have different purpose and might not be suitable to this study. (Saunders et al. 2009.)

3.3   Research Questions

The research questions below are open-ended, allowing flexibility for interviewees to answer. The types of questions are also specifying, meaning the topic is known and some more aspects of it is needed. There are also probing questions to go deeper into the topic or to clarify what has been said. (Saunders & Lewis.2012.156.)

Themes	Interview Questions	Objectives
Values / Company needs	1. Can you describe the value that Internet of Things (IoT) deliver to your company? 1a. What types of possible benefits does Internet of Things provide you? 2a. Can you give examples (of previous)?	To establish whether the company itself sees the value for themselves or for their customer. The company here is seen as a B2B partner in this case.
Challenges / new opportunities	2. Can you describe one of your challenges that Internet of Things help solve? 2a. Or maybe opportunities it has brought? 2b. Please give examples.	To better understand the company's needs leading to new opportunities and challenges.
IoT offers / possibilities	3. Can you describe the various products and services that Internet of Things enables for you? 3a. How does IoT services and products affect your customers? 3b. How about your company? 3c. What partners and business did you have in mind when you said new possibilities? 3d. How do you see the value of "a service", is it more valuable for customers or for the company?	To better understand the different means that the company captures value in IoT.
Opportunities / Future needs / Trends	4. Any new sets of needs surfaced that you didn't perceive possible before Internet of Things? 4a. Can you give examples? 4b. How do you see IoT develop?	To better understand what kind of new business needs IoT has brought and possible new partners would be revealed by new possibilities.
Ecosystem / Value Chain	5. Describe which for you are the interesting suppliers / partners that could be part of the business model in order to enhance the total value created? 5a. What type of part-	To have an idea of what the company's ecosystem may look like, and who they consider partners. To see what role they see themselves in:

| | ners/industry/business? | closer to end-user or some- |
| | 5b. Where do you see yourself in the IoT value chain? | where in the supplier side. |

Figure 22. Interview Questions

Figure 22 lists the themes and related questions that were asked in the interview. There are five main interview questions and the rest are probing questions. Based on the objectives, these interview questions are designed to determine the different value propositions that a company either offer their customers or in turn what they would value for themselves in order to serve their customers. Here, the values can be either quantitative such as price, speed of service; or qualitative like customer experience. Understanding the different aspects of value can give insights to what the customer think and feel as well as the gain and pain points that they experience. The study therefore does not just take into account value from one perspective, but the questions are designed to view both the customer as a supplier and a customer. The aim would be to understand the business opportunities that the company gains through creating the value for their end-users.

In this chapter, the research methodology was discussed and the research approach explained further. The choice of the study was stated and the case companies used for the interviews were presented as well as the research questions for the study. Furthermore, the methods, strategy, techniques and procedures for data collection and data analysis were elaborated upon. The next chapters will present the findings of the study and give recommendations based on those findings.

4 Presentation of the Findings

The study had two main objectives: first to understand the IoT business opportunities; and second to understand what the business landscape looks like for IoT at the moment. Each of these objectives had five supporting questions in total which I will be discussing in this section. I will present the general findings for each question followed by deeper discussion with examples.

4.1 Findings from the Interviews

4.1.1 Objective 1: to better understand the IoT business opportunities

Understanding any business opportunity requires initial knowledge of value that customers are expecting and the firm's skills to deliver that value. The supporting questions regarding the first objective are therefore focused on two things: a) finding out the company's and customer's needs and b) finding out how companies capture value in their IoT ecosystem. This refers to the company's own ecosystem in which the company interacts with the necessary partners, suppliers and customers.

(1a) What are the needs of different companies pertaining to IoT or its products and services?

A need can also be seen as a challenge for the companies and therefore an obstacle. The interviewees described their needs in IoT in terms of values, challenges or opportunities. It is often not easy to differentiate these from each other as needs are subjective. Challenges imply there is a need to overcome them. On the other hand, the customer value can also arise from their customer's needs besides their own, at which point they would bring value to customers by addressing those needs. Therefore opportunities for the companies to create value also lie in discovering what their customers find important in the services or products they offer.

In general, the findings at this point show that the IoT companies also reflect their customers' needs. There is an obvious desire for collaboration in order to expand their network to new channels not just for research purposes but they would also like to involve industries in order to turn their ideas to actual businesses. Naturally, one common challenge that each company is experiencing is to know which customer to choose and which to avoid. Companies, especially smaller ones, feel that they are isolated and are not able to network. For example case company 1 feel they have "challenges to find new channels" and in case of company 3: "one of the problems

have been that the academic community and the business community are totally different groups and they usually don't discuss with each other". In IoT, networking and finding partners are key aspects to thriving in the environment. This is because IoT comprises of so many levels of businesses and every player in the supply chain: hardware suppliers, network suppliers, and application, connectivity and service suppliers; are influenced by IoT one way or the other. This essentially depicts that not one company can afford to completely cover all facet of the value chain in IoT. Such infrastructure is costly and to be frank, not an option for sustainability. The fact that the academic community and the business community is experienced to be somewhat unconnected could be one of the reasons for companies not to be able to find new channels. On the other hand, there are IoT consortiums, test labs and Smart City projects ongoing with the involvement of national funding. Academia is highly involved in these projects. From my observation it is in fact the other way around, there is a lack of companies joining these research efforts. This leads me to conclude that the issue is the difference in perspective and goals of partnership rather than lack of options. From my observations, companies are reluctant to share their business plans, products and services to be scrutinized under research studies. This is a mentality that IoT companies cannot afford to have. A change in mindset is important to be able to embrace the value that IoT offers, i.e. the partnership and the profit flow that comes with it. Expanding to new channels in IoT means to partner with companies that enable ones business, in turn the companies will boost each other to create and capture value. Each company in the partner ecosystem may have different BMs and serve their own value chain. Nowadays, research partners are a part of an 'Open Innovation' business model that is already practiced in some companies. This means that research partners, whether from academia or companies, are involved in the development of a product or service together at a very early stage.

Further findings suggest that there is low willingness to invest in IoT regardless of high interest shown towards IoT and there is a concern around data analysis and processing. The lack of investment finding is not a big surprise but is a contradiction to the high level of interest towards IoT. In case company 2 for example: "We have had many discussions with potential partners and customers and everyone seemed very interested, but nobody is ready to invest." It looks like it is not an easy task to convince investors. Investors need tangible proof. The challenge with the IoT technology is that its value only increases when there are more devices deployed, and in increasing contexts. Substantial investment is required to cover that entire context, which also means longer lead-times. Instead of looking for more investment, it is probably better to focus on targeted deployments. This will not only reduce the need for initial investment but also shorten lead-times to value creation and maximize the value generated. Carefully targeting

certain deployments mean to prioritize the most important financial pain point or opportunity area for the company and to launch IoT services or products where they have the highest impact.

I mentioned the findings related to concerns around data analysis, integration and processing. With the existence of IoT, it is possible to gather intelligent information out of data. Implying the heterogeneous data collected from various devices can be integrated and analyzed for different usage. For example thermal devices with sensors in a house can automatically lower temperature or increase it depending on the room temperature. However, it can also collect user pattern, and predict the usage based on data collected; the same data can also be sent back to the energy company for energy optimization e.g. Nest Thermostat. Case company 5 also raised a practical concern: "battery is a problem". Not all technology develops in the same pace and therefore remains a limitation for IoT companies. The example of battery life shows a challenge for companies manufacturing different sensor devices, but is clearly an opportunity for companies producing batteries. This simple process of collecting data using sensors, like traffic or damp measurements, and using the same data for other applications, can be generally done for factories, bigger machines, shipment companies and logistics to mention a few. Therefore the expectation is that IoT would somehow provide an infrastructure that will enable these kinds of services. Case company 5 expressed their concerns over this: "because you put the sampling rates smaller and...Very simple things can make you process too much, and data is nothing. So it's a very interesting area how to do it properly". The need for data analysis is clear, regardless how data is collected. Mass data streams require proper platform and storage. 'Big Data', as it is called, has been investigated by companies for a while and solutions exist to deal with the phenomena. Some companies are already looking at the next stage, it is known as Fast Data, which is mass data stream processed immediately as it arrives, in contrast to Big Data being processed in batches. Fast Data is expected to give even more value to customers because instant processing is close to real-time and opens up further new opportunities for revenues. I think it is only a matter of time. The challenge currently is integration of data. The context from which data comes from is extremely versatile and covering all of that will require a lot of resources. Furthermore, and most importantly, there is a gap in the knowledge of customers and the available services. Bridging this gap is a clear point of opportunity.

One other important problem that I would like to address which came up from case company 4 is security issues. They expressed it like this: "security are enormous issue for people". Here there are two things I would like to point out; this is a case of customers' concern projected as a

need to the company. Therefore by addressing this concern, the company would be creating more value to their customers. Security is a big concern in IoT in general. IoT infrastructure requires storage that is accessible remotely and geographically unbounded, which essentially points to cloud services. Many IoT applications can with ease send their data to the cloud, for storage or for processing by another party. But not all data can be processed without security concern although cloud services have layers of security. Furthermore, it is going to be a long time before people can be convinced to change their mindset on how they perceive information. For example, social media nowadays are collecting user data without everyone being aware of it. But with IoT, the data sent can be from a sensor in your house (home automation), or in your heart (medical, healthcare). Does this type of information need consent from the user? And if the user gives consent for it to be used by targeted organizations, like energy or the health center, do those organizations have the right to store the information in a place where it can be further accessed via the Internet? With different types of consent, how can they manage the vast amount of data without compromising any permissions or customer rights? This challenge is related not only to security but also to data management in IoT. Personal data management is being regulated by EU legislations and other countries around the world. This adds a tidbit of challenge for companies when thinking of compliance. The rules will touch e.g. data ownership, storage and the right to delete data. I see this as an issue that will not be easily or quickly solved. I doubt that there can be a 100 percent secured cloud service, but there can still be preventive actions and fast reaction to any breach. The examples relevant to this section can be seen in Appendix 1.

(1b) How can companies capture the value in the IoT ecosystem?
This question relates to the first one and supports the next step after identifying the customer value that can be captured and converted to revenue streams. In this section we will discuss the value creation. Without value creation, there cannot be value capture - although one can create value without capturing it. Simply put, if you are in a business and have nothing to offer, then you cannot expect to get paid either. Making money in IoT or connected space is not limited to product sales nor is it a straightforward process. After the initial product/service sale, there are numerous possibilities to exceed the initial purchase price by exploring other revenue streams such as value-added services, apps and subscriptions. Customer value is seen as subjective in many cases, and even more so in IoT. It is very much dictated by customers. IoT in itself is an infrastructure upon which services and products are built. A person having IoT technology may not even notice it, for example the usage of smart meter for energy consumption measurements. The point here is when selling products and services in IoT; typically

one does not mention all sorts of IoT functionality, but more the benefits that a certain product or service can bring to the buyer. The process of understanding what the customer perceives as value requires therefore creating the value by forging relationships with customers. It is a continuous process of revising and personalizing the offering. In IoT increasing a company's revenue also requires the understanding of how partners in the ecosystem make money. In the IoT ecosystem businesses need resource from one another. Based on shared value and assets, understanding the value capture elements such as whether the firm will have to share profit with another and how, is important in positioning one's firm to be in a good bargaining position.

The findings are grouped into: customer needs, company common goals and IoT enablers. Values can be captured by identifying the different ways a company can serve the customers. Therefore the findings can be further categorized into the following perceived values: improving lives; convenience; networking and knowledge sharing; efficiency and cost reductions; and perceived opportunities. Let us now analyze these findings and further elaborate on the different ways value can be captured.

One of the main motivations of companies and innovators to capture value is to create different services and devices targeted to improve people's lives or give them more convenience. For example in the case of company 1: "Better mobility; can move easily either free time or work related. People can move easily from their homes to their business" or "people don't want to wait" and case company 4: "On the social side, people are demanding more transparency from governments, which can be achieved with more access to information and by involving citizens in the decision-making process of our cities". In both the examples mentioned, the value to the customer in general would be to get intelligent data that would allow them to predict traffic or be involved in the process of decision making for a better city. We are talking about value in service content, which can be multipurpose. It can be further concluded that these are not stand-alone services. These services would require some sensor devices (real time sensing), storage, data integration (real time coordination with other data streams) and analysis as well as application (mass visibility) making the data visible to the user. In the first case, the necessary traffic sensor data would be collected and the user can access the information for the area he/she lives or travels in. The traffic case can be seen as a "Freemium" model or a "Bait and Hook" model where the customer can pay for service through subscription and get the application for free. In the latter case, an additional aspect of Government sets in. The requirement for the latter case is commitment from both governments and private companies in order for the flow to work. As can be seen both companies

are to offer intelligent data, however, they could have different value capture models. In the case where government is involved, I believe further assessment is required. There may be data that can be freely available and sensitive data that cannot be released. In any case, I can imagine the revenue stream for such business could be found through licensing in an 'open business model' where value is captured by systematic collaboration with outside partners or by exploiting an idea within an organization.

When it comes to creating value or propositions through networking and knowledge sharing; cost reduction and efficiency; and new opportunities, the best way to evaluate how to capture value is to analyze the different value creation methods and touch base on business model possibilities. I will start by discussing the networking and knowledge sharing context in IoT. Since companies still have an unclear picture of their IoT ecosystem, the earlier the companies form alliances and partnerships the sooner they can evaluate the ecosystem. The highest value-added activity for networking and sharing knowledge in IoT can be seen already during the research phase e.g. case company 3: "We need a broader network, cooperating with different companies, not just for research work but for actual business." The example indicates that companies are already networking and sharing information during an early stage but finds it more valuable if they can get from there to actual business. From another angle in case company 4: "but we think about the new ecosystem and the new industry, we are creating, we would need a whole country with the same sensors to start to enable new businesses". The importance of networking therefore does not remain just in research, but it is good to start there. The needs mentioned imply that there are challenges for companies to deploy their services or products, or finding suitable partners to go into business with. This gap clearly opens up opportunities for yet new ideas. A good business model to explore in this case is the "Open Business Model". The rationale for it is clear: acquiring R&D from external sources can be less expensive, resulting in faster time-to-market. This is particularly true for smaller companies or start-ups. The partnership would be then with bigger companies who have better resources. There are trade-off issues here, but I will not be discussing those, in order to keep this more concise. It would require going deeper into the business model analysis, which requires for sure another study. The point is that both big and small companies can evaluate their pain points and prioritize the one that has the highest value if they form partnerships in order to combine resources.

IoT brings new opportunities for different companies e.g. "new classes of products", "preventive maintenance things clearly", "new concept study bring opportunity for us". It is clear that IoT as a new technology for companies will also bring them new ways to influence their BMs. And there are

also more chances to reduce cost or become efficient: "scalability in the kind of projects involved in IoT", "we can optimize the running cost of the equipment". The benefit for companies is limited only to imagination. That is not to say that harnessing the value in new opportunities would not take more effort, because it does. In itself reducing cost and increasing efficiency is value creating points for customers. We can discuss what that sort of offering entails from the provider in order to tailor to the needs of the customer. Reducing cost or increasing efficiency is connected to process optimization. This requires understanding of customer processes, so a long term client relationship or partnership is expected. Process enhancements require some sort of customization. So a business model that allows tailoring of value proposition is suitable. The examples that are relevant to this section can be seen in Appendix 2.

4.1.2 Objective 2: to better understand what the business landscape looks like for IoT at the moment

The second objective is to understand what the business landscape looks like for IoT at the moment. Understanding the landscape sheds light on the type of opportunities that exist for striking new partners and benchmarking businesses. Here, the supporting questions are related to partners and competitors, IoT ecosystems and co-creation of value.

(2a) Who are the partners and who are the competitors?

In general for a business, seeking partnership is a common means to enhance the business model and there can be various motivations to do so. Businesses need each other for resources and activities that they might not yet have. I have mentioned something about partnership in the previous sections. Here I will analyze the different partnership types in a business model and the reasons for the various partnerships.

The findings can be categorized into three different motivations to collaborate: optimization, resources and reducing risks. Optimization is considered one of the most basic forms of relationship in a business. It is forged to optimize the allocation of resources and activities. Reducing costs or sharing infrastructure can also be motivations in this relationship. Examples from the findings can be derived from cases of company 1: "research institutes for the moment...we are collecting data and giving some business area expertise for them so that they could develop other regions for congestion recognition and also for dynamic route planning. So they are the partners that we are looking for. Because if there comes new business or spinoffs or something..", "partners, suppliers...might be additional data providers...some company providing road sensor data.." and case company 2: "cooperation with health center, consulting companies, provisioning, infrastructure, property maintenance company, different retailers"

These companies seek other companies with different business areas that they do not have. In the first example it can be clearly seen that research institutes have more resources to do the relevant studies and therefor are sought after for their expertise. Anything they may come up with that can be turned into revenues is also taken into account. This is a non-competitive relationship where alliance is needed for strategic reasons. In IoT where the pace of technology development is quite fast, this sort of alliance is very valuable. The no rival factor removes stress from the relationship and allows a fruitful partnership. The second example implies the same strategic relationship forged for reasons of acquiring resources, similar to the third example. However, the partners could be other small companies who have the same need to acquire activities. This type of relationship can lead to 'coopetition', a strategic relationship between competitors. Creating this type of alliance will make the companies both partners and competitors at the same time. In an IoT ecosystem, this is a common phenomenon and even an encouraged one because IoT area is very competitive and uncertain at the same time. One other relationship that is motivated by the lack of resources is the acquisition of that particular resource or activity. For example what case company 2 is doing: "we do franchising because we don't have our own sales". This is clearly a good method to quickly gain knowledge and more importantly access to customers. The examples relevant to this section can be seen in Appendix 3.

(2b) What businesses are there in the IoT ecosystem?

The discussion in this part will shed more light into the landscape of IoT, for instance which areas are successful, which sector is more popular, etc. This can be done by analyzing the various businesses interacting in the ecosystem. In general, the findings showed that most of the companies see the ecosystem as an environment that enables them to do business better. They all seem to understand their roles and can identify what businesses they need in order to make their own happen. The findings can be categorized into two BMs: horizontal (e.g. wireless sensor platform, security) and vertical (e.g. transport, shipping, Telco).

Starting with the horizontal business, the advantage is that it permits rapid growth and innovation by allowing multiple providers/developers to work in a common platform; presumably the gateway and cloud functionality is in place for them to share, take for example ThingWorx or Xively. The idea is that the innovators using the platform can assume everything will work and they can focus on creating applications, services and devices. In case company 4: "we are not providing a closet product, but a development platform that allows to send any sensor data using any communication protocol to any information system", It can be seen they offer a platform solution that is

versatile and allows integration of data. The common platform enables information and resource sharing by the devices and services. However, there are always two sides to every coin; there is also a downside to being in a horizontal business. The most important challenge there is unfortunately out of one's control. Horizontal platforms need to gain significant traction before it can truly benefit developers. The example of case company 4: "the company focuses on challenges where the sensors can be used to better environment, urgency matters like natural disasters", implies that sensors cannot yet be used as widely as they would have hoped. This means either missing infrastructure or other open gateways and services. It also indicates that this needs to happen before any developers or providers have an adequate market to serve.

The vertical business has been the first in the IoT space, e.g. home appliances by various makers. They have become more dominant by leveraging their assets in combining them with cloud services and open gateways, which allows them to aggregate data. In this model the IoT device, the possible gateway and the cloud service is all provided and regulated by the same company, e.g. Philips Hue Lightbulb. The vertical model gives the end-user an advantage of having a single point of contact for support as well as no compatibility problems with various elements. The disadvantage with such a setup from the end-user perspective however, is that they are entirely dependent on that vendor for improvements and upgrades. The case companies 1 and 2 have vertical IoT offerings: "So the end goal of the system will feed and provide. And also information integration, for example weather data, congestion data, and then forecast data, history data combined.", "smart house concept, our idea is that we always drive the IoT in linked with constructions or buildings we put multisensory into flats", that represent the transport business and virtual homes. Transportation focuses on data related to vehicles, traffic and logistics. Hooking up with IoT enables them to provide their customers also with data concerning weather forecast, which can be combined with traffic information to add value to customer services, e.g. Miovision Platform specializes in exactly this. The smart house concept is a great example of vertical gone sideways. The idea is to integrate all kind of devices to control the home and automate it. Together the devices with sensors gather data and make use of them. In the case company this concept is combined further with construction or buildings. To enable the transmission of data back and forth in the bigger picture, this environment will need gateways to access the internet and as mentioned before a place for all the data to be stored and analyzed. The pattern seems to be the same regardless of which concept we are talking about.

After analyzing IoT in both the horizontal and vertical space, it is not clear which IoT business model will dominate the ecosystem, or if it will remain a mix. However, for now it is clear

that vertical models with their IoT fix is having the upper hand in that sense that they are taking advantage of their established market position to introduce IoT to their customers. It is unpredictable when the shift will happen that horizontal models will gain more market shares. Even though it is still a challenge to win over infrastructure providers, the horizontal platform is gaining traction all the same. The examples relevant to this section can be seen in Appendix 4.

(2c) How can the different companies within the IoT ecosystem help each other create value?

The answer to this question supports the understanding of the IoT landscape by further elaborating on how businesses can help one another create value; and understand the existing environment in order to build value propositions that support the company's competitive advantage. Earlier we discussed how businesses can capture value which is based on customer value creation. Creating value as an outcome of cooperation between firms will leverage on the earlier discussed relationships. Here, the discussion will be around businesses helping each other creating value in the IoT ecosystem and the motivation to maximize possibilities to capture value. I will also touch base with cross border issues as IoT needs global scale to really have potential for greater benefit. The general findings pertaining to this section are that companies have big ambitions. They have a general understanding of who they need to be partners with and they know what IoT can enable their businesses to do. They are willing to collaborate to bring more value to their customers.

In the case of company 1: "Resources are opportunities and guidance for business expansion is the key", "find new channels and new network for new R&D directions", they are seeking for not just new resources, but new ideas to which they can focus their developments. It is not clear whether they search expansion within their own vertical, or expand towards new market areas. It is obvious that IoT companies see the need to cooperate on one level or another. By doing that, they can take advantage of each other's resources: whether it is people, devices or software resources. The collaboration of companies can create shared values for the benefit of the environment, the people and for each other, e.g. in case company 2: "involves the municipal there as it involves also the environment responsibilities" and case company 5: "pushing to enable government transparency because their customer wants it". This shows that there is an increasing need for companies to collaborate with government or public domains. The challenges in this type of cooperation might surface if both parties do not have the same goals. To minimize the risk of not reaching target or diverting from initial objectives, these relationships could be forged on a contract

basis. Companies looking for ways to improve their offerings through IoT e.g. "Internet of Things can just enable a part of our agreement to be more efficient" are seeking providers that can enable them to enhance their business model with a point of differentiation. They do not divert totally from their traditional offerings but add value by bridging the gap for their customers through IoT because e.g. "IoT enables to give this type of offers more". In this case these two companies occupy different blocks in the supply chain. One company provides the other means to satisfy customer needs. They essentially help each other create value for the end-user. One important aspect that IoT companies should look into beyond the research community is how to collaborate internationally. This cross border collaboration will allow companies to boost their own market reach but also to allow new business opportunities to emerge. Case company 5: "we are moving from … an IoT only for corporations and business, to an individuals and consumers IoT, which makes a global IoT" implies an understanding of this point. The IoT is becoming globally accepted and therefore closes the bridge between companies in different geographical locations.

The motivations for IoT companies to work together can be identified as, besides increasing revenues, also enable IoT business and to serve common goals. According to the literature on this topic, companies need a mindset change in order to get the best out of creating and capturing IoT value. Generating recurring revenue which happens after the initial sales of products and services is what is appealing to most companies. Moreover, the importance of data in IoT has become pertinent and is the focus of many industries. Converging data and allowing useful information to be derived from it to improve people's lives and society is the main goals of companies. Of course somewhere along that process is where firms monetize on the value of that information. There are numerous ways to apply the data and create new possibilities e.g. new analytics and new services: effective forecasting, process optimization, preventive maintenance, and customer service experience as well as their behavior monitoring. In general, the increased sensor developments will allow for all types of measurements. In turn the data from those measurements are collected and aggregated into useful information. For example what NEST is doing with their thermostat, they measure temperature and predict user behavior to optimize energy consumption. The examples presented in this part can be seen in Appendix 5.

4.2 Findings from the Observations

This section presents the discussion regarding the observational data derived from conferences and workshops. It is divided into two areas: the international discussion, which adds a global context to the interview findings; and the IoT focus in Finland as a whole.

The message currently is that Internet of Things is happening, and is no longer something that is thought to be years away, no matter how unbelievable the technology seems. The idea of IoT is having various nodes collectively gathering a tremendous amount of data. Data gathered at crucial "pressure points" can be used to optimize various processes for a wide variety of applications, scaling all the way from consumer devices to manufacturing lines. The idea is largely about making things smarter. Companies are now focusing on building things capable of transmitting data and implementing actions in real-time due to evolved processes, automation and micro-computing. Likewise, applications combined with embedded designs also yield improved output. This indicates that IoT is gaining a lot of speed in development.

The biggest challenge has to do with architecture, scalability, and data science. How do we make sure that all the information flowing from the sensors to the control systems is synchronized and harmonized, and can be synthesized in a way that brings meaning to data? This is an ongoing challenge that experts try to solve.

There are huge efforts in developing IoT in other parts of the world, i.e. South America, Asia and Africa. Most of the countries that are somewhere on the map in IoT are driving for collaboration with the EU. Some of them are in fact already working together on the research level e.g. shared test labs in a particular country. Everyone has the aim to unify and promote IoT architecture, IP and cognitive technologies, as well as semantic interoperability. The message is clear that there is a need for more industry support. The aim of international collaboration is to capitalize on research advances for IoT deployments. There is a need to ensure interoperability and acceptance of its solutions in a global market driven and supported context. The different communities also see challenges in policy making and data ownership differences in various countries. International IoT themes that are relevant to this study are presented in the summary table in Appendix 6.

In Finland, the IoT outlook focuses on various asset managements, smart cities, and BMs. The national technical research center VTT claims that added value from assets comes in sev-

eral forms. In addition to economical values such as business profitability or high productivity, it can be related to environmental, social or other desired outcomes. Asset management is a structured approach that supports the achievement of added value while balancing cost, risk and performance criteria. For example their vision for services is to move from corrective or scheduled maintenance to condition based / predictive maintenance, essentially, towards an IoT-enabled service ecosystem. This clearly indicates that IoT is valued for process enhancements and enables providers to influence the entire process flow. Different universities and local companies across the country also have efforts on IoT developments in their own region. Their aims and objectives on what to develop depend highly on their areas and possibilities - for example, defining ecosystems for smart city, virtual homes, smart lighting, smart parking, etc. Besides the known technical challenges of IoT, they are also faced with challenges in common: how to cooperate fruitfully and the lack of general industry involvement.

4.3 Summary of Findings

The findings in the previous sections are summarized in Figure 23 below. It shows the questions grouped together and the findings related to each of the research questions.

Findings from (1a) What are the needs of different companies pertaining to IoT or its products and services? **(1b)** How can companies capture the value in the IoT ecosystem?

- A change in mindset is necessary
- There are new opportunities to capture value in IoT *after* the actual sales as well, not just before or during sales.
- Willingness to invest in IoT is not very high.
- Data management is an area that will get a lot of focus in the near future, and therefore can be seen as an opportunity worth capturing
- There is a lack of IoT knowledge and skills

Findings from (2a) Who are the partners and who are the competitors? **(2b)** What businesses are there in the IoT ecosystem? **(2c)** How can the different companies within the IoT ecosystem help each other create value?

- There are many non-traditional ways to capture value in IoT
- Successful Business Models in IoT at the moment are Freemium, Razor & Blade, Mass Customization and Long Tail.
- Change management - this becomes even more important when it comes to IoT because the landscape changes very rapidly.

Findings from Observations

- Companies and research labs internationally feel that the EU has strong IoT advantages.
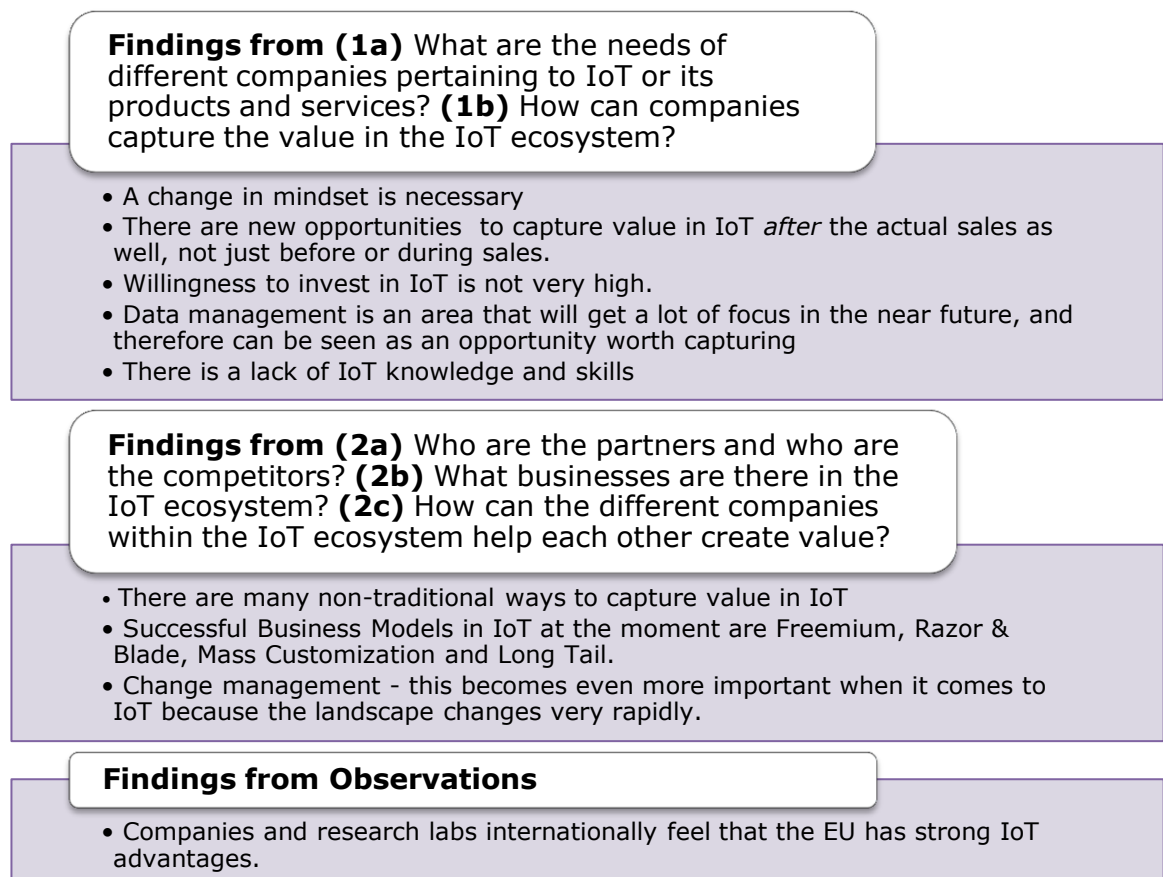
Figure 23. Summary of findings

5 Recommendations

This chapter presents specific recommendations to the Sponsor Company based on the findings discussed in the previous chapter. In the following, recommendations are indicated in bold.

5.1 Recommendations to the Sponsor

The findings give a good understanding of the IoT business: the way companies create value in the IoT ecosystem, the way they co-create value as well as capture value. The overall picture indicates that IoT has arrived and it is here to stay. There are so many efforts from companies and research institutes alike all over the world contributing to lifting barriers and obstacles to enforce IoT business. The impact of IoT in all areas is already very impressive.

The needs of a company can be derived from its own challenge and obstacles, or from the needs of its customers. Value can be created by addressing those challenges and discovering what their customers find important in the services or products they offer. There is an obvious desire for collaboration with research institutes in order for IoT companies to expand their network. But companies also expressed needs to gain new channels with business industries in order to shift from the research level to actual business. In IoT, networking and finding partners are key aspects to thriving in the environment. This essentially illustrates that not one company can afford to completely cover all facets of the value chain in IoT.

A change in mindset is necessary if IoT companies want to create and capture value. This is because IoT differs from the traditional market. In IoT many services are delivered on-the-go and on-the-air. Customers do not go into a shop and take a product off the shelf, go home and be done with it. IoT offers companies a unique opportunity to generate revenues after the initial purchase through subscriptions, customer experience and behavior monitoring, etc. Therefore **it is important for the Sponsor Company to identify the different needs and challenges of customers before the sales, but more importantly can focus on *after* the actual sales** in order to create value and recognize when to capture value.

Regardless of the high anticipation, interest and hype surrounding IoT, there seems to be very little desire to actually invest in IoT companies. This challenge could be because investors need tangible proof as well as fast return on investments. This is difficult for IoT companies

to provide because the value of IoT increases only when there are more devices deployed and when the number of application areas increases. Substantial investment is required to cover that entire context, which also means longer lead-times. To mitigate these challenges, **the Sponsor Company could therefore focus on _targeted_ deployment** and other means of getting resources, such as partnership and various collaborations. Once there are more IoT options investors will be attracted in turn.

IoT provides the infrastructure for heterogeneous data collected from various devices to be integrated and analyzed for different usage. This results in an explosive amount of data transmission, known as Big Data. Management of this data is quite challenging. The infrastructure should be capable of storing (cloud services), aggregating (gateways) and converting data to usable information. Some companies are already looking at the next step of development where data is processed instantly as it becomes available, known as Fast Data. **Data management is an area that will get a lot of focus in the near future, and therefore can be seen as an opportunity worth capturing**. Besides data management, some other challenges that companies currently face are: integration of data; security; and the ability to recognize relevant services to the company. This could be mainly due the lack of skills and knowledge in IoT. The deficient knowledge and skills in IoT can be a bottleneck when it comes to identifying new business opportunities. Therefore **the Sponsor Company should make sure all sales personnel and engineers involved in IoT possess adequate knowledge and skills**, even before they become involved.

Capturing value in IoT depends a lot on the value created. IoT provides new opportunities for innovative revenue streams even after the point of sales e.g. as subscriptions, or customer experience enhancements through behavior monitoring when the customer is using the product or services purchased. Therefore, **the Sponsor Company should be aware that there are many non-traditional ways to capture value in IoT,** including service content (which can be multipurpose); providing subscriptions; or licensing. Companies may have the same value creation motivation but can have very different value capture models. Some of the recognized and more used BMs that surfaced are: Open Business Model, Freemium, Bait and Hook, Open Innovation, the Long Tail and Multi-Sided Platforms. There can be a multitude of BMs out there that can be applied to IoT. But there is no dominant one that can be seen at the moment. Many are looking into the Internet models, e.g. **Freemium, Razor & Blade, Mass Customization and Long Tail are seen to be most successful currently**.

Most IoT companies can be seen in two more popular BMs planes: horizontal and vertical. There is no clear dominance of either one at the moment and it is hard to predict where the situation will shift. It could remain a mix of the two, or a new hybrid. Both of the models have their advantage and disadvantages. The good thing about being in the horizontal business is that it permits rapid growth and innovation by allowing multiple providers/developers to work in a common platform; presuming the gateway and cloud functionality is in place. The benefit for providers is that they do not need to worry about the infrastructure, hence, can focus on creating applications, devices or services. The disadvantage of a horizontal approach is that it needs considerable traction before the providers and developers can have enough market coverage to actually take full advantage of the business. On the other hand, the vertical's benefit for end-users is that they have a single point of contact for support as well as no compatibility problems with various elements. However the end-user disadvantage is that they are entirely dependent on the vendor for improvements. In the case of the company having a vertical approach the drawbacks may surface in time when users need to upgrade or enhance their system. In order to mitigate the challenge of rapidly changing landscape and allow the company to evolve with its customers, the **Sponsor Company should carefully maintain its ability to manage change in IoT in order to embrace new opportunities.** Although change management is a general discussion, the findings show that the IoT landscape changes even more rapidly than the usual requirement for a company to manage change.

IoT companies forge relationships with other companies not just in order to create value for themselves and their customers, but also to share the value creation with other companies in the IoT ecosystem. It is one means to ensure sustainable growth. The different motivations for collaboration dictate the ways they can create value together, e.g. it could be a non-competitive strategic alliance; an acquisition of resources; or coopetition, which is a strategic alliance with a competitive element. IoT is being recognized more and more around the world and many countries have put a lot of effort in researching and developing different means to take advantage of what IoT has to offer. Most research programs in different countries are eager to partner up with the EU. This indicates that the EU has a lot of influence in the IoT world at the moment, which implies that regulatory legislations that come from the EU will most likely be adapted elsewhere quickly. **Therefore, the company should take advantage of its strong position in the EU to influence new business opportunities.**

5.2   Implementation of the Recommendations

In this section I will highlight how the company can benefit from the recommendations. The recommendations will be listed and implementations given respectively.

- **A change in mindset is necessary** - always realize that there is a choice.
  Start thinking IoT by:
    - addressing real-time and network effect (the effect that one user of a product or service has on the value of that product to other people) in predictive manner
    - creating experience for current products and enable services with information convergence
    - enabling recurring revenue by monitoring value-in-use
    - adding personalization and context; interaction between products
    - understand how other partners in the IoT ecosystem make money

- **Identify the different needs and challenges of customers before the sales, but also focus on *after* the actual sales**
  In IoT there are many new opportunities in after sales. This could be the sales of the company's own products and services, however does not have to be limited to them. In order to seek new business opportunities, the company can actually make a survey, e.g. of its partner network, to see what different application areas have after sales need, e.g. behavior monitoring (human or machine). Look into the partner companies as well; it is good to find out not only their important expectations but also if they have any latent motives. Based on the knowledge that value to a customer is also a value creating point for the company, any partner needs can therefore become an opportunity.

- **Focus on *targeted* deployment**
  Within the company, evaluate the projects with focus on highest value. This means to focus on a certain product or services which is prioritized according to the company's (or customer's) pain/pressure points, i.e. which one has the highest value to a certain need when deployed. This also means that the company should find more focused target customer groups whose needs can be deeply understood and tackled, rather than working with too large or loose customer group when needs do vary more and company may end up offering "average" service and value to large group. They should know and understand

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the specific focused target customers very well, in order for the company to develop and have more compelling offering. For instance since IoT has smaller customer groups, the company can analyze and produce smaller package offerings to each target e.g. identify needs through big sets of data or data mining.

- **Data management is an area that will get a lot of focus in the near future, and therefore can be seen as an opportunity worth capturing**
Investigate the different opportunities in data management areas and leverage on the company's strong points as well as products and services synergy.

- **Make sure all sales personnel and engineers involved in IoT possess adequate knowledge and skills**
Awareness is the key. Personnel need training and exposure that supports the following not only the knowledge of IoT, but also knowing how to apply IoT in other areas of business and services. It is about the ability to innovate with simple ideas.

- **Be aware that there are many non-traditional ways to capture value in IoT**
Thinking out-of-the-box is the key in this point. I will mention here three ideas:
1. Many companies are acquiring or establishing smaller companies in order to penetrate the IoT market in which they do not have any market share yet. This can be seen through examples of Google with Waze, LogMeIn with Xively and Libelium with Cooking Hack, to mention a few. A far out of the box thought for a vertical company would be to establish one in the horizontal space and gain foothold there. The spawned company should keep its own name and function as separate entity.
2. Recombine the value chain
3. Combine business models and create hybrid models.

- **Freemium, Razor & Blade, Mass Customization and Long Tail are seen to be most successful currently**
These specific business models can be explored further and analyzed against the projects that currently exist in order to identify value propositions that may lead to creating value and possibilities to capture value.

- **Maintain the ability to manage change in order to embrace new opportunities**

Nowadays it is not always about competition, but it is more about the ability to manage changes that occur in an extremely fast pace. This is truer than ever with the IoT. The company needs to monitor and develop the ability to predict their customers in order to stay a step ahead of their evolution. This way the company can embrace new opportunities in addressing customer needs and challenges in IoT.

- **The company should take advantage of its strong position in the EU to influence new business opportunities**

The EU having a strong and respected position in IoT gives the company an advantage of location. Most likely the rules and regulations pertaining to IoT will be dictated from the EU to the world. Compliancy to them at an early stage will open opportunities of being first in the market.

5.3 Assessment of the Quality of the Result

Validity

The study can be considered valid at this moment. The findings are directly linked to the research problem at hand: the considerations for IoT business opportunities. The study was conducted with close involvement of experts in the field; the interviews considered existing, established companies and their representatives; the observations were done in a professional working setting, where making IoT better was the main objective. Therefore, considering the background of the study described, the study can be presumed valid. Furthermore, the literature also supports the claim of the research problem: that it is not easy for firms to venture into IoT at this point for many compelling reasons: the landscape is fragmented, there is no dominating business model, and there is a lack of global scale deployment due to the ambiguous nature of IoT as well as the technical challenges it presents.

Reliability

The reliability of this study supports the validity claims. The results of the study and its interpretation can be considered reliable because the discussion is guided by the selected theoretical framework and therefore the interpretation is based on these methods and processes. The theoretical framework, based on the concepts of customer value creation, value proposition and business models, see sections 2.5, and the literature are more than adequate to support the interpretation of the results for the study. They are frameworks that are well-known guidelines

for businesses and many companies including the one sponsoring this study, are familiar with them. It is therefore logical that the use the combination of such a frameworks for study. In that perspective, this study and its result is a reliable source of information from which the sponsor company can gain advantage.

Role of the Researcher

I had quite a divers and multi-dimensional role in this study. Apart from doing the study, I was also taking part in the research for IoT ecosystems, aiming to understand the different use cases for IoT, utilizing the business model generation methods in the process. This gave me a deeper understanding of the practical processes and the daily struggles pertaining to IoT. The fact that I was involved in the IoT project also gave me a privileged view on what is going on in the IoT world both nationally and internationally. It gave me access to resources that helped make this study more thorough. I gained a wider perspective of the challenges and the situation at hand by being involved in the project because I interacted daily with the relevant groups. Additionally, I am also a telecommunication engineer with more than 13 years of experience in the field. My understandings of the technical scope combined with my business studies put me in a unique position to conduct this research.

6   Conclusions

This study is sponsored by a global Information and Communications Technology (ICT) company that is providing equipment, software and services to mobile and fixed network operators all over the globe. The initial research issue of this thesis was derived from discussions with the experts and the country manager of Company X, who was also responsible for the vertical market sales. The main concerns regarding IoT were about the future outlook of business. It is unclear which market segment to enter and how the company should position itself in the market to be competitive in IoT. The study was set out with the objective to explore the concept of IoT and its business opportunities. In order to understand the opportunities and challenges of an IoT business, the study looked into the value that IoT firms offered the customers and considered concepts such as customer value, value proposition, value creation and value capture. The study was conducted with an inductive approach and an exploratory case study questions. It has identified the challenges and needs of the IoT based on the five case companies. It further investigates reasons and motivations for companies to forge partnerships and the various ways this can be done.

The research project met the set objectives and gave even more insights to the topic. The study gave sufficient data to answer the research questions. The main findings were related to a change of mindset in order to deploy non-traditional marketing strategies for capturing values in the IoT business: managing the explosive data in IoT is one means to create value to customers which is getting more attention; one of the bottleneck in identifying new opportunities is the lack of knowledge of what is out there; and some business model is more popular than another when it comes to IoT but there is not one dominating model as of yet. The success of a company in the IoT world is not about its ability to compete, but rather its ability to manage the change.

6.1   Suggestions for Further Research

There can be many prospects for further study in the list of recommendations. But they can be combined in further research so that the common themes can be used as guiding principle e.g. further studies into data management will also shed more light for instance on identifying the application areas where most after sales needs are. Further studies can be conducted to explore how the currently successful business model fit in with the company's offering and take that opportunity to study a combination of those business models to generate possible

new ones. Furthermore there have been many value creation methods and motivation identified in this study, one important follow-up study could be to understand means to capture those values in order to identify different revenue streams. The study would open up the possibility to identify latent ideas and their monetization.

Knowledge is the key to unlocking opportunities. The company can invest effort on finding out what specific knowledge and skills are needed pertaining to IoT for their staff in order to enable value creation and capture.

Reflections on Learning

When I started this thesis I was just starting out to learn about IoT and Business Models. The study gave me a great opportunity of combining these two interests and diving further into the business world. During the process of this research I learnt a great deal more after being exposed to different research groups, small and large companies and networking in business. The study gave me a glimpse into the business development world where the balance of chaos and order is constantly tested. I found that fascinating. It was interesting to see the people interaction: how people interacted with each other in different settings such as research where the competition ground is neutral for companies. On the other hand, it was also interesting to see the different relationships companies forged in order to serve a common goal. There was much to learn there. It was surprising to find out that regardless of the advanced technology, almost everywhere the mindset governing the business is still quite conservative. I believe my professional background combined with my studies gave me a good basis to do this research. For instance certain courses gave me the ability to assess foreign market opportunities and competition; ability to outline and evaluate the key patterns and trends in international business; and the ability to identify profitable customer relationships.

6.2 Assessment of the Business Value

This section contains the feedback from the sponsor company on the recommendations from this study. Technology users of the 21st century got used to business models with free or almost free services. This kind of approach is quite challenging for IoT businesses, as IoT requires both, utilization of the old existing communication infrastructure (such as the Internet) and additional IoT-tailored communication methods, networks and products. Naturally, building new communication options is costly, and therefore there must be ways for companies to get back their investments.

So far, there is no "killer-application" for IoT in sight, so most likely IoT companies will need to focus on development of new services for smart environments and products. As elaborated in this thesis, this may require also a change in types of services of the future. Real-time information processing, real-time monitoring, behavior predictions based on real-time data are promising technical features, which can create tremendous business value. Also the trend towards further personalization of information will be developed in a world full of smart environments.

This thesis contains findings from the study that are related to gaining business opportunities which the sponsor company thought as generic. For instance, the advice to stay connected with IoT customers after initial sales to sell further services (such as behavior monitoring or analysis of partner companies), which is generally true, but the sponsor thought such post-sales cooperation is not necessarily limited to IoT.

The recommendation to "find more focused target customer groups whose needs can be deeply understood and tackled" may create lucrative business value, especially if the sponsor company manage to be first to serve particular niche markets. This recommendation is certainly to be explored further.

As described in the thesis, acquiring or establishing smaller companies in order to penetrate the IoT market is a very fast way to gain market share and will be performed as opportunities open up. This approach is already being practiced within the company; however it was felt that further efforts to gather business intelligence need to be put into this. The recommendation to "take advantage of the company's strong position in the EU to influence new business opportunities" is valid and needs to be explored even further.

This thesis is seen as useful for the organization, but to which extend recommendations will be implemented remains to be discussed internally with different interest groups. Since the organization is very large, this will take some time. Overall the thesis has fulfilled the sponsor company's expectations and it gives a comprehensive overview of suggestions of how to increase the business value.

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Appendix 1. Findings for Question 1a - What are the needs of different companies pertaining to IoT or its products and services?

Classification	Categories	Quotes
Company needs	Company challenges	1aC1: challenges are to find new channels
		1aC2: We have had many discussions with potential partners and customers and everyone seemed very interested, but nobody is ready to invest. 1aC2: battery life is a problem
		1aC3: I think one of the problems have been that the academic community and the business community are totally different groups and they usually don't discuss with each other
		1aC4: security are enormous issue for people
		1aC5: because you put the sampling rates smaller and...Very simple things can make you process too much, and data is nothing. So it's a very interesting area how to do it properly

Appendix 2. Findings for Question 1b - How can companies capture the value in the IoT eco-system?

Classification	Categories	Quotes
Customer/end-user needs	Improving lives	Im1bC1: Better mobility; can move easily either free time or work related. People can move easily from their homes to their business
		Im1bC4: On the social side, people are demanding more transparency from governments, which can be achieved with more access to information and by involving citizens in the decision-making process of our cities
	Convenience	Co1bC1: people don't want to wait
		Co1bC2: Operator wants an end to end solution
Company goals	Networking & Knowledge sharing	Nw1bC3: We need a broader network, cooperating with different companies, not just for research work but for actual business.
		Nw1bC4: But we think about the new ecosystem and the new industry, we are creating, we would need a whole country with the same sensors to start to enable new businesses, like e.g. trading with the data.
Perceived value to companies	Efficiency, Cost Reduction	Ef1bC1: Information and tools for development
		Ef1bC3: One of the values is the financial value
		Ef1bC3: it allows us to combine academic research work and some software development work
		Ef1bC4: scalability in the kind of projects involved in IoT
		Ef1bC5: we can optimize the running cost of the equipment
IoT enable	Opportunities	Op1bC1: new concept study bring opportunity for us
		Op1bC2: IoT because it makes their job easier. It helps in that way that e.g. they measure water consumption. These type of data can be analyzed by research also, but it is just easier to get sensor data.
		Op1bC3: implement different kinds of solutions
		Op1bC4: new classes of products;
		Op1bC5:preventive maintenance things clearly

Appendix 3. Findings for Question 2a - Who are the partners and who are the competitors?

Classification	Categories	Quotes
Partners / Collaboration	Motivations: Optimization, Acquire resources, Reduce Risks	ac2aC1: research institutes for the moment...we are collecting data and giving some business area expertise for them so that they could develop other regions for congestion recognition and also for dynamic route planning. So they are the partners that we are looking for. Because if there comes new business or spinoffs or something..
		2aC2: we do franchising because we don't have our own sales
		2aC1: partners, suppliers...might be additional data providers...some company providing road sensor data..
		2aC2: cooperation with health center, consulting companies, provisioning, infrastructure, property maintenance company, different retailers
		2aC3: It has to be designed from different aspects and viewpoints, so then we need to have many different companies form many sectors and industries. co2aC3: cost effect of the innovation and design it in a way that it could be or would have a way to minimize the cost.
		2aC5: as much as possible current partners…vendors opt2aC5: basically have the best experts to have a look at the data more easily
		2aC4: but can we delivery something to our customers, to our partners and end users that is differentiated

Appendix 4. Findings for Question 2b - What businesses are there in the IoT ecosystem?

Classification	Categories	Quotes
Transport, sensors	Horizontal/ Vertical	2bC1_1: The company is focused on public transport
		2bC1_2: So the end goal of the system will feed and provide. And also information integration, for example weather data, congestion data, and then forecast data, history data combined. So that based on e.g. weather forecast, it can be estimated if there will be rush or jam when and where, so people can use alternate route or take bus 10 minutes earlier, or leave the car and take the bus
Information Security		2bC3_1: One of the areas that we work on is embedded area and some of the embedded companies are involved
		2bC3_2: information security work
Shipping		2bC5_1: It's our core business to know what data we want, but not a core to know which sensors to buy or which protocols to use here or there, to accelerate things. We can take a higher position.
		2bC5_2: In a sense that we utilize the IoT Technologies, and the advancements of getting all these cheaper and easier to do so, we are not a company that would have Internet of Things offerings. we are still offering our own traditional products, but internet of things can just enable a part of our agreement to be more efficient
Telco, sensors, virtual home		2bC2_1: virtual home
		2bC2_2: smart house concept, our idea is that we always drive the IoT in linked with constructions or buildings we put multi-sensory into flats
Wireless sensor platform		2bC4_1: the company focuses on challenges where the sensors can be used to better environment, urgency matters like natural disasters
		2bC4_2: we are not providing a closet product, but a development platform that allows to send any sensor data using any communication protocol to any information system

Appendix 5. Findings for Question 2c - How can the different companies within the IoT ecosystem help each other create value?

Classification	Categories	Quotes
Global scale / National scale	Cooperation Partnership Enables Common goals	2cC1_1: Resources are opportunities and guidance for business expansion is the key 2cC1_2: find new channels and new network for new R&D directions
		2cC2_3: smart groups are our competitors, but not so much because we prefer partnership, consulting companies 2cC2_2: involves the municipal there as it involves also the environment responsibilities. 2cC2_3: IoT enables that the manufacturers can take care of their products whole life cycle management
		2cC3_1: It has to be designed from different aspects and viewpoints, so then we need to have many different companies form many sectors and industries. It could be kind of 2 or 3 companies from different sectors. 2cC3_2: we're developing the innovation with the help of the research partners.
		2cC4_1: pushing to enable government transparency because their customer wants it 2cC4_2: we are moving from …an IoT only for corporations and business, to an individuals and consumers IoT, which makes a global IoT
		2cC5_1: not doing things too late, and all the preventing maintenance. We have lots better incentive for it anyway. IoT enables to give this type of offers more. 2cC5_2: Internet of Things can just enable a part of our agreement to be more efficient

Appendix 6. Summary of IoT Interest Internationally

	Challenges/Needs	Cooperation Interest	IoT Application domains
Brazil	Interoperability, Standards, Social and ethical aspects	Joint efforts in IoT Infrastructure Projects to support new applications • Surveys about each region needs, with a clear vision of all involved of the benefit for all • are open to all suggestions of how to have a real cooperation with the participants sharing efforts and knowledge.	RFID/embedded cases, demand for Sensor based systems is increasing. In retail, clothes and logistics are active segments starting to use RFID
China	Industry involvement	IoT Strategy, Architecture, Smart City, Testing bed, Standardization, Privacy and Governance.	Smart city solutions
Japan	-Public awareness (market acceptance) -Clear benefit (for people and society) -Global level standards (for interoperability) - how to contribute for People & Society and how to build International Cooperation	- exchanging ideas - exchanging the best practice - increasing research ties - expanding the application -discuss standardization issues -sharing know-how	- Food traceability - Healthcare & medical recording - e-Transportation, e-Passport - Identification/Authentication for Security/Safety - Maintenance check - Supply chain management - Manufacturing process control
Korea	- sees merging challenges in all IoT service areas (healthcare, transport, IT & network, construction, public safety, energy, smart homes)	- Sharing the experiences - Global scale deployment -Standardization	IoT Services, NFC, Smart Farm, weather monitoring, highway monitoring
Singapore	Increased urbanization putting a strain on city infrastructure and quality of life	to collect/analyze data, anticipate problems and coordinate resources efficiently	Smart cities, real-time monitoring
South Africa	Support and Maintenance: adequate infrastructure; sustainability; cost; usability; awareness; human capacity - Need to be robust & cost effective – Need for experimental & test facilities – Focus on sustainability and the environment	Possibilities for IoT collaborations opens up from three dimensions: Context (allow for unregulated environment), Technology & Applications (focus Smart Industry and Improved Service Delivery)	
Taiwan	Value creation to help Taiwan's manufacturing industry transform	-IOT, Cloud and Services Integration: Worldwide Standardization , Architecture Integration and Common Generic IOT platform	-security & Disaster management -Healthcare -energy & sustainability -smart transportation

		-Project Collaboration: Match Making of Running Projects -Test-beds and Joint Field Trials -Exchange of R&D People	-Convenience -agriculture & leisured Service Delivery