DIGITISED, CONNECTED PRODUCTS AND BUSINESS MODEL DEVELOPMENT AS A CONSULTANCY SERVICE:

A CASE STUDY OF COMBITECH

A thesis for MSc in Management

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ABSTRACT

As companies are digitising and connecting their products and venturing into the “internet of things”, they are facing challenges befitting what has been described as the third wave of IT-driven competition. In this wave, new technological capabilities are reshaping industries, redefining organisations and promoting new ways of doing business. To facilitate a holistic approach to these no doubt daunting challenges, recent theories have suggested the use of business models and practices of innovating and developing these. This thesis has explored the opportunities and challenges of providing business model development as a consultancy service by studying a large technology-oriented consultancy company. From its empirical findings, an opportunity for consultants to help customers develop their business models through a visionary leadership has emerged. Such a leadership, moreover, is likely to take its basis in a holistic approach to technology and business model development, supported by efficient sharing of knowledge and experience as well as effective collaboration across disciplines.

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INTRODUCTION

Background

Hardware-backed processing power in the form of microchips is becoming increasingly smaller, cheaper and energy-efficient. As a consequence, more and more mass-production products can be equipped with software and become digitised. At the same time, the internet is continuing to expand its capacity for transfer, storage and processing of large amounts of data, allowing data collection from a significantly larger base of sources. Together, these two trends enable novel applications of mass-production products in what has been described as the third wave of information technology, with predicted significant implications on competition and companies (Porter & Heppelman, 2014; Porter & Heppelman, 2015). Commonly referred to as the "internet of things" or IoT, these applications of smart and connected products are presenting significant shifts to companies' value creation processes. With the integration of a greater diversity of technological and non-technological components, these processes are moving towards more holistic approaches. It suggests trends in both technology innovation, with greater emphasis on combining many existing technologies in systems and systems of systems (Porter & Heppelman, 2014), as well as in an evolving operationalisation of business model development, with networks and partnerships in focus and value propositions via services rather than products (Iansiti & Lakhani, 2014).

A good example of a novel application of digitised, connected products has been provided by power tool producer Hilti, who has turned its tools from single transaction physical products into agents of service subscriptions (Johnson, Christensen & Kagermann, 2008). Instead of offering their customer drills and saws, they have turn to offering their customers the capability to make holes and cut material. Equipped with software and connected to the internet, Hilti's new generation of tools allow users to perform their tasks at lower costs and with fewer interruptions. By monitoring and charging for the usage of their tools instead of for the tools themselves, customers pay only for the jobs that the tools do. In addition, by monitoring the health of tools, preventive maintenance by their producer Hilti helps to avoid any interruptions in their use.

The "internet of things" has the potential of affecting any company producing products eligible for added digitisation and connectivity. It will also be an important domain for technology consultancy companies striving to stay ahead of their customers in their roles as consultants. The author of this research project has a background as a consultant software development engineer at the Swedish consultancy company Combitech. In an ongoing effort to establish itself within the "internet of things", Combitech has approached the author to help investigate what implications the "internet of things" might have on its operations.

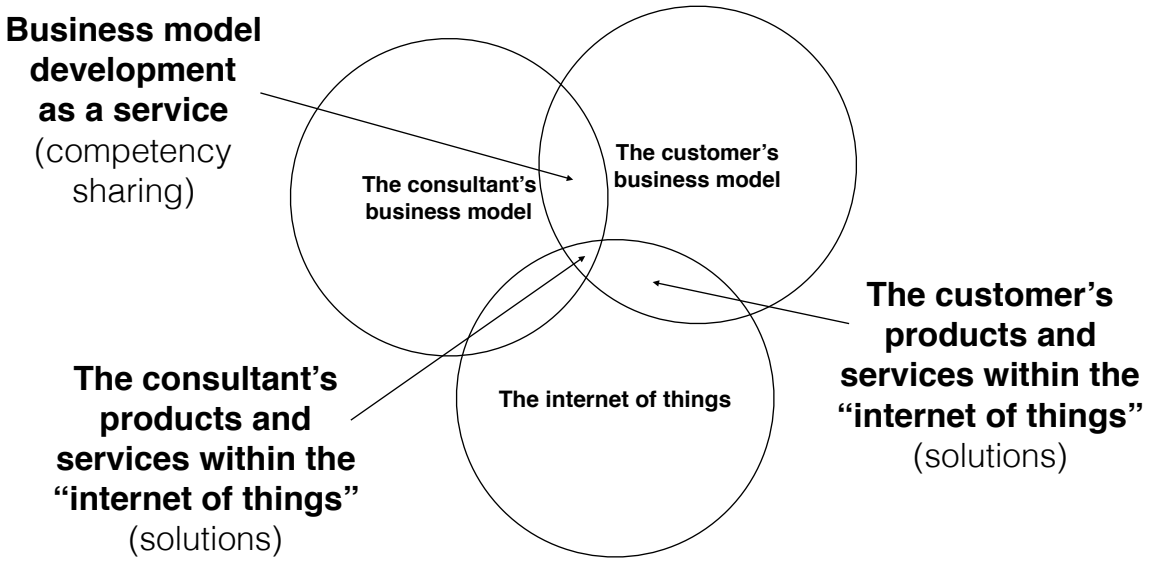
Problem discussion

Many companies are likely to have to innovate or develop their business models as they venture into the "internet of things". Hilti is a good example of this. In their case, they have transformed their business of power tools by re-evaluating the value that its power tools create for its customers as well as how they profit from this value. For technology consultancy companies who want to provide useful services to their customers, this might raise the question *'Can we help our customers in their transformation toward new business models? If so, what exactly are the challenges and opportunities of doing so?'*, and then possibly, *'How do we best do this?'*. Following discussions between the author and the company supervisor of this research project, a focus on business model development as a service has therefore been selected as the specific topic of this study. An initial assumption will be made that a consultancy company can in some way help its customer's develop their business model, which leaves this study at the second question of the opportunities and challenges of doing so. The third question is assumed to require further studies. For the sake of excluding potential biases, no formal definitions of what constitutes an "opportunity" or a "challenge" have been made prior to the study.

Although a substantial amount of literature exists on the "internet of things", business models and business model development, little if anything has been written about business model development as a service. This study hopes to add to this literature and contribute to the empirical as well as theoretical progression of this concept.

At this point, it may be beneficial to define the consultancy company's business models in relation to its customer's, as well as to distinguish how these relate differently to the "internet of things" (see Fig. 1). For the context of this report, the sole aim of the customer's business models

Figure 1. Interconnected business models and the "internet of things"



are to offer products and services directly within the “internet of things” (such as Hilti selling its power tools to construction workers). The business models of the consultancy company, on the other hand, are characterised by a potential duality of offering products and services both directly and indirectly within the “internet of things”; through the provision of outsourced solutions on one side and through competency sharing on the other. This report will primarily focus on the latter of these: competency sharing in the form of business model development as a service.

Purpose

The purpose of this research project is to explore the opportunities and challenges of providing business model development as a consultancy service within the “internet of things”.

A REVIEW OF THEORY

The “internet of things” and new technological capabilities

In what is commonly referred to as the “internet of things”, several technological trends are coming together to form the basis of a paradigm shift in telecommunications that is predicted to significantly impact the everyday lives of individuals as well as businesses (Atzori, Iera & Morabito, 2010). In very general terms, as the term “internet of things” suggests, this paradigm shift hinges on an increasing interconnectedness of ordinary objects. Based on this simple idea, however, many different visions have been formulated so far to capture its meaning and suggest its consequences. Although these different visions have likely served their purpose as roadmaps for further investigations, they may also have contributed to some fuzziness of what the term exactly encompasses (Atzori, Iera & Morabito, 2010).

As summarised by Atzori et al. (2010), “internet of things” visions may be categorised into those that focus on the augmented capabilities of objects, those that elaborate on the extension of the internet to include objects and those that stress the complexity from a potentially extreme number of connected sources of data. In the first category, some visions focus predominantly on the visibility of objects, with augmented traceability and awareness of their states (such as location and status). These visions were some of the first to be formulated and resulted predominantly from the emerging prevalence of mature and low-cost sensor technology based on Radio-Frequency Identification (RFID) tags. Later visions of this category go one step further in elaborating the capabilities of objects and emphasise their added intelligence, with a focus on their augmented autonomy, proactivity and collaboration. Visions of the second category focus instead on the development of internet protocols and network infrastructures that can accommodate the new capabilities of a growing number of connected objects. Finally, visions of the third category focus on the development of semantic technologies that have the capacity to sort, store and create meaning from the information provided by these capable and connected objects.

As exemplified above with object visibility and RFID sensor technology, “internet of things” visions are driven by the advancement of different technologies that taken together act as enablers for novel applications. Without any claims of producing a comprehensive list, some of the most significant enabling technologies include: increasingly smaller, cheaper and more energy efficient microchips enabling wireless communication, sensors, actuators, processing power and memory to be easily integrated into virtually any objects without significantly affecting their physical design, costs of production or mobility; sophisticated sensor networks that are able to collaborate with objects to expand their reach into their environments; higher capacity IT-infrastructures to enable quick transfer of large amounts of data; an emerging range of middleware software to manage the interface between software applications and physical objects, including cloud computing services that provide cost-efficient and on-demand scalable solutions for integrating and elaborating object data in specific applications; and finally, new ways of presenting data in usable ways (Atzori, Iera & Morabito, 2010; Gubbi, Buyya, Marusic & Palaniswami, 2013).

An immense number of application domains for the "internet of things" have been suggested, ranging from scientific research, policy implementation, defence, transportation, logistics, healthcare, smart environments (home, public or commercial) and personal/social life (Atzori, Iera & Morabito, 2010; Gubbi, Buyya, Marusic & Palaniswami, 2013; Chui, Löffler & Roberts, 2010). Notably, McKinsey has categorised what may perhaps be the most frequent applications into two distinct groups: information and analysis, and automation and control (Chui, Löffler & Roberts, 2010). See Fig. 2 for a summary. In the first group, they suggest, applications seek to collect data from objects and elaborate it in order to improve decision making. These types of applications may track the behaviour of people, objects or data; enhance the real-time situational awareness in particular environments; or, assist in complex decision making through deep analysis and visualisation of sensor data. In the second group, applications are likely to build upon those of the first group and, in addition, re-feed objects with data that has been elaborated into instructions and set them to actuate these in their environment. Applications in this category may be to optimise a process of a particular system through automated control; optimise the consumption of resources such as power, space or time; or, create complex autonomous systems that perform tasks of different sophistication without human intervention.

Figure 2. Categories of "internet of things" applications (McKinsey)

Information and analysis	**Control and automation**
Tracking behaviour	Process automation
Enhanced situational awareness	Optimised resource consumption
Sensor-driven analytics	Complex autonomous systems

Sensing → ***Analysing*** → ***Actuating***

Source: Chui, Löffler & Roberts, 2010

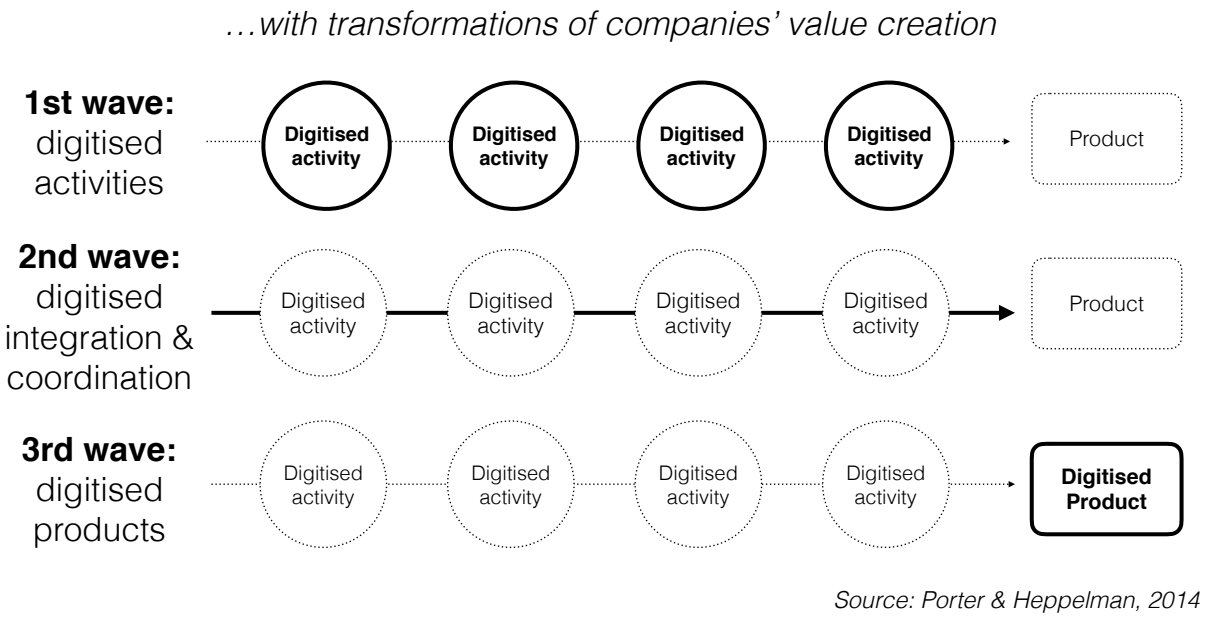
New technological capabilities are reshaping industries

With these new technological capabilities comes new ways of doing business. Many different industries are likely to be affected by innovative modes of competing, forcing many companies to re-evaluate what industry that they are in, its structure and their position in it in order to claim or re-claim a competitive advantage (Porter & Heppelman, 2014; Grant, 2016, p. 410).

A third wave of IT-driven competition

Authors Porter and Heppelman (2014) have described the emergence of "internet of things" technology implementations as a third wave of IT-driven competition. The first wave occurred in the 1960s and 1970s when individual value chain activities such as order processing and industrial design were digitised and automated, and process efficiency as a result was transformed. This, the authors argue, in turn lead to a standardisation of processes and the need for companies to review the distinction of their strategies. A few decades later, with the emergence of the internet, the second wave introduced the possibility to connect digitised individual value chain activities to enable the integration and coordination of processes. Again, value chain efficiency was transformed and companies were encouraged to review their strategic choices. In the current third wave of transformation, digitisation and automation has continued to transform process efficiency, but has taken an additional significant step: it is now also an "integral part of the product itself" (Porter & Heppelman, 2014). In other words, from transformations of value creation in production, in terms of value chain efficiency improvements, this latest wave of transformation also involves the way value is created with the product (see Fig. 3).

Figure 3. A third wave of IT-driven competition



Source: Porter & Heppelman, 2014

Transformational digitisation and connectivity

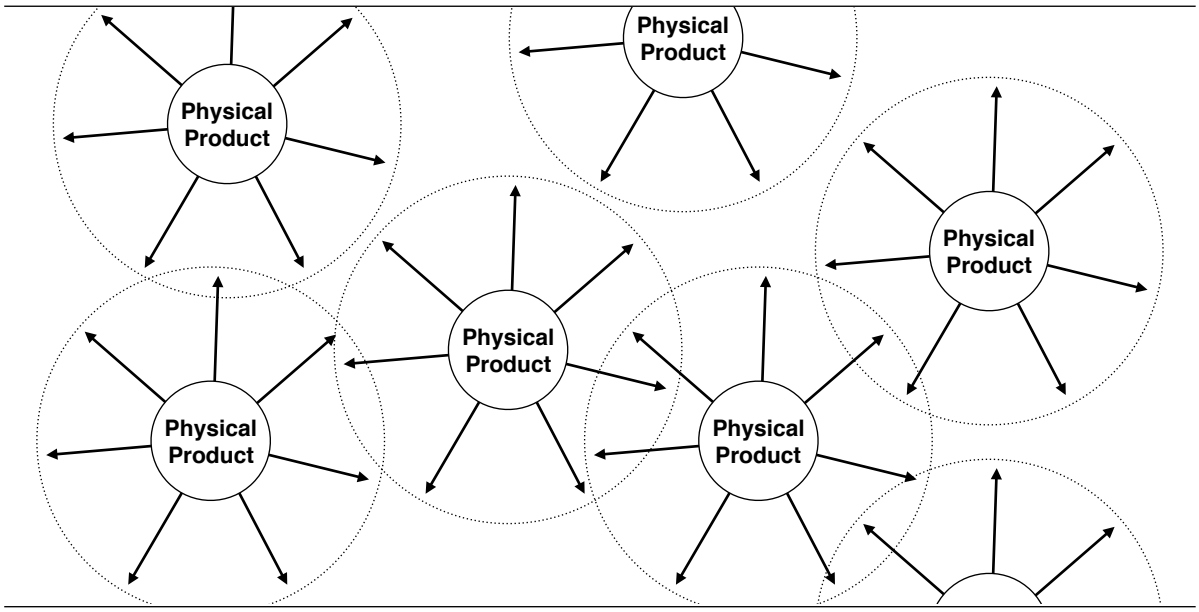
To understand the significance of the digitisation to products, the fundamental properties of digital technology has to be considered (Iansiti & Lakhani, 2014): first, digital signals are superior to analogue signals in that they can be transferred without error; second, digital technology can be replicated indefinitely without any loss of quality, suggesting a zero marginal cost of production; and third, given adequate investments in infrastructure, the marginal cost of adding users and tasks

to digital technology is close to zero. As argued by Iansiti & Lakhani (2014), it is this superiority and almost-zero-marginal-cost economics that gives digital technology its transformational potential on businesses (Iansiti & Lakhani, 2014). In addition to this, the marginal costs of adding users may also facilitate the creation of network effects, where the value benefitted by users increases with the number of users connected to the same network (Brynjolfsson & McAfee, 2014, p. 30), potentially pushing the transformational property of digitisation even further.

When products are digitised, their basic conditions for creating value as well as for capturing (profiting from) this value changes. The added dimension that digital technology brings to products enables them to be produced, maintained and developed in fundamentally new ways. After digitised products leave their factories they are no longer restricted by their initial configurations, but may easily be reconfigured at any time during their product life cycle to change their capabilities of creating and capturing value. With connectivity, these reconfigurations may in addition be performed remotely, almost instantly and at very low costs (leveraging the superiority and low marginal costs of digital technology) (Porter & Heppelman, 2014).

Digitisation also affects the potential boundaries of products (Porter & Heppelman, 2014), see Fig. 4. With software-based functionality and reliable connectivity there is no longer any need to keep all capabilities of products contained within their physical boundaries. Instead, demanding functions such as data management and analytics are often preferably placed in external, central and more powerful products. In other words, not only will the capabilities of products be dynamically reconfigurable after they have left the factory, their scope and scale of capabilities are potentially also dynamic.

Figure 4. The expanding boundaries of products



Porter and Heppelman (2014) takes this reasoning one step further and suggest that digitised and connected products will increasingly tend to create and capture value together with other closely related products in systems and systems of systems. This will, in their view, confront many traditional companies with the strategic choice of pursuing a system integrator role or risk having their products become commoditised and become themselves an original equipment manufacturer (OEM) supplier to system integrators of their industry. Companies, they say, "whose products and designs have the greatest impact on total system performance will be in the best position to drive this process and capture disproportionate value" (Porter & Heppelman, 2014).

Toward greater service-orientation of products

As the capabilities of products to perform new and different tasks increase and become dynamic with added digitisation and connectivity, so does their capabilities for creating and capturing value. With these new technological capabilities, the value that products create may now be tailored throughout their life cycles to do the specific jobs that are momentarily needed by their users, and the capture of value from these jobs may be adjusted accordingly. In other words, if great value is created, great value may be captured. In this way, digitised and connected products are extending the opportunities for companies to be competitive, enabling them to more accurately and distinctly do the job that their customers want and to more proportionally profit from it. Instead of earning money from selling products in traditionally transactional ways, companies are being enabled to sell services to their customers in more continuous ways (Johnson, Christensen & Kagermann, 2008; Atzori, Iera & Morabito, 2010; Iansiti & Lakhani, 2014; Porter & Heppelman, 2015).

In this shift, some companies will undergo transformations that move them away from being developers, marketers and sellers of products to being developers, marketers and sellers of product-service-systems (PSS) - transformations that for many companies may turn out to be complex undertakings (Wallin, Chirumalla & Thompson, 2013). This report will return to this topic in later sections. From an industry perspective, shifting toward a greater service-orientation of products has some significant implications in terms of the new ways companies may compete and in how the industry that this competition takes place will look like (Porter & Heppelman, 2014). According to Porter and Heppelman (2014), *"companies must look beyond the technologies themselves"*, and ask *"what business am I in?"*

New technological capabilities are redefining organisations

As significant as the analysis of the environment that a company operates in may be for the strategic choices that it makes, a consistent strategy also needs to take into consideration the internal resources of the company's organisation - a notion that is commonly referred to as strategic fit (Grant, 2016, p. 10). With the new technological capabilities that digitisation and connectivity offers, many companies will need to re-evaluate their internal structures, processes, assets and competences in order to stay competitive when their industries are transforming (Porter & Heppelman, 2015).

Organising around data

The internet of things has been described as a transformation of the traditional pathways of information, in which "the physical world itself is becoming a type of information system" (Chui, Löffler & Roberts, 2010). As argued by Chui et al. (2010), when companies are entering into the world of digitised and connected products, new patterns of data pathways are likely to be required in their organisations to support new capabilities. In many instances, new types of data may need to be introduced, data may likely need to be shared more efficiently between functions throughout organisations and real-time capabilities to process large volumes of data may need to be developed (Porter & Heppelman, 2015). As suggested by Porter and Heppelman (2015), for companies pursuing digitised and connected products, data is likely to become a core asset, and the capabilities to collect the right data and to maximise its utility will become important contributors to competitive advantage.

In a recent study of 100 leading North American and European companies offering "internet of things" products and services, Capgemini analysts conclude that many organisations still lack necessary data management capabilities (Gunnarsson, Williamson, Buvat, Nambiar & Bisht, 2014). These capabilities include a IT-infrastructure that can accommodate high capacity storage of data in a way that can be scaled up quickly as businesses grow, an ability to intelligently analyse large amounts of streaming data in real-time, and adequate frameworks for maintaining data security. Porter and Heppelman (2015) agree that a capable IT-infrastructure will be very important for "internet of things" companies and add that it must take on a new, more active and central role in organisations. In their view, IT-operations need to develop new types of relationships in organisations and integrate and collaborate more directly with other functions, especially those involved with the research and development of products and services. To achieve greater collaboration, the authors suggest an increasing reliance on cross-functional teams and the set up of dev-ops teams for the management of marketed products and services. To manifest a data-centricity in organisations, they also suggest creating dedicated data management units that are responsible for data coordination and "enterprise-wide visions of data analysis".

Of course, different companies will have different distances of transformation to go. Perhaps most obvious, companies that already have capable software organisations will have have a shorter distance to go. In addition to those related to the capabilities to develop software, Porter and Heppelman (2015) point to several lessons from software development that might be useful when developing and maintaining "internet of things" solutions: shorter development cycles and agile methodologies to facilitate iterative collaboration; new and innovative business models that focus on continuous customer relations and products as services; integration of product systems with frequent incorporation of third-party solutions; and an increasing reliance on analytics as a competitive advantage.

New relationships with customers

Other than IT-operations and software development, a broad range of functions are predicted to be affected when developing "internet of things" capabilities. One of these functions is the marketing of solutions. As products become more service-oriented and companies profit less from traditional transactions and more from continuous subscription-type models of payments, new, more long-term and interactive relationships with customers emerge; this transformation follows general trends in marketing that have evolved over the past few decades, towards a relationship marketing paradigm (Grönroos, 1994; Gummesson, 1997) and service-centered marketing logic (Vargo & Lusch, 2004). In these trends, the traditional one-directional seller to buyer relationships are abandoned in favour of more interactive value-creating relationships that, backed up by empirical studies (Gummesson, 1987), more effectively satisfies market needs in more cost-efficient ways. As argued by Gummesson (1987), in reality value is created in the interactions between many different parties, within and outside of companies, not in one-to-one temporary connections but in enduring many-to-many networks. The co-creation of value is mutually beneficial and it lasts as long as the relationships in which it is created. An optimised total value and cost-efficiency then, he says, is possible by maintaining established relationships instead of iteratively dropping and re-establishing them in the form of multiple single transactions. This view on marketing has implications for a large share of company employees who, Gummesson (1991) says, must become "part-time marketers" and partial owners of a distributed responsibility for managing value-creating customer relationships.

Porter and Heppelman (2015) recognise the changing and growing need to actively manage customer relationships within the domain of digitised and connected products and suggest that special "customer success management" units be set up for this reason. These units, they say, should not replace existing sales, marketing or sales units but should assume the overarching responsibility to handle after-sale customer relationships and continuously monitor and elaborate the data and values created in these so that its utility is maximised.

Value chains versus value networks

As may be seen from the above discussion, when companies take on the corporate-wide challenge of organising around its data and developing its customer relationships, its existing value chains will be significantly impacted. Porter and Heppelman (2015) has pointed out many of the potential changes that value chains might need to undergo in companies entering into the "internet of things". They have suggested a new level of complexity in organisations, where greater collaboration, integration and coordination is central to the creation and capture of value. Westerlund, Leminen, and Rajahonka (2014) has brought the ideas of Allee (2000) into the realm of the "internet of things" to argue that value is created in networks rather chains. According to Allee (2000), the traditional value chain suffers from a production-line perspective that belongs to industrial models that have lost their usefulness in the more fluid and complex structures that have developed recently

in an increasingly knowledge-based economy, such as those introduced with, for example, e-commerce.

Westerlund et al. (2014) draw on the notion that "internet of things" value is created in ecosystems of many different actors, with the company itself being one. Although there is no agreement on a common definition (Westerlund et al., 2014), efforts have been made to define these ecosystems 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 utilising a common set of core assets related to the interconnection of the physical world of things with the virtual world of Internet. These assets may be in a form of hardware and software products, platforms or standards that focus on the connected devices, on the connectivity thereof, on the application services built on top of this connectivity, or on the supporting services needed for the provisioning, assurance, and billing of the application services" (Mazhelis, Luoma, & Warma, 2012)*

Parallels can here be drawn to the systems-of-systems described by Porter and Heppelman (2014). With these ecosystems in mind, rather than trying to transform the sequential parts of value creation in an organisation, Westerlund et al. (2014) argue that companies should adopt a more dynamic approach and base their transformation on the identification of value networks. Building their argument on an increasing complexity of general services in ecosystems, based on partnerships, Visnjic and Neely (2011) come to similar conclusions and argue that value creation is beginning to "take on the shape of a value net or a web rather than a value chain".

Developing new business models

Gartner recently forecasted that the "internet of things" would constitute close to 2.6 billion connected things by 2020, which, mainly through the provision of services, would result in a global economic growth equivalent to $1.9 trillion (Middleton, Kjeldsen & Tully, 2013). Yet, according to the Capgemini study mentioned earlier, as much as 70 of the surveyed 100 leading North American and European companies were not generating any service revenue from their "internet of things" solutions despite the expected and attractive potential of these (Gunnarsson, Williamson, Buvat, Nambiar & Bisht, 2014). Analysts at Deloitte point out that, although the opportunities of it are great (and widely believed to be so), the "internet of things" is still much in its infancy (Openshaw, Wigginton, Hagel, Brown, Wooll & Banjeree, 2014).

Based on a workshop with industry leaders at MIT Media Lab, Openshaw et al. (2014) describe a worry among executives about the perceived risks of implementing "internet of things" solutions in relation to the economic rewards that they represent. These perceived risks, they suggest, are connected to the interoperability and security of technological solutions. At the same time, Openshaw et al. (2014) conclude that some "internet of things" providers are lacking a clear and comprehensive vision for how the "internet of things" will become longterm profitable for

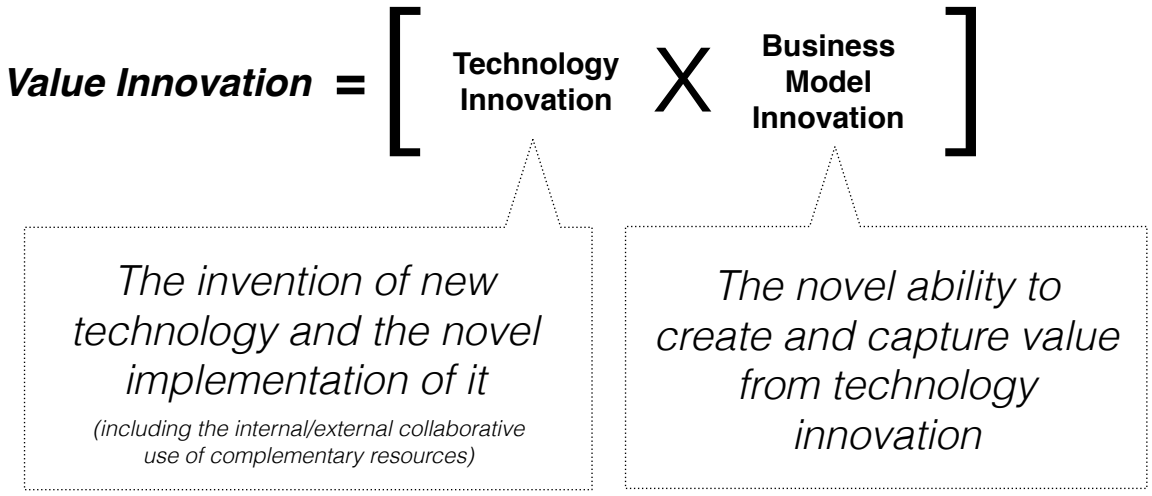
companies. Based on their findings, many opportunities are missed because visions focus to narrowly by attempting to sell technological solutions to CIOs and failing to engage other functions such as CEOs, CMOs and CFOs in the process, who are likely to be central in the larger scope of business transformation.

Technology and business model innovation

The failures of technology innovators to profit from new products has previously been investigated by Teece (1986), who has concluded that economic success from technological innovation often hinges on a commercialisation process that utilises other, complementary assets of a company or its environment.

In line with this, Chesbrough (2010) has argued that "technology by itself has no single objective value". Instead, he says, "the economic value of a technology remains latent until it is commercialised in some way via a business model" (see Fig. 5 for an illustration of this). This is perhaps not so surprising; to be able to profit from anything for any extended period of time, some sort of repeatable structure for doing so must be in place, albeit intentional or not.

Figure 5. The innovation of value



But what Chesbrough (2007) also suggest is that, to continue to be profitable, many companies must *increasingly* rely on a capability to innovate their business models alongside of their technology. His reasoning is based on the changing nature of products and production. While new products traditionally were able to remain distinguishable in the market for some time before, thanks to their technological edge, over time they have increasingly started to become commoditised at a much faster pace, forcing companies to keep shorter product life cycles. At the same time, he says, the total costs of creating, developing and shipping products has significantly increased. Shorter life cycles of more costly products are, in other words, limiting the economic value that traditional

business models can produce. This suggests an economic driver of new business models. According to Teece (2010), who agrees that product innovation needs to be supplemented with business model design to a greater extent for companies to be profitable, much of this is due to developments in the global economy and new relationships between customers and suppliers. In his line of reasoning, global trading and communications have afforded customers greater power in choosing their suppliers and in finding suppliers that are able to satisfy their specific needs. Suppliers therefore need to sharpen their ability to identify customer needs more accurately and find competitive ways of delivering these needs to customers profitably. In addition, the internet and low-cost information technologies that have created expectations from customers that basic services should be free. This, he suggests, has further amplified the need for creative solutions to capturing economic value from products and services. As summarised by Teece (2010):

> *"[…] the way in which companies make money nowadays is different from the industrial era, where scale was so important and the capturing value thesis was relatively simple i.e. the enterprise simply packed its technology and intellectual property into a product which it sold, either as a discreet item or as a bundled package. The existence of electronic computers that allow low cost financial statement modelling has facilitated the exploration of alternative assumptions about revenues and costs."*

At the same time, as has been discussed previously in this report, new technology is opening up new possibilities for how economic value can be created. Porter and Heppelman (2014), for instance, have suggested that the new abilities of "smart and connected products" will allow radical changes to the traditional business models of manufacturers, and that the shift from traditional products toward products-as-services will open up a "a spectrum of new business models for capturing value". This suggests a second driver of business model innovation, namely that of emerging new business model opportunities created by technology innovation. To maximise the economic value of new potential technology, companies must find the most suitable business models or risk having their competitors do it before them (Chesbrough, 2010).

Long-term profitability, then, will rely not only on companies' ability to create innovative products, but also on their ability to find new and competitive ways of turning these into economic value. Yet, as noted by Teece (2010), successful innovative business models by themselves are not guarantees for a sustained competitive advantage; companies still need to consider strategic choices that may enable them to develop business models that are not only efficient, but also differentiated and difficult to imitate. This may not be an easy task, but one that could prove to be vital for companies' future profitability. For many companies, who are traditionally much more capable of innovating technology, however, this means that new capabilities must be developed (Chesbrough, 2010).

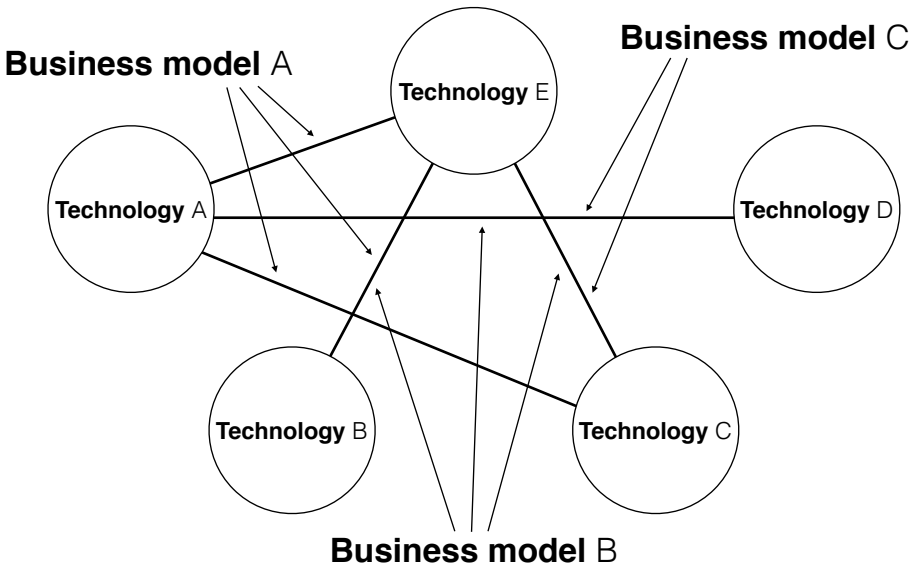
The relationship between technology innovation and business model innovation is not always immediately apparent. While technology company executives often neglect to include business models when they think of innovation (Teece, 2010), technology innovation is also frequently limited by existing business models. As argued by Baden-Fuller and Haefliger (2013), the

relationship between technology and business models goes both ways and is often complex. From one perspective, they say, the technology that is immediately available to a company may influence the perceived range of business models that it could implement. From another perspective, the business model that is currently implemented at a company may influence the perception of how technology could be developed and in which ways this technology could become profitable.

An good example of the limitations on technology by an existing business model is that of Xerox (Chesbrough & Rosenbloom, 2002). In their account of the many spin-off ventures originating from the Xerox company, Chesbrough and Rosenbloom (2002) demonstrate how a company with a strong, successful business model may fail to turn promising new proprietary technologies into business value. Instead of evaluating these technologies through new and suitable business models, Xerox' existing business model was used to forecast their economic potential. History showed, however, that technologies that were deemed unworthy of further investments by this standard, proved to be successes when implemented externally in spin-off ventures of different business models.

Another important attribute of the relationship between technology and business model innovation, that connects to Teece's (1986) findings about the importance of complementary assets, is that of technology ecosystems. Baden-Fuller and Haefliger (2013) points out that information technology and the increasing prevalence of digital platforms is transforming the interoperability of technology, making it "more intense, dynamic and uncertain". The complementarity of these new technologies, they suggest, depends on the choices of business models through which technologies are made available. In other words, the complementarity of technologies in their ecosystems involves also the complementarity of their business models (see Fig. 6). Or, in a reversed perspective, adopting an ecosystem perspective of technology enables greater collaboration and the innovation of new business models (Baden-Fuller & Haefliger, 2013).

Figure 6. Technology and business model ecosystems



To conclude, business model innovation is becoming an increasingly important factor in establishing a competitive advantage and leveraging new technology. In many cases, it will require new company capabilities. But, in order to make use of its full potential, companies may need to develop their awareness of the relationships between technology innovation and business model innovation and reduce influences of limiting cognitive frames and biases stemming from existing technologies and already implemented business models.

What is a business model?

In order to more effectively be able to address business model development, a clear definition of what a business model is and a shared language to talk about it is needed.

Zott, Amit and Massa (2011) have performed a survey of journals published between 1975 and 2009 (based on the EBSCOhost database) to map the emergence of the "business model" term. They found that the use of the term has steadily but slowly increased since the late 1970s, until circa 1995 when it started to increase more drastically. In line with the argumentation above for the emerging need to innovate business models, this break, they say, has been attributed to the introduction of the internet, fast growing emerging markets and companies' increasing dependency on postindustrial technologies. Yet, despite the steady increase of the term over the last few decades, several authors have noted that an agreed-upon common definition has yet to be established (Teece, 2010; Arend, 2013; Baden-Fuller & Mangematin, 2013; Spieth, Schneckenberg & Ricart, 2014). To explain this and offer a path forward, some authors have suggested that progression in the definition of the business model relies on greater clarification of its relationship to business strategy, a field with which it often overlaps (Magretta, 2002; Casadesus-Masanell & Ricart, 2010; Markides, 2015). Notwithstanding the lack of a common definition, a few general common traits of business models have been concluded from the survey, namely that the business model: is an emerging unit of analysis; takes the holistic approach to how companies "do business"; concentrates on the activities of companies; and, sets out to explain not only how value is captured, but also how is it created (Zott, Amit & Massa, 2011).

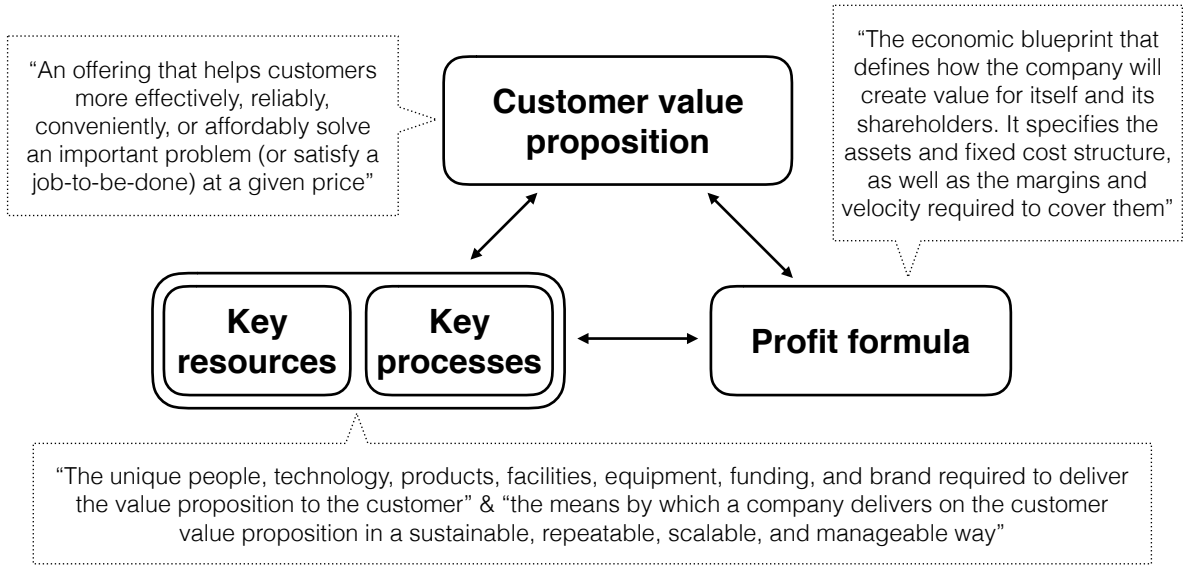
In its most basic form, Magretta (2002), has described business models as "telling a good story". In this view, business models are narratives that tell the stories of companies using elements such as "precisely delineated characters, plausible motivations, and a plot that turns on an insight about value". New business models are created, just like stories, through "reworkings of the universal themes" or, in more business-oriented jargon, in "variations on the generic value chain underlying all businesses" (Magretta, 2002).

In an effort to concretise a general framework for the term, several authors have described business models as systems of interdependent activities taking place both inside and outside of companies (Zott & Amit, 2010). In short, this activity systems perspective focusing on the what, how, who and where of activities to construct systems that capture value through generic themes such as novelty, lock-in, complementarities and efficiency. This perspective, Zott and Amit (2010) argue, comes

natural to entrepreneurs and managers and offers a holistic perspective that can easily be developed and refined.

Using a well-known analogy, Johnson (2010, p. 46) has described the business model as the architectural blueprint of business. In this analogy, which is also shared by software development, business model development conceptualises the creative and technical design process that goes into the the discipline of constructing complex structures. It highlights the creative process, the demanding technical integration of details into a whole and the importance of visualising the real-world product before as well as after it has been built. It serves as a justification for developing new blueprints, because just as with business models, "without a clear plan, any house that is built will probably look like the last house the crew worked on, because that's all they have to go on" (Johnson, 2010, p. 46). In an effort to simplifying a manageable and repeatable business model innovation process, Johnson (2010, pp. 21-46), has described a "four-box" framework consisting of a customer value proposition (CVP; or "job-to-be-done"), a profit formula and supporting key resources and key processes (see Fig. 7).

Figure 7. The "four-box" business model framework

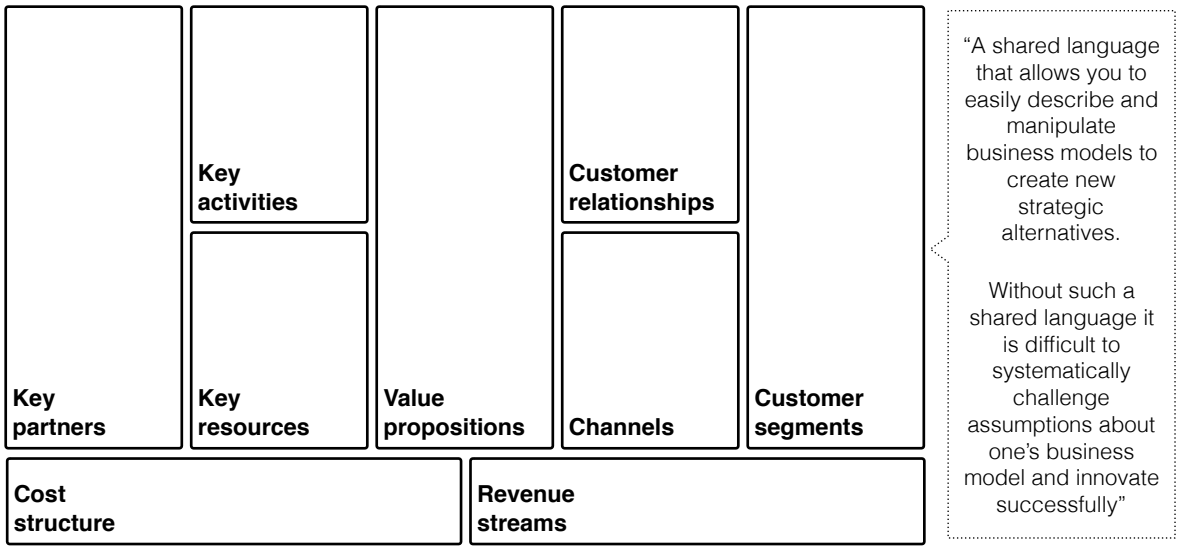


Source: Johnson, 2010, p. 24-46

Osterwalder and Pigneur (2010, pp. 15-19) also draw on the notion of the business model as a blueprint, but suggest nine different building blocks to represent it: customer segments, customer value propositions, (communication, distribution and sales) channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure. By placing these nine building blocks on a chart that they refer to as the "business model canvas" they suggest the use of a generic template for creative business model development work and discussion (see Fig. 8). As nicely exemplified by its users' comments, the canvas is suggested to be used as a tool for defining and redefining business models; translate business plans into processes; illustrate business

interdependencies; and, constitute a platform for business decisions as well as discussions (Osterwalder & Pigneur, 2010, pp. 50-51).

Figure 8. The business model canvas



Source: Osterwalder & Pigneur, 2010, pp. 15, 18-19

Business model innovation practices

In his description of the "four-box model", Johnson (2010, p. 113) is attempting to build a framework that will enable a systematic and repeatable process of business model innovation. Although "luck and inspired leadership will take you a long way", he says, such factors cannot be generally relied upon. By using a framework, as the ones described above, business model innovation is in the long run more likely to result in predictable outcomes.

Building on the use of such frameworks, several business model innovation practices have been suggested. With the frameworks, representing different business models in a common language is possible. This in extension means that a library of different typical business models can be built, studied and subsequently used as references when new business models are developed. In other words, with these frameworks comes the possibility of creating and using design patterns. Such a concept has already been used in other contexts, notably in the development of object-oriented software architectures (Gamma, Helm, Johnson & Vlissides, 1994). Several authors have suggested and exemplified the use of such patterns for business model development (Johnson, 2010, p.131; Osterwalder & Pigneur, 2010, pp. 55-119; Gassmann, Frankenberger & Csik, 2014); see for example Gassmann, Frankenberger & Csik's (2014) collection of 55 different business models.

With a practitioner's point of view in mind, Osterwalder and Pigneur (2010, pp. 124-195) have suggested several activities that may be useful in the business model development process: "ideation", meaning a the creative process of thinking outside of the box and conceptually asking

'what if?'; "visualisation", with concretisation of abstract ideas for discussion, understanding and exploration; "prototyping", in an iterative experimentation of designs as proofs-of-concepts; "storytelling", as a tool for bringing attention to, engaging and guiding employees in the transition from one business model to another; and "scenarios", for mapping future implications of different business model alternatives.

Challenges to business model development

This section will highlight some of the most frequently referred challenges to business model innovation and development.

Resource immaturity

Specifically for the "internet of things", from a technological perspective, business model development is challenged by the diversity of objects, an immaturity of innovation and a lack of ecosystem structure (Westerlund, Leminen & Rajahonka, 2014). As summarised by Westerlund et al. (2014), the diversity of objects suffers from a lack of standardised interfaces that would enable a smoother integration of products and services; an immaturity of innovation means that products and services are not yet being developed with enough modularisation to leverage efficient complementarity; and, the unstructured ecosystems are faced with unsettled definitions of roles, value-creating logics and governance to encourage significant collaboration.

Limited knowledge and uncertain assumptions

Johnson, Christensen and Kagermann (2008) have posed the question of why it seems difficult to realise the growth that business model innovation is theoretically capable of. The answer, they say, is two-fold. The first hurdle is that business model innovation is a still a relatively new field of study that will require further analysis to more completely understand the dynamics and processes involved in innovating business models. This first problem, they suggest, is a lack of definition. To be able to more fully control the activity that is business model innovation, more research is needed to uncover its fundamentals. In this reasoning, with a more precise definition, practitioners would be able to more effectively and predictably undertake business model innovation, as well as feel more confident in doing so. As suggested by Johnson (2010, p. 130), the implementation of new business models is a task of managing assumptions, which to varying degrees are based on a lack of knowledge and uncertainty, and therefore carry with them a certain amount of risk. To manage them, he continues, is to clearly define them and to effectively test them. Perhaps, the more complete the definition of business model innovation would be, the more structured the process of defining and testing assumptions would also be. With a well-defined and repeatable model for business model innovation, managers would be better equipped to confidently approach and handle the inherent lack of knowledge and uncertain assumptions on which it is based.

The second hurdle to achieving growth through business model innovation, according to Johnson, Christensen and Kagermann (2008) is that many companies lack a good understanding of their current business model. This may be because companies' business models have evolved

progressively through natural adjustment to its environment or organisation, or because its design has prevailed for such a long time that it has become a silent component of its operations. As Johnson (2010, p. 46) puts it:

> *"Eventually, the elements of the business model commonly fades into the mists of institutional memory, even as it lives on as a practical matter in the rules, cultural norms, and metrics. This may be the reason why so many companies may operate so effectively without being able to articulate what their business model is."*

Yet, as Johnson, Christensen and Kagermann (2008) suggest, to be able to realise when a new business model is required and to be able to leverage existing core business, companies may first need to understand their current business model. As suggested by Chesbrough and Rosenbloom (2002), in their study of Xerox, failing to understand existing business models may leave companies with a hidden cognitive bias that will unconsciously influence their ability to identify and evaluate new opportunities.

Internal and external inertia

Even in the case that a company realises that change is necessary and successfully designs a new business model, the implementation of it may not come easy. As described by for example Sydow, Schreyögg & Koch (2009), organisations often progress over time to become increasingly path dependent: in "a regime of positive, self-reinforcing feedback constituting a specific pattern of social practices", as they describe it, organisations evolve to increasingly reinforce their historical solutions, structures and processes with a tendency to reject alternatives. This is perhaps not so surprising, companies gradually learn and become better at and more involved in what they do. From another perspective, this phenomenon of increasing stability with time has also been called an evolution toward fit (Siggelkow, 2002).

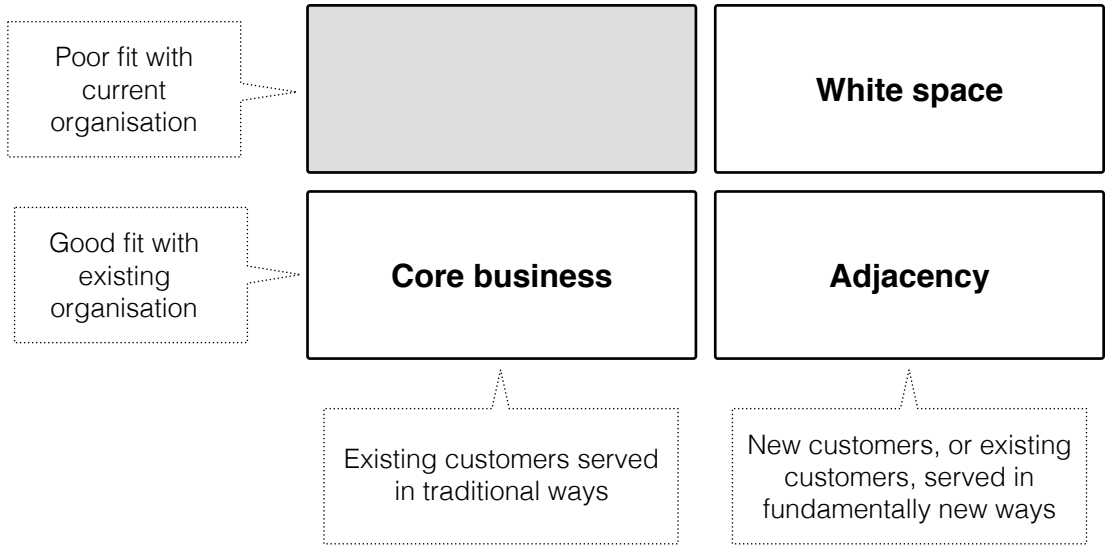
The struggle of established companies to overcome organisational inertia is perhaps especially true when new business models are to be implemented. The reason for this is that business models incorporate so many of the different aspects of an organisation. In order to implement a new business model, a company might need to re-evaluate and restructure its resources and processes; it might need to collectively shift its focus of the value that it is trying to create for its customers; it might need to completely rethink how it communicates and interacts with (potentially new) customers; it might need to reconsider how revenues and costs are registered in its systems; etc.. Of these changes, companies might find it especially difficult to make changes that affect how they finance operations. As discussed by Johnson (2010, p. 162-164), making changes to the profit formula of a company often requires a different take on the margins that can initially be expected of the new business models as compared to the old. This, of course, is a natural result of margins decreasing over time as fixed costs gradually have been paid off. To get around this, financial managers are faced with the challenging cognitive biases of sunk costs.

Often, the changes that might be needed to implement a new business model cannot be managed separately. As becomes apparent in the description of business models as activity systems by Zott and Amit (2010), the organisational inertia in changing business model is emphasised by the interdependencies of its different activities. One activity is often dependent on another, and so changes in one might require changes in another in order for them to remain compatible. As suggested by Markides (2015), "it is not a matter of replacing 10 activities with 10 alternatives: they must be changed and put back together into a self-reinforcing mosaic where everything fits together effectively."

In a larger perspective, business models often span across the boundaries of companies (Zott & Amit, 2010; Wallin, Chirumalla & Thompson, 2013). In line with this, Sandström and Osborne (2011) have argued that the challenge of innovating business models must include all interdependent actors, inside or beyond the boundaries of the company. With the "internet of things", and the ecosystems of actors emphasised therein, such consideration perhaps seems extra relevant.

To define business model innovation in the context of existing business versus new business, Johnson (2010, p. 6-8) has suggested the terms "core business", "adjacency" and "white space" (see Fig. 9). If core business represents traditional business that fits well within the current organisation, and adjacencies represent businesses that are new to the organisation but would still fit well within it, then the white space represents businesses that are both new and transformational to the organisation. With this definition, in line with previous discussions, many "internet of things" efforts are likely to involve a transformational journey, from their core business into their white space.

Figure 9. Business model innovation into the "white space"



Source: Johnson, 2010, p. 8

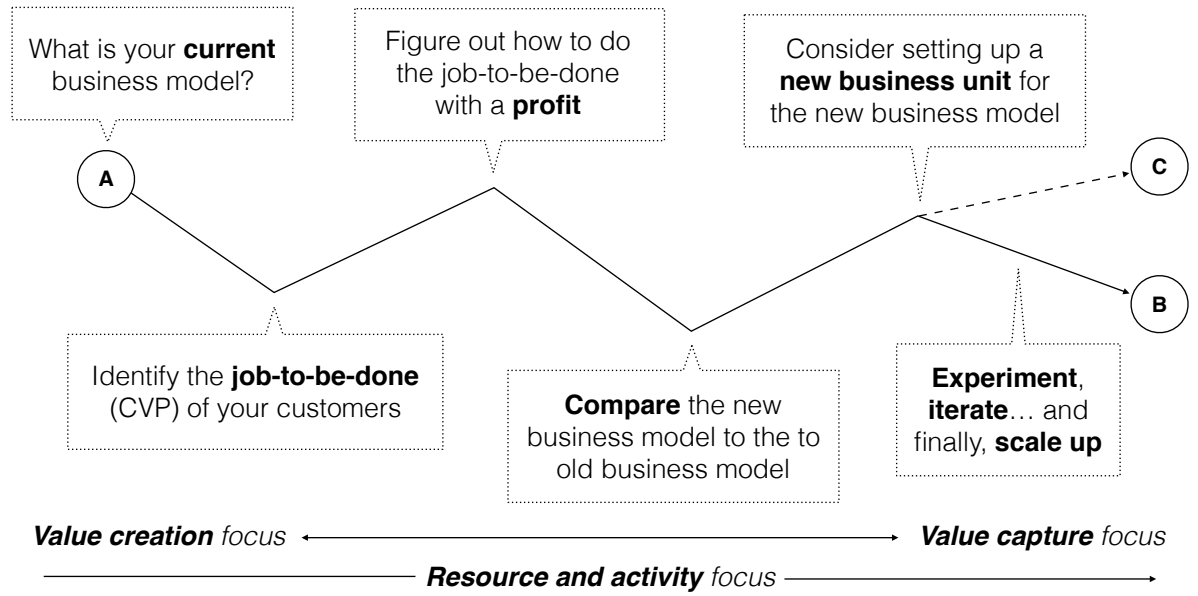
In this section, approaches that have been suggested to overcome challenges of business model innovation and development, in the context of the "internet of things" or more generally, are discussed.

Develop a roadmap

Several authors have suggested the usefulness of developing a roadmap for business model innovation (Johnson, Christensen & Kagermann, 2008; de Reuver, Bouwman & Haaker, 2013). The benefits of this activity is to visualise the process of getting from point A to point B as well as to provide a platform for early discussions about the different choices that may be involved in the transition (de Reuver, Bouwman & Haaker, 2013). Developing a roadmap may also be a good way of addressing relevant assumptions at an early stage, which then can be used to manage risk and set up metrics for later evaluation of new business models (Johnsson, 2010, pp. 143-145).

According to Johnson, Christensen and Kagermann (2008), who defined business models in terms of the "four-box" framework, a roadmap should consist of at least three basic steps: first, identify the CVP or job-to-be-done of your customers; second, construct a blueprint of how this job-to-be-done can be carried out with a profit; third, compare this new business model to your old business model to see what changes are needed and what parts of the old business model can be reused (see Fig. 10).

Figure 10. Develop a roadmap - from A to B (or possibly C)



Johnson (2010, p. 129) has stressed the importance of first focusing on the value creation of business models. The reasons for doing so, he says, has to do with change and testability. With

reference to change, the CVP is expected to evolve during the process as new customer-insights are gained and therefore benefits from an early start; the profit formula, on the other hand, tends to be the part of the business model that is initially dependent on largest set of loose assumptions, formulating these too early will not be very efficient since a large part of them are likely to change in the process. From a testability perspective, while the CVP to some extent may be tested at an early stage in the process, the profit formula which to a much greater extent is based on numbers does not lend itself to reliable early testing, again based on its large set of loose assumptions. As can be seen from this reasoning, as noted previously, developing business models likely has a lot to do with managing assumptions.

Start small, experiment and learn

In a recent paper by researchers and practitioners at Bosch IoT Lab (Bilgeri, Brandt, Lang, Tesch & Weinberger, 2015), the importance of challenging and validating assumptions in developing business models is discussed specifically for the "internet of things". In the authors view, business model development work needs to include a parallel process of controlled experiments to manage risks as well as to incorporate stakeholders in the process (internal as well as external). The validation needs to take into evaluation both the level of uncertainty as well as the potential impact that assumptions may have. The process of business model development as they suggest it consists of an iterative process with a first phase of ideation followed by phases of preparation and evaluation. In this way, the authors suggest that business model development should be undertaken initially in a smaller scale, in an experimental way with a scaling up only when the business model blueprint has reach some maturity and its most significant assumptions have been adequately addressed.

Other authors have also advocated an experimental approach to business model development (Magretta, 2002; Chesbrough, 2010; McGrath, 2010; Johnson, 2010, p. 135). Magretta (2002) describes the process of business model development as "the managerial equivalent of the scientific method - you start with a hypothesis, which you then test in action and revise when necessary." Arguing on the basis of business model development's highly uncertain assumptions and the inability of companies to predict the future, McGrath (2010) has suggested the competitive advantages of a discovery-driven experimental approach. In her view, business model development should aim for an evolutionary learning process through a focus on low-cost and rapid prototyping rather than analytical and long-term plans. The aim should be to leave behind assumptions or metrics that the organisation has established in its current business model and instead recognise that winning new business models are hard to predict.

McGrath (2010) also point out that business model experiments usually take place across as well as within companies. In other words, it is important that experiments reflects the real-world in which it is supposed to be implemented. To get a sense for how assumptions survive in their designated contexts, Johnson (2010, p. 137) has suggested that trial-and-error iteration of business models should aim to provide small but early profits as proofs-of-concept. In agreement with McGrath (2010), such testing of assumptions, he says, should be made early, at low costs and often. To do

this effectively yet with contained costs (and risks), a foot hold market that is representable of the final market should identified and used as a laboratory (Johnson, 2010, p. 138). To be able to accurately validate the performance of new business models and the validity of the assumptions on which it is based, a crucial step will be to set up effective metrics or criteria for its success (McGrath, 2010; Johnson, 2010, pp. 141-145).

Once a gap analysis of the old and new business model has been performed, some authors have suggested that the set up of a business unit should be considered (Johnson, Christensen & Kagermann, 2008; Johnson, 2010, p.138). Such a consideration may look at the historical and cultural ability of the current organisation to manage two different business models in parallel. This is exemplified in Wallin's et al. (2013) account of a Swedish OEM of military aircraft engine components transforming their business model towards a PSS:

> *"[…] the challenge for manufacturers is to 'take a mental break' from their product when exploring how to develop a PSS. History and attachment to the product may make it difficult for the company to see radical innovation opportunities that may or may not require significant changes to their core product."*

Often, however, as suggested by several authors, to avoid the path dependency of the existing organisation and current business model, it might be a good idea to set up a new business unit during the development phase of the new business model (Johnson, Christensen & Kagermann, 2008; Zott & Amit, 2010; Markides, 2015; Johnson, 2010, p. 138). The degree and mode of separation, however, may differ depending on the situation. Sometimes it might be possible to share resources between separated units (Johnson, 2010, p. 134). And sometimes, as suggested by Khanagha, Volberda & Oshri (2014), an ambidextrous approach of recursive iteration between separated units may be a necessary component in transitioning the entire organisation and learning collectively.

Identify and acquire (agile) capabilities

As mentioned previously in this report, in the context of the "internet of things", many companies will need to acquire new capabilities to support new business models (such as IT, software, service and marketing, etc.) However, many companies will also need to acquire new capabilities to be able to successfully take on the journey that is the innovation and development of their business models.

To prepare itself for the organisational challenges of implementing a new business model and battle the stability/rigidity of the existing business model, Doz and Kosonen (2010) have suggested that companies sharpen their agile capabilities. Such agile capabilities include, in their terms: a higher strategic sensitivity based on for example greater foresight, experimentation and conceptualisation; greater leadership unity based on for example dialogue, integration and alignment; and, increasing resource fluidity through for example decoupling, modularisation and ambidexterity. Partly in line with this, Hock, Clauss and Schulz (2016) have found in an empirical study of companies in the engineering industry that strategic sensitivity, collective commitment and resource fluidity

particularly favour business model innovation. These cultural qualities therefore stand in contrast to those that are less novelty-oriented but more efficiency-oriented and, according to their study, contribute less favourably to a business model innovation capability.

Heikkilä, Heikkilä and Bouwman (2015) has taken these dynamic capabilities a step further and suggest that business model innovation with its need for fast iterations, early market-based results and continuous stakeholder integration should follow the principles developed for agile software development.

Explore the ecosystem and find a niche

As has been suggested previously in this report, "internet of things" solutions are likely to benefit from an ecosystem's perspective on complementary technologies and business models (Zott & Amit, 2010; Wallin et al., 2013; Openshaw, et al., 2014; Westerlund et al., 2014; Bilgier et al. 2015). This, in turn, suggests that companies may need to explore potential ecosystems, find a strategic niche position within them and evaluate this position in relation to the other actors of the ecosystem:

> *"[…] a solid understanding of the respective ecosystem is paramount in order to identify one's potential position/role within the new ecosystem as well as other important collaborators, their roles, and their motivation for participating in the ecosystem" (Bilgeri et al., 2015)*

Westerlund et al. (2014) have suggested that business model development in "internet of things" ecosystems need to focus more systematically on the connections and dynamics of values networks and have suggested a design process based on an ecosystem-wide mapping of value drivers, value nodes, value exchanges and value extracts. In an earlier work, focusing on value creation in technology innovation ecosystems, Adner and Kapoor (2010) suggest the importance to "distinguish between upstream components that are bundled by the focal firm, and downstream complements that are bundled by the firm's customers."

To evaluate the position of a company in service ecosystems and to manage the risks that come with the increasingly collective engagements therein, Visnjic and Neely (2011) have suggested that companies should also map the "accountability spread" between actors. Such a mapping should include an analysis of the different "operational, financial, dynamic, systemic, performance or incentive related" risks involved in collaboration.

Network and collaborate

To cope with business model changes that involve a greater network of companies, Berglund and Sandström (2013) have suggested that companies adapt an "open systems" perspective on collaboration. For managers, the authors say, this often means greater "development of shared knowledge, appropriability regimes based on trust, network stability and the alignment of heterogeneous interests". To adress the challenge of unstructured ecosystems, as described by

Westerlund et al. (2014), companies need to find ways to network and collaborate to a greater extent.

In what they call “open business models”, Osterwalder and Pigneur (2010, pp. 108-119) have suggested business model developers invite external partners and customers in the process. In a more general perspective, Miles, Miles and Snow (2006) have suggested that companies who struggle to be competitive on their own instead become collaborative entrepreneurs. This new perspective on value creation, they argue, is based on learning through experience; starts from internal collaboration within companies and moves outward; requires ongoing investments in intangible assets; and, hinges on more general, societal values.

In line with the agile capabilities suggested above, in order to increase internal collaboration, Edmondson (2012) has suggested that companies should try to foster an ability to dynamically create teams “on the fly”. To be able to do this effectively, she says, “leaders need to manage the technical issues of scoping out the challenge, lightly structuring the boundaries, and sorting tasks for execution”. Leaders can accomplish this by “emphasising purpose, building psychological safety, embracing failure, and putting conflict to work.” This type of team-based organisational dynamics is also reflected in the recent report on Global Human Capital Trends by Deloitte (Schwartz, Bohdal-Spiegelhoff, Gretczko & Sloan, 2016). According to this report, changing global markets and digital disruptions are forcing companies to innovate at a faster pace than before and are as a result of this now changing in how they organise. These new organisations are moving away from functional structures and towards “network of teams” with “a high degree of empowerment, strong communication, and rapid information flow.”

METHODOLOGY

Research design

This report has so far presented a literature review of some of the latest relevant theories on the "internet of things" and business model development. Special attention has been paid to the theoretical opportunities and challenges that may be found when companies wanting to expand into the domain of the "internet of things" set out to develop their business models.

Based on this review of existing theories, a case study of current and potential activities at the consultancy company Combitech has been performed. In line with the purpose of this research project, this case study has sought to explore the opportunities and challenges of providing business model development as a consultancy service for customers striving to establish themselves within the "internet of things".

The case study format was chosen because of the opportunity presented to the author to study an organisation with which he already had a relationship. This, in turn, allowed the research to jump more quickly to in-depth observations and insights. In addition, the organisation of the case study was thought of as particularly interesting in its rather well-defined position in relation to the research topic; as a traditionally technology-oriented company put next to a traditionally non-technology-oriented activity. By providing new empirical data from a case study of a representative organisation, this research has tried to extend existing theories inductively with its exemplification (Bryman & Bell, 2011, pp. 62). At the same time, however, by employing the case study format, the research will inevitably suffer from some limitations of generalisability (Bryman & Bell, 2011, pp. 64).

The case study is based on a few but in-depth qualitative and semi-structured interviews with key persons within Combitech. The overarching aim with this approach, as is typical, was to collect language data that would indicate the views, perceptions and opinions of the persons interviewed, through the language they use (Easterby-Smith, Thorpe & Jackson, 2012, p. 242).

The qualitative nature of the study serves several purposes. First, the limited structure and flexibility that is significant of a qualitative approach (Bryman & Bell, 2011, pp. 405-406) has enabled the research to commence with a more open-ended set of initial expectations. At the start of the study, little was known by the author about the state of business model development at Combitech, and of offering such an activity as a service to its customers within the "internet of things". Nor did any existing theories from studies of similar companies provide any indications in terms of which findings could be expected. Such studies were simply not found. This lack of initial expectations of potential findings matched well with the limited structure of the qualitative approach. The flexibility that this approach afforded the author in conducting interviews, resulted in findings that may otherwise have been excluded if a more structured yet poorly directed approach had been taken instead. Second, the qualitative approach fits well with the contextual perspective that was required

to understand the state of the company being studied. In this perspective, the author needed to quickly produce a large set of details that could be used to to find plausible explanations for how the company views and and interacts with its environment. Third, a qualitatively oriented approach was required in order to effectively navigate the rather complex and novel topics at hand. This complexity includes the conceptualisation of business models in several layers, with the consultancy company's own business model in one layer and its customers' in others. It also include the relatively novel significance of business models and business model development in the context of an ecosystem of different actors. Indeed, as should be noted with hindsight of the study, to get to the core of the topics, discussions and elaborations between the author and the respondents of the interviews turned out to be indispensable to its findings.

As these discussions and elaborations might suggest, the interviews performed in this case study involved to some degree the participation by the author. This participatory aspect brings to mind the concept of action research, in which the researcher collaborate with participants to diagnose and provide practically useful solutions to real problems of the studied organisation (Bryman & Bell, 2011, p. 413-414). Still, this study cannot be said to have incorporated the full collaboration that action research might entail, although some aspects such as the participation of the researcher in discussions and generation of insights may overlap.

Data collection

While conducting the interviews, as should be expected from semi-structured interviews (Bryman & Bell, 2011, p. 467), an emphasis has been put on trying to understand how respondents frame and understand the issues and events in focus. Efforts have been made to ask open questions and to probe for more details to an as large degree as possible in order to limit interviewer biases in the data (Easterby-Smith, Thorpe & Jackson, 2012, p. 242). Due to the participatory approach of the interviews, however, some degree of biases in the data was expected and considered in its analysis.

Guidance were given to interviews with the use of a written interview guide containing questions elaborating around the opportunities and challenges of business model development as a service. The same interview guide was used as a basis for some common structure in all interviews. Interviews were in almost all cases (except when not considered necessary) initiated with a short introduction of the respondent, including his or her background and role at the company. After this, a short discussion followed on the meaning of the terms "internet of things" and "business model". This was done so that subsequent discussions would be based on a common understanding of terms. Once this was accomplished, a discussion circulating around or probing different aspects of the research topic were performed. See appendix for the interview guide used.

All interviews have been conducted in Swedish and by the author. The duration of interviews ranged between 30 to 90 minutes. With two exceptions, interviews have been located in the work environments of the respondents, in face-to-face meetings. Because of time constraints, two interviews were conducted over telephone. All interviews were audio recorded for accurate later

analysis. All together, eight interviews were conducted. Interview respondents were selected in collaboration with one of the respondents, who holds a central role in the company. Selection was made purposively (Bryman & Bell, 2011, p. 441), with respondents selected based on their likely ability to contribute to the usefulness of discussions and findings, their different roles as well as their potentially different perspectives. Not all selected respondents were able to participate. See below list for the order, context of interviews as well as titles and name of respondents who participated in the study.

Order	Context	Respondent's role	Name
1	In person	Business Area Manager, Information Security	Pernilla Rönn
2	In person	Business Development Manager	David Skyborn
3	In person	Business Area Manager, Information Technology	Niklas Barkman
4	In person	Business Developer	Sarkan Gazrawi
5	In person	Business Developer	My Ljungberg
6	In person	Technical Manager, Reality Labs	Jesper Tordenlid
7	Telephone	Senior Business Developer	Jan Sjunnesson
8	Telephone	Chief Executive Officer	Hans Torin

Data analysis

To distill the large amount of details that were collected in the albeit few but in-depth interviews that were performed in this study into useful concepts, an interpretive approach was used. In this way, the author's background as an employee at the company was utilised to quicker be able to come to insights. In addition to prior personal experiences, ideas from the existing theory reviewed in this project also helped steer the analysis in a relevant direction. Further steering of both the interviews as well as the analysis was done through an iterative and recursive identification of themes based on the outcome of interviews. Following one interview, in preparation of the next, themes were refined and developed. This processes enabled an increasingly focused awareness of the themes that emerged from the interviews and made possible the prior preparation of relevant follow-up questions or tests of concepts that might have been missed in previous interviews. This process of iterative and recursive refinement continued until themes eventually reached some sort of theoretical saturation, and little additional refinement was possible. In such cases, the refinement of saturated themes were abandoned in favour of still unsaturated themes. Following the completion of all interviews, all collected data was re-examined jointly to re-evaluate the validity of identified themes. During the full process of analysis, a careful consideration of biases introduced into the data by the author was made. As a rule, any data solely or disproportionately connected to the thoughts or view of the author were excluded from the findings.

Trustworthiness

To establish the quality of this research project and its findings, the criteria suggested by Lincoln and Guba (1985) as suitable for a qualitative approach have been used.

Credibility

To establish a credibility of the accounts presented in the findings of this study, a validation with respondents as well as the university and company supervisors has been performed. Further credibility is given by the fact that the company supervisor has personal experience of the research topics at the company of the study, yet has not participated in the interviews.

Transferability

This study has focused on a small case study of one company. From a theoretical perspective, therefore, the findings should be considered contextually highly specific and of low transferability. Yet, it has been in the author's best intentions to portrait the issues studied and the themes found in an as descriptively rich way as possible within the confinements of the project's format. Building on Bryman and Bell's (2011, p. 398) account of qualitative transferability and the "thick descriptions" of Geertz (1979), this description of findings in this report is hoped to serve as a basis for new interpretations by readers through their perspectives, and in extension inspire transferable ideas.

Dependability

To ensure that findings are backed up with a sense of dependability, all written and recorded material created during the process of this study has been stored electronically for future auditing (Bryman & Bell, p. 398). This material includes audio recordings from all interviews, early material contributing to the problem formulation of the study as well as all written correspondence.

Confirmability

Although business research in general and this study specifically cannot claim complete objectivity (Bryman & Bell, 2011, p. 398), the backed up material indicated above is thought to provide a basis for future auditors to confirm the process by which this study has proposed, collected and analysed its data.

A CASE STUDY OF COMBITECH

In this section, the result of the case study of Combitech will be presented. First, a short introduction of the company will be given. After this, the empirical data found during the case study will be presented. To help guide the reader through its finding, the data will be presented the sub-sections that represent the themes that have emerged during the case study. Finally, at the end of this section, a discussion of the findings and their relation to the theories found in the reviewed literature will follow.

The company

Combitech AB, of circa 1,450 employees, has a long and broad experience in developing systems of diverse technology (Combitech, 2016). In recent years, the company has also developed special focus areas to highlight and concentrate its efforts in: cyber security, big data, analytics & intelligence as well as the "internet of things". All of these focus areas directly or indirectly relate to the "internet of things". On its webpage, the company describes itself as:

> *"[...] an experienced partner in all areas dealing with technical systems. Our consultants have expertise in information security, systems safety, logistics, systems integration, systems development, robust communications, technical product information and mechanical engineering" (Combitech, 2016)*

With the established focus areas and a description like the one above, the company intuitively seems well positioned from a technological perspective to take on the challenges involved with the "internet of things".

Findings

The following section presents the themes identified during the interviews of the study. After these, a discussion of their meaning, in the context of reviewed theory will follow.

A diversity of technology competencies

The name Combitech is a composition of "combined technologies", referring to the company's large diversity of technology competences ranging from defence and aviation to telecom and heavy-duty industry. With the company slogan "combinatory power", this diversity is generally considered a significant part of the company's identity and a corner stone in its competitive diversification. As the slogan suggests, by combining the diversity of competences, a value larger than the sum of its components is thought to arise. But the range of technology competencies is not only broad. In specific areas, drawing on the company's extensive experience in the Swedish defence industry, competencies such as complex information technology, sensor technology, systems engineering and

cyber security are also quite deep. Specifically, the competencies in sensor technology, systems engineering and cyber security are mentioned several times as especially useful for the "internet of "things". Other than these technological competences, the company also has significant competency in risk-, crisis- and project-management.

Several respondents identified cyber security as a pivotal component for customers within the "internet of things", and underlined the extensive and leading capability that the company has in this area. According to the respondents, cyber security, or information security as the business area is called, is often something that the customer has a low awareness of in the context of digitised and connected products. Examples were given were customers' high quality ambitions were threatened by their unawareness of cyber security and the impact a lack of this might have on the perceived overall quality of their products. For customer who are especially known for their high quality, cyber security solutions will be an important component in maintaining their brand identity. As argued by the respondents, even customers who are traditionally very capable of producing secure products are now faced with having to rethink and expand their definition of secure products as information becomes an integral part of them.

All of the respondents agreed that the diversity of broad and deep technology competency is an important opportunity in capturing the overall opportunities offered with the "internet of things". As pointed out by one respondent:

> *"What is so interesting for us at Combitech is that we have the competencies within all of the areas… we can handle the complete chain, so to speak, and that is a strength based on the background that we have."*

In other words, Combitech has a great potential in the technological competencies that it can offer to customers within the "internet of things". This potential draws on the breadth of competencies, but also on the depth of some specific competences that are especially relevant to customers with the "internet of things". Having access to multiple different competencies for projects within the "internet of things", such as being able to combine IT and embedded software capabilities, sets the company at a good position to deliver technologically within the "internet of things".

A challenge for the company, however, as described by respondents, lies in effectively integrating, packaging and communicating existing competencies. Respondents described the full potential of the company as much larger than what is currently being utilised, and referred to a lacking ability to bring competences together and realise the full potential of the "combinatory power". The recent setup of company focus areas such as cyber security, big data as well as the "internet of things", however, has the potential of engaging greater company-wide collaboration around these technological areas. In addition to this, the company needs to able to better package and communicate what it is capable of. According to one respondent, discussions have started as to which new channels need to be added to reach new segments of customers, broadening the

traditional range of industries that the company targets. Another respondent expressed a similar view:

> *"If you look at the 'internet of things'. We have amazing people who can build the software of products, we have really capable people who know communications, how to communicate with different communication technologies, and we have people who can integrate this into a good solution so that is works. And then we have a layer of people who know security, 'how will this work in a secure way, from all ends?' We have these competencies, but we haven't really marketed it"*

Projects often initiated and driven by technology and technologists

In approaching and interacting with customers within the "internet of things", the company often focuses on the technology departments and the technology managers of its customers. A couple of reasons for this has been given by the respondents. From the company's perspective, new projects often come about because of an existing network of personal contacts and earlier technological solutions that the company has provided to customers' technology departments. In addition, "internet of things" efforts at customers are often driven by their technology departments wanting to add new technological solutions to their company. This desire may be driven by a sense of external forces from competitors or a desire to keep up with general trends in technology. Specifically for the "internet of things", as noted by one respondent, discussions with customers usually start with *"we have to connect our products*". However, this technological focus often seems to lack a sense of direction or purpose. According to the same respondent, a clear focus on how the new technology could best be put to use is often missing:

> *"[Customers] don't always know what to use [the new technology] for. To just connect the product in itself is not really… sure, there is a value in that, but that is perhaps not where the full potential is. And I think that we have a great potential there, in being able to support and be able to see 'how could you use this in your operations?' and 'how could they make money on this?'. Because it is also about the business models of the companies changing… 'are we going to view this as a new product that we sell, or is it the services that we make money on?' There is so much you can do with that."*

However, as was commonly expressed by respondents, the competitive advantage of many companies will need to be re-evaluated with a new perspective on technology and products. For example:

> *"What I notice is that… at least in the western world, you are wrestling a lot with… building a truck, or be that a base station, or some paper machine, or whatever it may be… the price becomes rather high in comparison to competitors in China or India or whatever it could be. But for the western world to continue to be successful, you have to think in new business concepts and new business models. It might not be about selling this paper*

machine but you perhaps need to sell a complete solution. You have a business model where you don't sell the paper machine itself but you sell a complete commitment where you need all of this sensor technology to increase efficiency… you see that the bearings are starting to become bad and then you can make a quick replacement so that the time the machine is down for less time."

As noted by several respondents, technology is no longer a limiting factor in coming up with new ways of competing. Rather, they said, we are now at a point in time where technology that has existed for some while has reached a maturity that is pushing new ways of using it:

"This thing about connecting a car and be able to do different things, that was around already at the beginning of the 2000s, well 2000, that you had your CAN bus and you could connect with GSM, which it was at that time, and you could lower the window and you could download software and so on. The technology was there but you hadn't really started thinking about 'what is the value and who is going to profit from it?', 'what saving can I make?' It was more about the technology… […] but you have to think about what the value is with the technology, because someone has to pay for it and therefore there needs to be a value, either in being able to charge for it or to make savings"

In order to have a sustainable competitive advantage, the same respondent suggests, many companies will need to reinvent their business models:

"There are many examples of companies that have remained in their old business model and then someone comes from the side and think in a completely new way. And the truck example is pretty good. There many have remained… they sell their trucks and get their returns on that side. And then suddenly, cheap trucks arrive and knock them out completely, because their price is too high. Or because they actors arrive that have new concepts. And then instead of selling the truck, you sell a complete solution where you get to pay a monthly fee."

A tendency of separating value creation and value capture

In order to help customers identify and prioritise potential business values from "internet of things" solutions, Combitech offers a service called *"business value analysis"*. In workshops consultants from Combitech help customers to structure their thoughts and pinpoint what they think are the most important areas to focus on. The aim with these workshops is to identify what values should be created with the new technology. Yet, as described by several respondents, these workshops do not address the way the identified value should be captured. For example:

"We are trying to […] look at the actual business value, and look at why we should do this. To encourage the customers to identify, as we say, the effects of performing a change. […] Then we prioritise them and try to find what will give the most 'bang for the buck'. But then

one would also like to maybe… need to take it a step further. Because when you implement a new point of view or mindset like this, it is going to hit your organisation, it is going to hit your business models, it is going to hit your market, etcetera."

Instead, as customers' technology departments strive toward adopting new technologies and connect their products, they often have to construct business cases to sell their ideas internally to top management and other functions within their companies. As described by one respondent, new technologies are often viewed as investments that need to be supported by calculated forecasts of appropriate returns if they are to be approved by management:

"[…] that is how it works in most of the companies, if they want to make an investment then they have to motivate why they are doing this and show the potential of it. And the potential is often in the economics. Because if they say 'well, it is going to cost this', 'well, what are we going to profit from that?', 'no, but we don't really know how we are going to profit from it', 'no, but then we probably can't take that investment now, because it costs too much'."; "[Customers] feel that it is a challenge to them, how to sell it internally… some express it like that."

The activity of developing internal business cases is, according to the same respondent, currently something that often is preferred by many customers to be managed by themselves, with reference to their inherent knowledge of *"their domain"*.

An emerging need to address the business level of customers

As identified by several of the respondents, there is an opportunity for Combitech to take on a greater role in helping customers with a more holistic approach to their business model development. This opportunity lies in guiding customers towards creating value as well as to capturing value from the technological capabilities of the "internet of things". In order to do this, however, a different approach is needed. This new approach, several respondents agreed, is about raising existing technology discussions to the business level:

"I think our biggest challenge is the background we have, that we are a technology consultancy company. […] And that we must… I mean there are companies that are business consultants, on an operational… and on that business level. We have to understand businesses too. We are good technically. And we can give really good guidance in how the technical solution should look like, how the architecture should look like. But I think that we might need to raise ourselves in sort of understanding the business of our customer to be able to sell ours… the technical solution at a value for our customer's customer or for the customer's business, so to say. Because I think that that is where the core is, I think, in the business of our customer."

As noted by several respondents, there might exist a sort of comfort zone in which the company feels at home selling services. To step out of this, respondents suggest building new competencies and experiences. As one respondent discussed:

> *"I think that we probably have a competency gap… we have a few persons who can take this type of missions, or go out and do this type of activities… but too few, I think. I think that it is something new that I think we have to build to a slightly larger extent than we have today. Because… absolutely, where we feel the most at home is when we get to go out and talk technology with a development manager, if you generalise… that's when most managers and sales persons are feel at home."; "I don't have that many around me that can naturally go out and take… how should I say, that we can go out and talk with authority what it means to transform from charging for your product, to charging for your service, and to be there, to be able to advice throughout the complete process."*

Although technology might be a central factor in giving the company a competitive edge, the same respondent also noted how a different approach with a larger perspective may be crucial to its current capability to compete:

> *"We actually lost a couple of businesses here in the region because we have competitors who talk more visionary and about the big picture of this. We were already from the start… that's probably one of the reasons why we are where we are today, that we from the start went out and talked quite a bit of technology by old habit and that others then came and talked holistically about the transformation to new business models and new ways of charging."*

As expressed by one respondent, it is about starting off talking about the value of solutions as opposed to the technological components involved in developing it:

> *"You have to come up, higher up in the hierarchy in the companies, where you need to come up to management level more, where you can talk value for the customer. Because it is… if you go to the CEO or a aftermarket manager, then you can't talk about how you are going to develop these sensors and what programming language or what type of communication buses you are going to have. You have to start by talking about what the value is with this solution. And in terms of… what kind of increased revenues and savings. Because we have traditionally been down at the unit manager level where they have a need for… 'we need to develop these sensors, we need five persons who know C++ or these constructions', or whatever it may be. And then they buy based on this type of competency, they don't buy based on the value."*

As pointed out by one respondent, although the company does offer management services within some areas such information security and risk, one challenge is also that the company in many ways is viewed externally as a technology consultancy company:

"The challenge we see is that Combitech to a large extent is viewed as a technology consultancy company, so we have a hard time to view ourselves as an alternative when it comes to management services. The you may rather buy the service by PwC or EY or Deloitte, or something like that. Because they are the ones that we have to fight with many times when we offer risk management services and crisis management. So it also the about profiling to some extent. […] I think it should be our part as well. Really. But it is a bit of a journey to go, I think, to be viewed as the supplier that has those services, from the point of view of the customer."

Searching for new positions in complex ecosystems

With the "internet of things", new business models are becoming possible. As suggested above this is likely to affect the customers of Combitech, providing Combitech with opportunities to help their customers with their business models. But, the "internet of things" is also affecting the business models of Combitech. With the new technology, just like its customers, Combitech is enabled to change what services it offers, the way it charges for its services, how it manages its relationships with its customers, etc.. This is currently an ongoing process at Combitech. Other than reviewing the range of traditional hourly consultancy services such as assisting customers in the development their technology or, as discussed previously, help them identify the potential values of new technology, entirely new offers are also being designed and developed. Such new offers include the growing support of in-house, full-commitment projects to rapidly help customers get on their feet with new solutions. They also include the development of generic software platforms, that out-of-the-box can be customised to specific customers' needs, saving them from having to develop solutions from the ground up.

These platforms challenge the existing business models of Combitech by requiring a greater separation of cost structures from revenue streams, as they must be developed long before they become profitable. They also challenge the existing relationships with customers; with these new platforms, Combitech is able to partner with customers and become a continuous component of their value creation process through long-term commitments of running and maintaining platforms. With these platforms, new revenue streams are also possible. Instead of charging customers per hour, Combitech may decide to charge per units of data that passes through their platform, or via new types of subscriptions or licenses. In addition, key resources and processes may need to change to accommodate these new ways of creating and capturing value. In short, the "internet of things" encourages not only the customers of Combitech to develop new business models, but also Combitech itself. Through its emerging platform-based services, Combitech is not just a supplier to customers within the "internet of things", it is also, along side of its customers, increasingly becoming a supplier within the "internet of things" on its own.

As an example, one respondent talked about a security solution that the company has developed:

"We have had this security surveillance function running at full capacity for 1.5 years now, and we are still sort of unsure of how to charge for it. Because we have invested a lot of money in it during many years, and of course we cannot charge one customer for all of this. It is something that we have to distribute on many customers during a longer period of time. And as a consultant company […] we are not used to investing a lot of money and then waiting for the revenues, we need to have a cash flow all of the time. So that is a great challenge for us. We often don't have the long-term perspective in our investments."

As a supplier of solutions within the "internet of things" it is important to be able to relate to the growing ecosystem of different actors and how your own business model fits within this value network. At the same time, as a consultant, it is important to understand the business models of your customers and think how you can best help them in their specific value creation. This consultancy supplier duality invites a new type of complexity to be addressed by the company. As one respondent discussed:

"The challenges are the business models. We are now in the middle of trying to charge for the usage of our platform, for example, and we are trying to understand Microsoft's business model in relation to us, for example. How they charge, it is pretty complex. […] Then I wish that we could tie together… we have our technology information department, who work with aftermarket, an aftermarket tool, and so on. And there you are talking about customers maybe wanting aftermarket portals and web portals. And then you have a certain type of information there, and I think that we could build something… from a Combitech perspective, that we would be able to find some level where we can contribute with even more powerful complete solutions, where we also integrate with existing business systems at customers."

Consulting with technology and business model development

Several respondents talked about the changing business models as a transition for the company as much as for its customers. In this transition, the company needs to find new ways to create and capture value for itself at the same time as it helps its customers do the same. These activities go hand in hand. By developing business models internally, one respondent suggested, competency can be accumulated through experience and then offered as services to customers. At the same time, another respondent argued, some customer have already come quite far in this respect. To gain experience and competence, Combitech should try to work with companies that are already demonstrating an ability to develop their business models. To efficiently benefit from this type of experiences, however, which may not be immediately abundant as many companies have yet to embark on this journey, the company will need new approaches to knowledge sharing as well as, perhaps, a greater integration of activities in the organisation:

"A challenge that we have, is that traditionally we have our silos in our organisations. And in a business area or a division, maybe you ge this opportunity to create a new business

model, or come up with new ideas for the customer, at a few occasions. And then you don't have the time… you have a hard time building this experience. And I think you have to have people who work with these types of questions a little more on a daily basis. Because if you get this opportunity every year maybe, to come to the customer and suggest this, then you lose the knowledge you have built and you have to learn again."

Once valuable experiences of business model development have been gained, an opportunity exists for Combitech to share this with customers who need it to move forward. By visualising these experiences in inspirational ways, Combitech may help its customers to reach an increased awareness the new opportunities that lay before them. In addition, business model development may serve as a platform for leveraging the existing diversity of technology competencies:

"[…] instead of coming to the customer and saying 'do you need ten developers who can help you to develop these buses in the truck or these sensors on the brake discs?', you instead say 'you get a complete logistics flow, you get the connectivity to your customer, your partners, and so on', 'you would get these revenues', 'this is how your revenues would change', or that 'you would get decreased costs'… and then you come from the other direction, and the customer becomes interested, 'I definitely want increased revenues, and also decreased costs'… and then they ask the question 'how do we do this?'. And then you can say 'we need to come and develop these sensors', or whatever it may be."

One respondent also noted a possible interconnectedness of business model and technology development. Iterating these activities back and forth may be a good way of progressing in the face of uncertainties and in finding the best fit between what is possible technologically and what makes sense from a business point of view.

Combining technology and business competences, several respondents agreed, could produce synergetic effects that would strengthen the company's image and position on the market. As one respondent expressed:

"I think that it is very important that we also work with the softer sides at customers. We have to show that we understand their reality and that we understand how you, they build their businesses, to be able to deliver the right services."; [business competency] could confirm the image of us as a stable technology consultancy supplier, that we have insight about how the customers are doing and what challenges they are facing. I think it is a way for us to confirm ourselves on the market and strengthen our positions."

As noted by several respondents, technology and business development includes different people. Technology- and business-oriented people need to be connected somehow. And setting up cross-functional teams with different types of people are often very productive. According to one of the respondents, It is about having the right people aboard and putting these together. In this context,

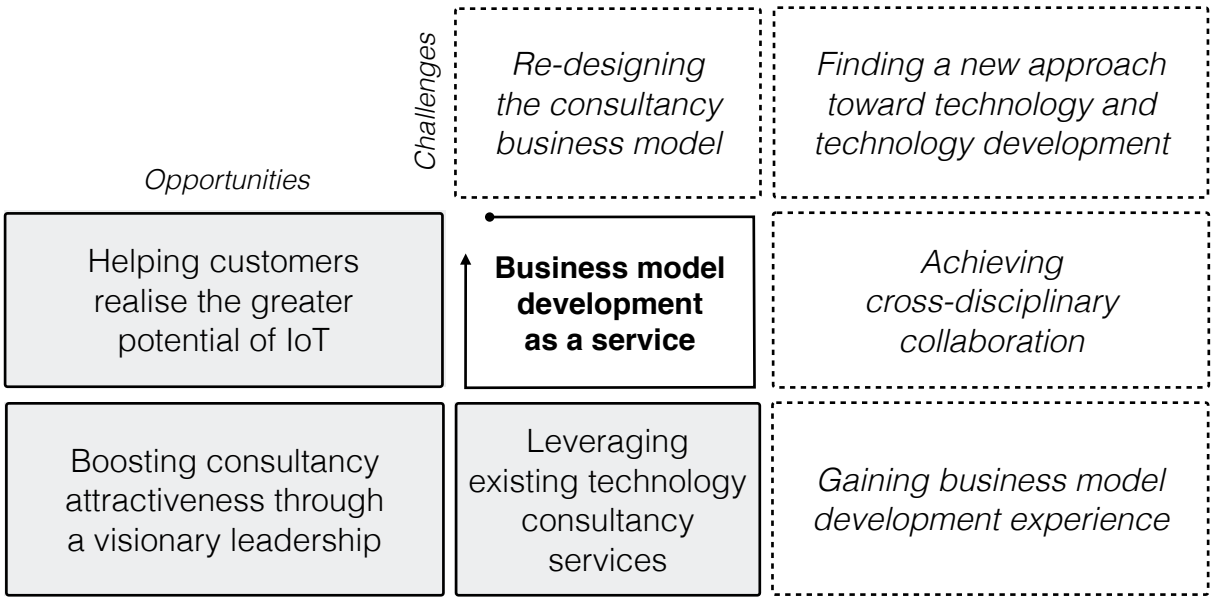
the company slogan "combinatory power" easily comes to mind. As one respondent summarised the discussion:

> *"I think that it is an advantage to understand the business and the company at the same time as you understand what is technologically feasible… I think that is a good combination."*

Discussion

Emerging from the themes and their accounts above is a general sense of the transition that many technology companies wanting to digitise and connected their products face. This transition involves the re-evaluation of what constitutes competitive products and what role technology has in creating a competitive advantage. What existing theory suggests is that competitive advantage is not only about having the latest or the right technology, but also about having a competitive implementation of that technology, often in a complex network of different actors. To create and to capture value with technology, many companies will need to think in new ways of how they make their products fit with their environments while being at the same time both useful and profitable. To manage this fit, existing theories have suggested the use of business models and business model development. The above findings have revealed several opportunities and challenges that technology consultancy companies may have in contributing to this transition by use of business model development, for itself, and in extension, for its customers, as a service. The following section will further discuss these opportunities and challenges in a more general perspective as well as link them to existing theories found in the literature. See Fig. 11 for a summary.

Figure 11. Opportunities and challenges



Opportunity: helping customers to realise the greater potential of IoT

The new technological capabilities involved in the emerging field that is the "internet of things", have been described as part of a third wave of IT-driven competition (Porter & Heppelman, 2014). In very general terms, this wave incorporates trends that transforms the way companies do business, with a tendency toward greater service-orientation of products, organisations that evolve around data, new relationships with customers and a new, more complex perspective on value creation and value capture.

However, as noted in the findings above, the customers of the studied consultancy company are often unsure about what potential direction the new technology may take them in and how they can make it profitable. A service is currently provided to help them identify and prioritise potential values from technological solutions. Although no doubt an important activity, this service does not link potential values created with potential ways in which these values can be captured. Instead, a general trend has been identified in which customer's technology departments propose internal business cases to their higher level management in order to seek investment approvals for potential new technology-based values. Indeed, as suggested in the findings, in some cases these business cases may even be preferred to be developed internally by customers themselves because of their inherent domain knowledge. Not being sure of how the new technology should best be put to use and relying on internal domain knowledge for profitability, however, suggests a risk of not being sensitive to the full potential of the new technology. The risk here, of path dependency, as exemplified by the Xerox case (Chesbrough & Rosenbloom, 2002), is that the consultancy companies' customers fail to fully seize the opportunities that the new technology offers to them by measuring it against norms that draw on their existing business models. In the terms suggested by Johnson (2010, p. 8), illustrated in Fig. 9, customer's "internet of things" efforts risk missing the benefits that potential business models of their white space may provide; in other words, searching for new ways of creating and capturing value that fit within the current organisation will restrict business model innovation efforts to perpetuated core business or adjacencies of these.

Relating back to the workshop performed at the MIT Media Lab, this finding resonates with that found by Openshaw et al. (2014), where "internet of things" opportunities often were missed due to too narrow visions of selling technological solutions to CIOs and excluding other important functions.

In general, the findings have suggested that a separation exists of technology from business and of technologists from other disciplines perceived as more business-oriented. This separation directly challenges the potential of value creation and value capture that is possible with new technologies. To successfully be able to deliver on the promises of the "internet of things", companies need to at a larger extent recognise the interconnectedness of technology to business and business models. In here lies an opportunity of consultancy companies to bring external perspectives and experience into the organisations of their customer's and to help them realise the greater potential of the "internet of things".

Opportunity: boosting consultancy attractiveness through a visionary leadership

As suggested in the findings, by offering business model development as as service, consultancy companies with an existing portfolio of relevant technology competencies may gain an overall greater attractiveness by being able to offer a more complete range of services to their "internet of things" customers. By combining technology and business model development, consultancy companies would arguably be able to approach their customer in more holistic and visionary way, with potentially more ambitious projects and more profitable results possible. Albeit connected in that one reinforces the other, while the previously suggested opportunity lay in improving the performance of consultancy and its customers, this opportunity lies in being selected by customers as a supplier of consultancy.

As suggested by existing theories (Gunnarsson, Williamson, Buvat, Nambiar & Bisht, 2014; Porter & Heppelman, 2015), much of the efforts involved in the transition toward profitable "internet of things" solutions involve both technology and organisation. Organising around data, for example, means being able to plan for new technology as well as for new organisational resources, processes and structures (Porter & Heppelman, 2015). To be able address an optimal fit, the available range of competencies need to span both technology and organisational development.

In addition, new possibilities of value creation and capture is shifting companies to produce products that are more service-oriented than before (Atzori, Iera & Morabito, 2010), to build new relationships with their customers (Porter & Heppelman, 2015) and to establish themselves in new collaborative networks of partners (Westerlund, Leminen & Rajahonka, 2014). For many companies this will mean a significant transition in the ways that they interact with their environment; an interaction which in the scope of the "internet of things" involves both clever technological solutions and industrial analyses.

To undertake such transitions, companies are likely to benefit from as well as be attracted to the leadership of an visionary leader who can take previous experiences and success stories of former customers and replant these in the contexts of new customers.

Opportunity: leveraging existing technology competency and services

Business model development as a service may also serve as a platform for additional technology services. By helping customer realise their greater "internet of things" potential, consultancy companies are also paving way for more and better technological solutions. For the consultancy companies with the capabilities of realising such, business model development may be a way to leverage existing technological competences.

The development process of new business models may well raise the awareness of the technological complexity that may be required to implement new solutions. As suggested by literature, raising

such awareness at an early stage in the process, perhaps by means of a roadmap, may be a good way of managing assumptions, uncertainties and risks (Johnsson, 2010, pp. 143-145). An important and relevant example here is information security. As noted in the findings, customers who are digitising and connecting their products often lack a good understanding of what signifies good quality in this area and how this is to be accomplished. By combining business model and technology development, assumptions, uncertainties and risks of new solutions may be managed in a process that involves both business objectives and technological solutions. In this way, efforts of establishing new businesses will consider not only the risks of industry competition, but also of technological effectiveness, efficiency and robustness. In the example of information security, combined business model and technology development may set new "internet of things" solutions up already from the start to incorporate an appropriate ability to secure its data.

Challenge: finding a new approach toward technology and technology development

Many of the challenges facing consultancy companies' customers within the "internet of things" are likely to also face consultancy companies. For the technology-oriented consultancy company setting out to offer its customers help in developing their business models, a new approach may be needed that transcends technology incentives and technology departments.

As noted previously, this is important in order bring together the value creation and value capture of new business models. To do this, in turn, requires the involvement of all relevant functions of the new business models, ranging from technologists to economists, marketers and managers. As suggested by Bosch IoT Lab (Bilgeri et. al, 2015), companies need to find ways of challenging and managing assumptions in controlled experiments that involve all relevant stakeholders.

This is a cultural challenge in that a new perspective often is needed on technology and its purpose. It is also a competency challenge in that a greater general awareness of the relationship of technology to business models and of the activities of business model development will be required.

Challenge/opportunity: re-designing the consultancy business model

To add business model development as a service and benefit from the previously identified opportunities, consultancy companies, just like their customers, will also need to develop their business models; with this new service a different value proposition is possible, new key resources and processes are likely to be required and new customer relationships need to be developed.

If, in addition, consultancy companies (as in the case of Combitech) aim to add products and services to their customers that more directly involve a niche position within the "internet of things" ecosystems (such as with the use of platforms) their cost structures, revenue streams and key partners may also have to be reconsidered. In this process of internal business model development it is quite possible that consultancy companies realise the need for several business models. If this is the case, effort may also be need to evaluate the fit between different business models.

For consultancy companies as well as for their customers, profiting from the "internet of things" may involve facing the challenges of business model development discussed in the literature review above. However, with the challenges of developing new business models internally also comes an opportunity. As noted in the findings, learning business model development at home, by developing the consultancy company's own business models within the "internet of things", is also a way of acquiring experience that later can be turned over to customers in a service.

Challenge: gaining business model development experience

As suggested by existing literature (Johnson, 2010, p. 131; Osterwalder & Pigneur, 2010, pp. 55-119; Gassman et al., 2014), in many cases business model development can benefit from already developed business model concepts, or design patterns. The use of these is based on the reasoning that *'one does not have to reinvent the wheel'*. Although these could be very useful in coming up with new ideas quickly, their full potential arguably involves some use of context-based experience. In other words, it would seem a mistake to think that one could simply take a typical business model developed at one company and graft it onto another without serious considerations of possible contextual differences. As each company has its unique set of conditions, a sense of adaptation of generic concepts to specific contexts based on experience will likely always be needed to successfully develop a company's business model.

As suggested in the previous section, business model development experience can be gained internally by developing the consultancy company's own business model. Although many good lessons may be learned from this, its single-context-basis will limit its usefulness. The best way of acquiring business model development experience, as noted in the findings, is rather by working with as many customers as possible who are currently covering or have already covered some ground in their transitional process. Because not too many companies like this exists, however, the challenge here, as noted in the findings, is partly in keeping up a continuous accumulation of new experience and not loosing momentum in-between learning opportunities. In addition to having enough cases to gain experience from, another challenge here is in effectively sharing acquired experiences within the consultancy company.

Challenge: achieving cross-disciplinary collaboration

As explained by existing theory, efforts within the "internet of things" are likely to involve a more cross-functional or cross-disciplinary approach to technology development based on a larger degree of collaboration (Porter & Heppelman, 2015). With the addition of business model development, this need to collaborate becomes even more true.

In order to collaborate effectively to create and capture value in the complex ecosystems that are developing within the "internet of things", in agile ways that enable rapid and cost-efficient experimentation, companies are likely to benefit from an efficient integration of different

disciplines. This includes development activities as much as knowledge sharing between such activities. For the technology consultancy company that decides to help its customers with business model development, integration and collaboration of different disciplines, between different orientations of technologists, as well as with more business-oriented people, is likely going to be a complex but fruitful challenge. To overcome this challenge, exiting literature has suggested the adaptation of agile capabilities (Doz & Kosonen, 2010), strategic sensitivity, collective commitment, resource fluidity (Hock et al., 2016) and an increasing ability to dynamically form cross-disciplinary teams "on the fly" (Edmondson, 2012).

CONCLUSION

This study has set out to explore the opportunities and challenges of providing business model development as a consultancy service to customers within the "internet of things". Through a review of existing theories followed by a case study of a technology-oriented consultancy company, several findings have been presented and discussed that indicate what these opportunities and challenges may be.

To many companies, the "internet of things" may represent new and exciting technology. However, as shown in this report's review of existing theory as well as in its empirical findings, holding on to this perspective may significantly contribute to an undermining of its inherent potential. To create and capture the value of the "internet of things" companies need to address new business models as much as new technologies. It is in this perspective that its full potential may be fulfilled. Helping customers to realise the greater potential of the "internet of things" can become an opportunity for consultancy companies who are able to lead the way into this perspective. Such a leadership is likely based on a capability to holistically discuss the existing business models of customers and to visualise how these could be developed toward a new and more sustainable competitive advantage. Critical components to this leadership will likely be competency in business model development practices as well as business model development experience. As indicted by this study, to appropriate these components, consultancy companies may initially want to focus their attention to developing their own business models; try to work with as many customers as possible who are already successfully developing their business models; and, devote resources to developing greater cross-disciplinary collaboration and knowledge/experience sharing, within as well as across company boundaries. Successfully venturing into the "internet of things" may well be described as an integration and collaboration around purposeful technology. Coincidently, during the process of writing this report, the company of this study, Combitech, has announced a new strategy which focuses on *"technology with a purpose"* and sets for itself goals of greater collaboration and integration of competencies in an effort of leveraging its "combinatory power".

Despite its restricted scope and limited generalisability, this study has provided some further indications of the significance of business model development to the "internet of things". Moreover, by framing them in the context of a consultancy service, this study has added to the understanding that the progression of these fields is likely to involve a collective movement of different actors, within as well as between companies.

Suggested further research

Many of the topics covered in this report would gain from further studies. Specifically, more research should be done to clarify the practical relationship of business model and technology development. In this report, several references to software development practices have been made in the context of business model development, promoting questions like: *'What can business model development learn from software development, and how can these learnings be transferred to improve business model development?'*

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APPENDIX

Semi-strukturerad intervjuguide (English version follows)

Intro: en kort studie med syftet är att utforska hur affärsmodells-utveckling kan utgöra en konsulttjänst inom “internet of things” - vilka möjligheter och utmaningar som finns.

A: Introduktion & Definitioner

1. Berätta lite om dig själv (bakgrund, utbildning, yrkesroll och dagliga uppgifter)?
2. Vad skulle du säga är innebörden av “internet of things”?
3. Hur skulle du definiera en “affärsmodell”?

B: Vilka möjligheter och utmaningar finns i att erbjuda affärsmodells-utveckling som en konsulttjänst till kunder inom “internet of things”?

4. Från Combitechs kunders perspektiv (nuvarande eller framtida), vilket förhållande (om något sådant finns) skulle du säga att “internet of things” har till affärsmodells-utveckling?
5. Vilka skulle du säga är de huvudsakliga möjligheterna för Combitech att hjälpa sina kunder inom “internet of things” med att utveckla deras affärsmodeller? - Vilka utmaningar har kunder inom “internet of things”?
6. Vilka skulle du säga är de huvudsakliga utmaningarna för Combitech med att erbjuda en sådan service?

C: Hur kan ett konsultföretag ta del av möjligheterna och klara av utmaningarna med att erbjuda affärsmodells-utveckling som en tjänst för kunder inom “internet of things”?

7. Hur skulle man kunna utnyttja dessa möjligheterna?
8. Hur skulle man kunna klara av utmaningarna?
9. Från ett helhetsperspektiv, vilka aktiviteter, processer, typer av organisation eller förmågor ser du som de viktigaste för att at del av möjligheterna och klara av utmaningarna?

D: Eftertanke

10. Har du några sista tankar kring de frågor vi har diskuterat?
11. Finns det något du vill lägga till?

Semi-Structured Interview Guide

Intro: a short study to with the purpose to explore how business model development can make up a consultancy service within the “internet of things” - what possibilities and challenges exist.

A: Introduction & Definitions

1. Tell me about yourself (such as background, education, role and daily tasks)?
2. What would you say is the meaning of the “internet of things”?
3. How would you define a “business model”?

B: What are the opportunities and challenges of providing business model development as a consultancy service for customers within the “internet of things”?

4. From the perspective of Combitech’s customers (current or future), what would you say is the relationship (if any such exists) of the “internet of things” to business model development work?
5. What would you say are the main opportunities of Combitech helping its customers within the “internet of things” to develop their business models? - What are customers within the “internet of things” struggling with?
6. What would you say are the main challenges for Combitech in offering such a service?

C: How can a consultancy company capture the opportunities and overcome the challenges of providing business model development as a service for customers within the “internet of things”?

7. How could the opportunities best be captured?
8. How could the challenges best be overcome?
9. From a wholistic point of view, what activities, processes, types of organisation or capabilities do you see as the most important ones in capturing the opportunities and overcoming the challenges?

D: Afterthought

10. Do you have any final thoughts on the topics we have just discussed?
11. Is there something you would like to add?