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Co-Creating Knowledge Work Automation Content

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Co-creating Knowledge Work Automation Content

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Abstract

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A number of trends undoubtedly show that what is today known as knowledge work will significantly change in the future. Stable employment will be increasingly a thing of the past. Employees will work in freelance mode, on a small piece of a bigger project, on their own time and with tools of their own choice. Yet they will have to smoothly cooperate and build and use organizational knowledge together. Knowledge will have "legs" and employees will have to make sure they are re-employable after every gig. Organizations will have to be increasingly agile and at the same time provide meaningful employee experiences in order to attract customers and talent. Automation will have a major effect on improving productivity and releasing time for more creative work. At the same it will also come with threat of loosing control to robots.

The objective of this thesis was 1) to explore possibilities behind the automation of knowledge work, 2) make a contribution towards reducing negative effects associated with it and 3) turn it to a knowledge worker's own advantage. By using a rich set of Service Design techniques a service business model has been proposed to meet the needs of the future agile organization, atomization of knowledge work, knowledge sharing between people and robots, bridging the gap between employees and their tools and putting the knowledge worker in control. The business model has been made around co-creation of reusable, atomic automation content. A hypothesis has been made that a digital knowledge worker, a.k.a. software robot, when smoothly embedded within the proposed business model, can significantly empower a human knowledge worker instead of simply being a threat.

The above hypothesis was first validated by means of business simulations. It was shown that by carefully balancing investments between new business opportunities, manual- as well as digital- workforce the ecosystem behind the proposed service can thrive and create value for all stakeholders. Furthermore, the business model has been validated by conducting interviews with the key stakeholders. It was confirmed that reusable, atomic automation content would bring value. It was concluded that automation has to be two-directional (human-robot-human) in order to ultimately bring value, enable learning and not harm innovation. It was also identified that creating such content is not easy, and requires special skill. This only confirms the need for the proposed service. Based on the results of validation, the proposed service model has been adjusted to better serve the real customer needs. Possible future research directions are laid out as well.

Keywords: Knowledge work automation, Business process automation, Business process management, Robotic process automation, Business service automation, Artificial intelligence, Shared value, Service logic, Service ecosystem

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1 Introduction

Marked by bringing together physical, digital and biological systems the Fourth Industrial Revolution is well under way (Schwab, 2016). The promises it holds are that we will be able to better understand ourselves as human beings, and change our relation to life, planet and work. What is today known as knowledge work will be heavily affected by this phenomena, and often in very subtle ways. By knowledge work we use a combination of Druker's (Drucker, 1999) and Manyuka's et al (Manyika et al., 2013) deffinitons as work which involves primarily dealing with information to perfrom complex analyzes, make subtle judgments and do creative problem solving. Automation in general, and automation of knowledge work in particular is seen as one of the most influential trends of the decade and major cause of that change. Estimated productivity improvements caused by automation of knowledge work alone are amounting to up to 6.7 trillion USD per year by year 2025 (Manyika et al., 2013).

Needless but still important to say, the above change will be full of opportunity and threat. While there will be few jobs that might disappear completely a majority will be changing slowly but steadily. New jobs will be created on the way due to the mundane jobs being outsourced to robots and people having more time to utilize their creativity. And it is almost certain that, for some knowledge workers, this change will be the major source of frustration as well.

The objective of this thesis is 1) to explore possibilities behing the automation of knowledge work, 2) make a contribution towards reducing negative effects associated with it and 3) turn it to a knowledge worker's own advantage. The challenge is not easy and calls for divergent, convergent and systemic thinking. It calls for carefully considering knowledge worker's everyday's journeys of today and tomorrow. It calls for careful consideration of interactions between knowledge worker, robot and other stakeholders. It calls for thinking far beyond designing a single product. In other words, it calls for designing a service. And what would be a better way to address the challenge than the rich set of Service Design tools and processes. Service Design is a process of designing a service (Reason, Løvlie, & Flu, 2016). It has emerged from a niche branch of design over 20 years ago into mature and well established way to tackle customer, business and organizational challenges. It is a way to address the fact that "services are less productive and cause more frustration to customers than pure products" (Reason et al., 2016).

The rest of the report is organized as follows. Section 2 gives overview of relevant literature. The literature related to future of knowledge work and trends impacting it is reviewed first. Second, the contemporary enabling automation technologies are reviewed. A brief overview of the prevailing networks/ecosystem view of business as a foundation for creation of shared

value is given next. Finally, the set of relevant service design processes and methods to be used in the thesis project concludes the literature survey.

Section 3 contains the most important part of the thesis. It starts by the description and motivation for the project in Section 3.1. It continues with the description of the service design process and methods used throughput the project in Section 3.2. The details about how particular methods have been used as well as about their outcomes have been given in Sections 3.4-3.7. Finally, conclusions and possible areas of future work have been outlined in Section 4.

2 Literature review

2.1 The future of knowledge work

The future of knowledge work is very much discussed topic, both in academia and industry. The on-going strategic-opening project Reknow of Finnish Funding Agency for Technology and Innovation reported several key trends influencing knowledge work and needs of knowledge workers' tools that are generated at the intersection of these trends (Lehtiniemi, Kuikkaniemi, Poikola, & Nelimarkka, 2015). According to the report the most important collisions happen between *Project work and freelancing* and *Bring your own tools* as well as *Work Automation* and *Data Diversity* trends. The corresponding needs arising from the first collision are tools that can support *collaboration*, *interoperability* and *autonomy and mobility*. The second collision results in need for tools that can support *breaking the info bubble*, *proactivity* and giving *sense of control* (Lehtiniemi et al., 2015). According to Deloitte (Mahidhar & Schatsky, 2013) the future of knowledge work will be impacted mostly by the new ways of finding talent and due to technology advances in the areas of artificial intelligence. The former impact is resulting from the increased movement of workforce onto the online job-mediation portals as well as shift from stable jobs to project-based work. This is also known as *atomization of jobs* and *crowdsourcing (strongly related to freelancing)* (Evans, 2016; Farrell, 2011; Stefanie & Wihbey, 2015). As stated by McLaughlin et al (McLaughlin & Stankosky, 2010) the knowledge increasingly "has legs", since organizations cannot offer stable work and knowledge workers themselves have to ensure that they are employable at all times. The later impact is due to artificial intelligence technology inclreasingly being able to automate cognitive tasks.

Other significant trends related to knowledge work are *atomization of applications and services* and also *B2WE* (AccentureDigital, 2016). The first, *atomization of applications*, stems from the fact that standalone mobile applications where user has to manually navigate and switch between applications simply does not fit into the modern views of seamless user expe-

rience. The second, *B2WE,* arises from the fact that businesses start to realize that they need to invest in employee experience in order to attract the talent and stay competitive. This is very much reflected in the tools that the employees use on a daily basis (AccentureDigital, 2016).

From all the above, automation is inevitably having a large effect on the future of knowledge work. Due to automation the knowledge work is undergoing the similar kind of transformation as the manual work in the beginning of the last century (Chui, Manyika, & Miremadi, 2015). While the previous wave of automation has taken away most of the low wage jobs on production lines, the new wave does not guarantee automation-free status even to the C-level of the organizations. As a matter of fact a recent research (Chui et al., 2015) shows that as much as 30% of work of an average Chief Executive Officer can be automated. At the same time, some of the work currently considered low-wage (e.g. all kinds of maintenance) has very little possibilities for automation. However, it is much more likely that portions of existing jobs (i.e. specific tasks) will be automated than that the entire jobs will disappear. In other words, what is likely to happen is redefinition of the existing jobs rather than entire job dissapereance (Chui et al., 2015). Despite not so radical transformation as some tend to predict, the aggregate effect of this trend is certainly not negligible. According to McKinsey automation of knowledge work is identified as the second largest trend in terms of global economic impact, expressed in monetary terms as being up to 6.7 trillion USD by 2020 (Manyika et al., 2013).

What is then likely to be expected by the knowledge workers from automation? In their recent article Lacity et al (2015b) remind us of the reality in most organizations. When faced with the "automate vs informate" dilemma the managers usually go for the first option, blindly *transferring* human tasks to the machines, instead of empowering workers to innovate by *extending* their capabilities through automation. It is interesting that this phenomena was predicted in the very beginnings of the information technology by Zuboff (Zuboff, 1989). In a recent interpretation of the Zuboff's book Burton-Jones (2014) identifies the reasons to be a tradeoff between automation feeding both knowledge of the shop-floor workers and reducing manager's power. Depending on the "*market necessity*" the managers have a choice as to how much to fundamentally innovate vs how much power to retain. More often then not, the later wins, at the expense of the knowledge worker.

2.2 Practical automation methods and technologies

2.2.1 Business process management

Business process management (BPM) is a discipline that “combines knowledge from information technology and knowledge from management sciences and applies this to operational business processes” (W. van der Aalst, 2013). As illustrated in Figure 1 BPM has evolved over time as a way to separate business logic (process) from the underlying supporting software (SW) applications. The traditional specialized software applications typically have both business logic and the underlying supporting application merged into a single entity, while in the BPM case these are separated for easier maintainability both from the application and from the business process perspective.

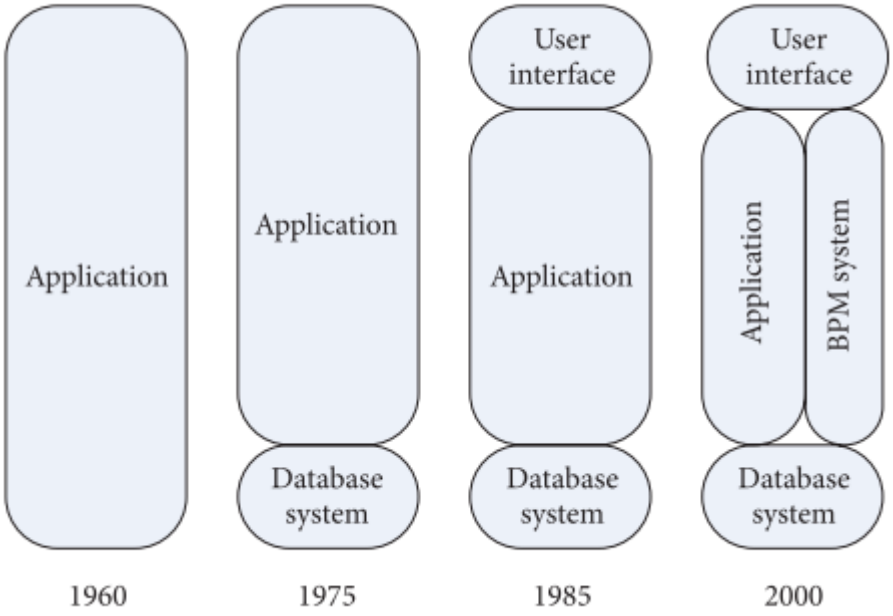

Figure 1: Historical view of development of information systems (W. van der Aalst, 2013)

One of the areas under the BPM umbrella is business process automation. It is incorporated in BPM through *executable* process models (W. van der Aalst, 2013, p.6). Executable process models are essentially a machine-readable descriptions of the process to be performed. When loaded onto the BPM execution software platform they automatically turn into process driven applications that either guide the human user through the process, or are executed completely autonomously on the BPM execution software platform. Typical use cases are flight ticket reservation systems or onine shops. Automation in BPM case is essentially performed by “teaching” the BPM execution platform on how the process should be performed.

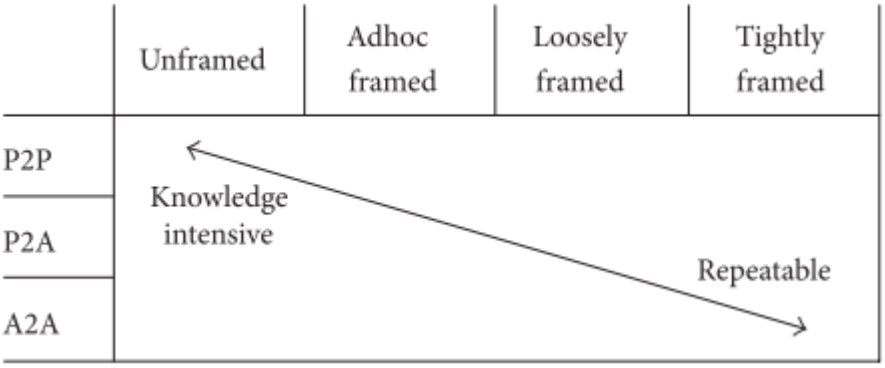

Figure 2: Classification of business processes (W. van der Aalst, 2013)

In the extensive survey by Aalst (2013) business processes are classified in two ways. First, on how framed they are, i.e. how much in advance their course of action can be predicted. On one end of the spectrum there are unframed processes. Those are the processes which do not allow for any process model to be created, like e.g. work happening through online group collaboration. In other words, the processes can be defined on an individual task level, but no clear sequence of tasks can be defined. On the other end, there are completely predictable, i.e. framed, processes, that are performed many times in exact same way. Second classification is based on whether processes are human centric or system centric. In other words they are Person-to-Person, Person-to-Application or Application-to-Application. As illustrated in Figure 2 most of the processes are located along the line having knowledge intensive on one end and repeatable processes on the other end.

Reusability is also commonly recognized benefit in the BPM field. If the processes are available in form of atomic process patterns they can easily be combined and rewired into more comprehensive processes whenever business needs change. A comphensive reviews on the reusability within BPM framework can be found in (Fantinato, Béttio, & Paulo, 2012; W. M. P. van der Aalst, La Rosa, & Santoro, 2016; Zaaboub Haddar, Makni, & Ben Abdallah, 2014). Modularization of business processes is also seen as one of the strategically important tools in achieving strategic agility (Doz & Kosonen, 2008).

2.2.2 Robotic proces automation

Robotic Process Automation (RPA) is another approach to automation of knowledge work that is rapidly gaining ground in the industry. Institute for Robotic Process Automation defines RPA as “the application of technology that allows employees in a company to configure computer software or a robot to capture and interpret existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems” (IRPA, 2016). The technology has emerged as a response to ever increasing transaction vol-

umes that the service providers have to handle. While this was typically handled by business process outourcing (BPO) to low-cost countries, both the the increasing amount of transactions and increasing costs of low-cost country have become such that even these slutions are not effective anymore. RPA has been powered by the technologies that can execute computer tasks in exact same way as humans (Lacity & Willcocks, 2015a). As illustrated in Figure 3 the method is especially appropriate for range of tasks in the region between low-complexity high-volume repetitive ones and high-complexity low-volume ones (Lacity & Willcocks, 2015a).

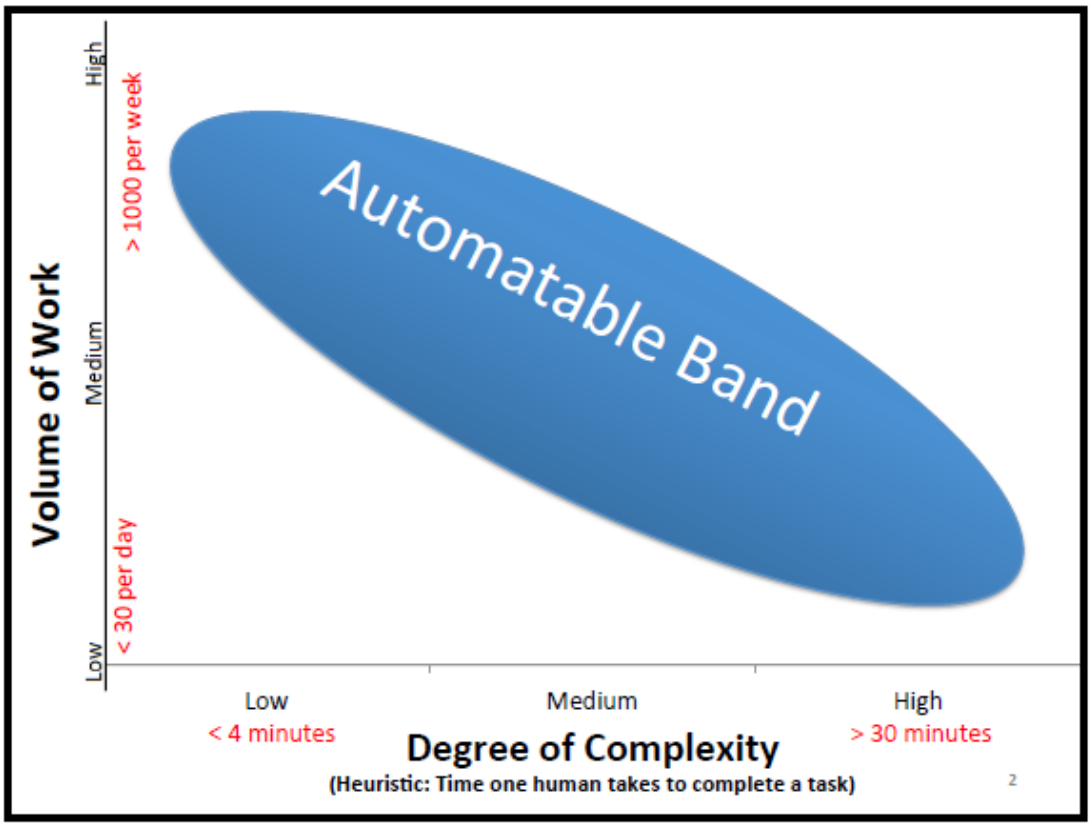

Figure 3: Range of RPA suitability

Therefore RPA is not a solution for every business case. Instead it has found its own niche as a complement to the traditional automation approaches like BPMS and dedicated and specialized SW applications (typically built thorugh traditional software development) like CRM, ERP or SOA.

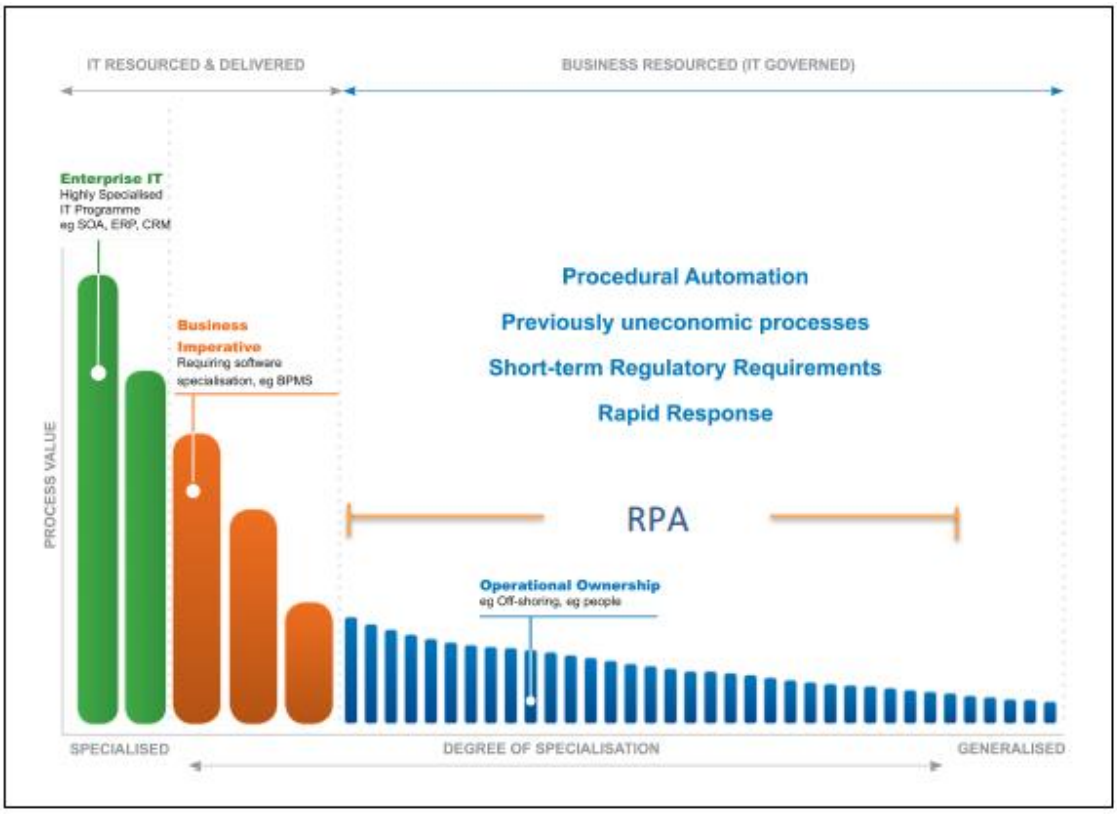

Figure 4: Mapping of the tasks to be automated onto the currently available automation technologies

In terms of the automation competencies required RPA is far less less demanding than both traditional software development and BPM. According to all the major vendors one does not require knowledge of programming in its traditional sense in order to perfrom automation (AutomationAnywhere, 2016; BluePrism, 2016; UIPath, 2016).

2.2.3 Artificial Intelligence

The interest in artificial intelligence (AI) has exploded over the past decade, both due to its promises (Fildes, Everett, Barnes, Matthews, & Orton-Jones, 2015; Manyika et al., 2013) and perceived threats (Bohannon, 2015). In the seminal work on the topic (Russel & Norvig, 2009, p.2) several deffinitions of the artificial intelligence are given. They are classified as machines that either think as a human, act as a human, think ratonaly or act rationally. All four deffinitions are used in parallel and there are four parallel research streams on the topic. “Act as a human” stream has developed a Turing test to define a set of criteria for a machine to be classified as AI. “Think as a human” stream bases its research on modelling of the human cognitive processes and is therefore rooted in the field of cognitive science. The approach is based on the thinking that once there is a sufficiently sound theory of the human mind that theory can be transformed into a computer program. “Think rationally” stream is

grounded in reasoning processes and logic. “Act rationally” stream is based on the concept of rational agent, i.e. a machine which acts so as to achive the best outcome (in deterministic scenario) or best expected outcome (in uncertain scenarios).

As for the actual automation methods, most of what is powering AI today is grounded in machine learning techniques, which in turn are based on statistical methods. Ghahramani provides an excellent easy-to-read overview of the topic (Ghahramani, 2015). Another comprehensive survey of the techniques especially suited for big data is given in (He, Li, Luo, & Shi, 2014; Müller & Bostrom, 2014). Other notable techniques that power various forms of AI are optimization techniques, digital signal processing techniques and techniques from control theory (Russel & Norvig, 2009, p.25,120,309). The basic principle behind machine learning is to train the mathematical model (linear or non-linear function) with data to determine the function parameters. Once these parameters are known they can be used to determine which of the predictor variables are likely to have most of the impact on the variable being predicted. This and various data visualization techniques are then used to *gain insights and understanding* from data. The generated models can also be used to *predict* or *infere* the value of the variable being predicted based on the previously unobserved set of predictor variables. Unlike in the standard automation procedures like traditional software development, software BPM and RPA where automator needs to explicitly state all the rules and exceptions for the machine to perfrom the task, AI automation approach learns all the rules and exceptions from the already available human-generated data.

Application areas of the AI today are already numerous. Some typical examples of tasks automated by AI are driving of vehicles, recognition of speech, recognition of text, recognition of images, planning and scheduling, language translation, control of robots, control of radio resource allocation in wireless networks, to name just a a few (Russel & Norvig, 2009, p.29). The AI capability goes so far as to “automate the automator”. An example is given in a recent article by IBM Watson researchers (Samulowitz, Sabharwal, & Reddy, 2014) where various cognitive tasks performed by data scientists themselves (i.e. people creating AI services and applications) can reportedly be automated. All these automated tasks have been used to power various services and applications like driverless vehicles, spam filters, automated helpdesk agents, automated document handling systems, autonomous robots in factories, personal assistants etc. Just a few of the numerous examples reported in the academic literature are in genomics literature annotation and medical imaging (Naik & Bhide, 2014) as well as mass customization in production (Fast-Berglund, Åkerman, Karlsson, Hernández, & Stahre, 2014; Fasth-Berglund & Stahre, 2013). In their comprehensive review on the potential of Big Data McKinsey & Company (2011) estimate that the domains with most transformational potential are Health Care, Public Sector, Retail, Manufacturing, and Personal Location data. In another independent research the business verticals that have or will have a viable business

case for AI are Law, Marketing and Advertising, Retail and Customer Service and Healthcare (Fildes et al., 2015).

On the industry side, major RPA vendors are either developing their own cognitive automation solutions (AutomationAnywhere, 2016; IPSoft, 2016) or are entering partnerships with already established vendors (Celaton, 2016; UIPath, 2016). Professional services companies are also actively including AI-based automation capabilities in ther service portfolio, under either cognitive or intelligent automation names (Accenture, 2016; Deloitte, 2016; KPMG, 2016).

In summary of this section, the traditional automation approaches like software development, BPM and RPA mostly target repetitive end of the processes spectrum and at their best provide tools for the humans to interact with each other. AI on the other hand, goes one step further. From the above review it is very clear that AI-based automation aims at the Person-to-Person and Unframed end of business process spectrum illustrated in Figure 2.

2.3 The networks view of business and shared value

According to (Håkansson, Kan, & Snehota, 2006) the traditional approach to strategy management is based around three central issues. First, there are clear organizational boundaries determined by the proprietary or contractual controls which guarantee access to the resoruces, including individual actors and people. Second, organizational efficiency is measured by its "bargaining position", i.e. the capability of organization to acquire scarce resources through exchange with other parties in its environment. The criteria for thereby assessing organizational effectiveness is typically the accumulation of monetary wealth over time. Third, management of organizational effectiveness is achieved by allocation of company internal resources so as to maximize efficiency in transforming inputs into outputs (Håkansson et al., 2006). This input-to-output transformation efficiency is seen as a key variable that the organizational efficiency depends on. In the traditional view the organization is observed through interface with its (changing) environment and the strategy management aims at coming up and implementing a pattern of activities that will align the organization with the environment, by changing this key variable, i.e. input-to-output transformation efficiency.

In an alternative, network view, the organization interacts with a limited number of other organizations (which make the focal organization's context), through relationships. The focal organizational identity and unique capabilities of the organization are therefore built though these relationships. In this model, the resources of other organizations within the context can be mobilized through relationshipss. Therefore the boundary of the organization is not only defined by hierarchically (proprietory or contractual) acquired resources. In this view the "in-

tangible" relationships (also including reputation, fame etc.) become an essential part of the company resources. The key variable to be used for strategical management is not simply input-to-output transformation efficiency, but it also depends on the level of interrelatedness of the organization with its context.

The basis and majority of the organizational effectiveness in the network view is formed by "strategic identity" and the organization's "network position" (Håkansson et al., 2006). The "network position" can be understood as the capability of the organization to make "remote" resources (offered by parties further within the network) available to the other parties to which these resources are not directly available. The "strategic identity" is defined as a function of the organization's capability to build, maintain and manage relationships with other parties within its context. Relationship starts to exist only if there is action or reaction at both sides of the link. This happens only if both parties perceive that there is potential exchange potential on both sides. The theory therefore suggests that in orther to manage organizational effectiveness, it becomes essential to manage relationships and interactions that these relationships consist of, in addition to managing and allocating internal resources. It is suggested that this can be done in two ways. First, by framing the organization's context (i.e. choosing with whom to be in a relationship). Second, by creating set of values and norms of behavior which would guide interactions and consequently relationships. Therefore the pattern of activities that is identified and implemented as part of strategy management process changes from being a script-based prescription of activities to guiding the activities by a set of values and behavioral norms.

In an analysis on the competitiveness on US economy Kanter (2012) illustrates several examples of practical business networks which essentially provide "shared value" (Porter & Kramer, 2011), where multiple actors benefit simultaneously. Kanter points out that links in four areas are essential to create and maintain: generating ideas and applying them into market-ready enterprises, connecting small and new enterprises to large companies, aligning education with industry needs and aligning leaders across various sectors to develop ecosystems. The above theoretical analysis is also related to enriching the ecosystem and thereby essentialy creating *shared value* as defined by Porter et al (2011). Shared value is created when generation of economic value is aligned with creation of societal value though satisfying currently unserved societal needs. Other examples of how to create and maintain such relationships within network context are by managing and utilizing communities (McDermott & Douglas, 2015; Mintzberg, 2015) and utilizing methods line Value Net Model (Ballantyne & Williams, 2008) to manage for influencing other actors in the network.

Few practical examples of such networks which are related to the objectives of this thesis are various co-creation platforms like Algorithmia (Algorithmia, 2016) and Kaggle (Kaggle, 2016)

for machine learning algorithms. However, it is worth mentitiong that even though they do enable co-creation to some extent they still do not take a controlled aproach on the atomization and wider reusability of the created content. They are also not very inclusive for stakeholders other that SW developers and data scientists. Similarly, RPA robot platform vendors like UIPath (UIPath, 2016) do have low level automation content offered with the platform. However, the shared content is exclusively built by the vendor and does not offer any higher (business logic) level content for specific businesses.

2.4 Service design processes and methods

2.4.1 Processes

While each designer, like any professional in general, has slightly different ways of approaching and performing his or her job, from the bird perspective they all follow a certain pattern of operation. In other words, the design is not an entirely unstructured endevour. On the contrary, there is a clear process by which design as a creative discipline produces its outcomes. There is a number of models that summarize these higher level patterns, which consist of three to seven phases, depending on the model. They all essentially share the same mindset. Furthermore, no single model will work in all situations and the first step in every service design project is to define the process to be used, iterated and changed during the project (Stickdorn & Schneider, 2010). The following several chapters outline some of the most prominent service design process models.

Double Diamond (Design Council, 2015)

Double Diamond design process (Design Council, 2015) created by the British Design Council (Design Council, 2016) is one of the most popular design processes in general. It has its roots in Design Thinking but has found its way into Service Design as well. It consists of the four stages named Discover, Define, Develop and Deliver. It maps how the design process passes from several divergent phases where thinking and possibilities are as broad as possible to corresponding convergent phases where possibilities are deliberately narrowed down and focused.

The project starts with the Discover phase. In this phase the problem or need to be addressed through design is identified, the solution space is defined and rich knowledge base including insights is built. During Discover phase the designers look at the world in a fresh, unbiased way and search for inspiration. They gather insights, developing opinion about what they see. The specific methods used in this stage are User Journey Mapping (also known as Customer

Journey Mapping, see Section 2.4.2), User Diaries, Service Safari and User Shadowing (Design Council, 2015; Moritz, 2005; Polaine, Løvlie, & Reason, 2013; Stickdorn & Schneider, 2010).

In Define phase the output of Discover phase is analyzed, findings are synthesized into a small number of opportunities and a clear brief is defined to agree upon with all stakeholders. The main methods used in this phase are Personas (see Section 2.4.2), Branstorming (see Section 2.4.2) and Design Brief (Stickdorn & Schneider, 2010).

In Develop phase the brief is developed into a service for implementation, service components are designed in detail and the concept is tested iteratively with end users. The main tools in this phase are Service Blueprint (see Section 2.4.2), Prototyping (see Section 2.4.2) and Business Model Canvas (see Section 2.4.2).

In Deploy phase the service is launched into use, customer feedback mechanisms are put into place and lessons learned during the development process are shared back to the organization. The main tool used in this phase are Scenarios (Stickdorn & Schneider, 2010).

Iterative Four Stage Process (Stickdorn & Schneider, 2010)

The iterative, four step service design process proposed in (Stickdorn & Schneider, 2010) consists of Exploration, Creation, Reflection and Implementation phases. The process is rather similar to the Double Diamond model, but it recognizes that whole process should be iterative instead of linear. The four phases map rather well onto the corresponding phases of the Double Diamond model.

Exploration phase is rather similar to the Double Diamond's Discover phase. It is acknowledged that getting to know and understand the customer is one of the key tasks in this phase. However, an important addition to Double Diamond is an argument that the the first task in this phase is to understand the culture and goals of the service provider organization and their overall readiness for the service design process itself. After the above is clarified, the second task in this phase is to understand the real problem that service design is hired to solve. The authors argue that much of the work in this stage is articulating organizational problem from the perspective of current and potential future customers (Stickdorn & Schneider, 2010). The third task is then to visualize the findings and thereby establish a basis for discussion between service design team memebers, including all the necessary stakeholders.
A variety of methods are used in this stage. E.g. User Journey Mapping (see Section 2.4.2) and User Diaries (Stickdorn & Schneider, 2010) could be used to map, understand and visualize the customer service experience and understand the organization problem from the cutomer

perspective. User Shadowing (Stickdorn & Schneider, 2010), Contextual Interviews (see Section 2.4.2) and The Five Whys could then be used to gain idetailed insights. Service Safari (Stickdorn & Schneider, 2010) could be used to collect ideas of good customer experiences to be used when coming up with a solution. Stakeholder Maps (see Section 2.4.2) could be used to visualize key inter-stakeholder relationships.

Creation phase is the generative activity within the iterative process and its closely related to the next, Reflection, phase. It is between these two phases that most of the iterations occur. The main task of this stage is to create a solution for the identified problems and in-depth insights identified in the Exploration phase. This is done through identification of customer needs, motivations, expectations, service provider's processes and constraints. In order to achieve a holistic yet relatively detailed solution it is crucial to include all the stakeholders in this creation process, including customers, service employees, management, engineers and designers.
The main methods to use in this stage are Idea Generation (aka Brainstorming, see Section 2.4.2), What-If (Stickdorn & Schneider, 2010), Design Scenarios (Stickdorn & Schneider, 2010), Storyboards (see Section 2.4.2), Desktop Walktrough (Stickdorn & Schneider, 2010), Service Prototyping (see Section 2.4.2), Service Blueprints (see Section 2.4.2) and Business Model Canvas (2.4.2).

In Reflection phase the concepts created in Creation phase are tested with the customers. This is challengins phase due to the intangible nature of a service. The key is to show the intangible in such a way that customer can understand it and form an opinion about it. Techniques like Storyboards (see Section 2.4.2), Desktop Walktrough (Stickdorn & Schneider, 2010) and Service Prototyping (see Section 2.4.2) are extremely useful methods in this stage. As mentioned earlier, this phase is heavily iterated with Creation phase to refine the concepts based on the customer feedback and test them again.

In the Implementation phase the designed and tested service concept is put into production. The Implementation phase is inevitably accompanied by the process of internal change within the service provider organization. Besides customers, the employes are extremely important factor during the process of change. Therefore clearly communicating the service concept to the employees including its emotional efects on the customer is crucial for the employees to understand the reasons for the change. Involving employees early in the design process, especially during Creation and Reflection phases, will help them understand the service vision and feel like being part of it. Service Blueprint (see Section 2.4.2), cocreated with the employees and other relevant stakeholders is very useful tool in this phase.

Finally, once the service is taken online, the change needs to be reviewed and its effect assessed. This leads to the iterative process described in this Section.

AT-ONE (Stickdorn & Schneider, 2010)

AT-ONE is an approach which focuses on differences between products and services and has a clear user-experience focus. The approach is used to assist service design teams especially in the beginning of the service design process. Each of the letters A, T, O, N, E corresponds to a different "innovation lense" (i.e. different source of innovation) used to explore the same design challenge.
Letter "A" stands for Actors, which collaborate in value networks. The key of this lense is to understand who are the actors that need to collaborate in order to produce compelling customer experiences. Stakeholder Maps (see Section 2.4.2) are very useful tool in these workshops. Letter "T" stands for Touchpoints. The key of this lense is to focus on choosing the right set of touchpoints and creating consistent customer experience through these touchpoints. Customer Journey Map (see Section 2.4.2) is a usefull tool to consider in this phase. "O" stands for service offering and the facts that service brand is very closely approximated with the service offering. It is important to create service "personality" that describes the brand as if it were a person. Brainstorming (see Section 2.4.2) and e.g. Storyboards (see Section 2.4.2) and Storytelling (Stickdorn & Schneider, 2010) might be very usefull tools to consider in this phase. Letter "N" stands for the Need, or what the customer wants. Etnograpic methods like Contextual Interviews (see Section 2.4.2), Shadowing (Stickdorn & Schneider, 2010) and Personas (see Section 2.4.2) are usefull tool to consider in this phase. Letter "E" stands for Experiences that surprise and delight the customer, which has become the main playground for differentiation. Customer Journey Maps (see Section 2.4.2) are usefull tool in this stage as well.

The process starts by choosing the order of lenses to focus on that best suite the concrete project. Then a series of workshops is organized around these five dimensions with the idea to stretch the solution space as much as possible as early in the process as possible. Each workshop has three phases. First is Start phase which establishes the common knowledge platform. Second is Divergence phase where many ideas and solutions are generated. Third is Convergence, with focus on synthesis, prioritization and decision making. Each workshop results in five most promising ideas. After this another workshop is held where one to five holistic concepts are created from the original groups of five ideas. The final concepts are then visualized and communicated to the decision makers.

From Insight To Implementation (Polaine et al., 2013) and Moritz 6 stage process (Moritz, 2005)

Out of many other service design processes two are still mentioned here on the high level. Moritz (2005) proposes six stage service design process. In the first, divergent, stage, *SD Understanding*, articulated and unarticulated customer needs are understood. The contexts, constraints, resources and relationships are understood and possibilities are explored. In the second stage, *SD Thinking*, a strategic planning, direction and scope of the service design project is set. As such it is a convergent phase, building on insights created in the previous stage. In the third stage, *SD Generate* a set of alteranative ideas is generated. This is again a divergent stage. The forth convergent stage, S*D Filtering*, takes care of selecting, testing and evaluating the best solutions from the previous stage. *SD Explaining* stage makes sure that the selected best concept is communicated in a best possible way to all relevant parties. *SD Realizing* is the actual implementation of the service concept. The process proposes iterations between stages two-five before moving to the actual realization phase.

In (Polaine et al., 2013) a similar six stage process is proposed. *Understanding people and reationships* is very similar to the above *SD Understand* stage. *Turning research into insights and action* is very similar to the above *SD Thinking* phase. *Describing the service ecology, Developing the service proposition and Prototyping Service Experiences* very much overlap in scope with the above *SD Generate*, *SD Filtering*, *SD Explaining* and *SD Realize* stages with slight differences in the order of doing different tasks. This difference becomes blurry through the iterative nature of the process described in (Moritz, 2005). Polain et.al. also stress the importance of measuring the services once they are put in place. The measurement should be established in a transparent way so that it enables and motivates the organization towards continuous improvement.

2.4.2 Methods

Customer Journey Mapping

What is it?

User Journey Mapping, also known as Customer Journey Mapping is a visual representation of a user's journey through a service. It shows all different interactions that the user has with the service touchpoints or channels (e.g. web-page, phone call, e-mail, face-to-face interaction). It also shows customer emotional journey during interaction with the service illustrating pain-points for the users as well as "magic moments". There can be many and different user journeys for a single service, each illustrating certain aspect of the service offering.

How it is created?

Customer Journey Maps draw on the output of the ethnographic research methods like interviews and Shadowing, where the customer is directly asked about the experience or User Diaries and Service Safaries where the user documents the journey him- or herself (Design Council, 2015; Reason et al., 2016; Stickdorn & Schneider, 2010). The key is to document the journey from the user perspective, and using user's own language to provide the basis for emphatic engagement.

Once the material is gathered, the most important is to first indentify the key touchpoints between the service and the user and how are they perceived during customer journey. Once they are identified they are connected into a visual flow-like representation over time. The typical customer journey map is multichannel representation over time. To facilitate emphatic engagement for the team the customer journey can be based around persona or around visual material that the user himself has created when documenting the journey. It is also important to identify and visualize customer emotional state during the journey and thereby identify pain-points and "wow-moments" and associate them with the touochpoints (Design Council, 2015; Reason et al., 2016; Stickdorn & Schneider, 2010). Different time stages in the journey map can be grouped into before-during-and after groups, to illustrate where in the overall service delivery they happen.

What are the outputs and benefits?

A customer journey map provides the high-level overview of factors influencing user experience, and doing so from the user perspective. The usage of personas and user generated material can make it even more visually appealing representation of user experience. The overview of the map enables identification of the pain points, identification of opportunities and correspondingly new idea generation. Since the representation is structured around the common language, it enables fair comparison of several different exeriences (Design Council, 2015; Reason et al., 2016; Stickdorn & Schneider, 2010).

Interviews

What is it?

An interview is a face-to-face discussion, usually with a single person, to collect data to be later interpreted for insights (Design Council, 2015). It is usually time limited, carefully planned, and always interviewee and not interviewer centered. It requires special training and practice by the interviewer to be able to build rapport with the interviewee in order to gather valuable insights (Portigal, 2013).

How it is created?

The interview is usually carefully prepared in advance. For example objectives of the interview are first clarified and target group is identified. The right participants are then recruit-

ed. The field guide is usually prepared before the interview containing the high level flow of the interview and questions to be asked. Interviews are then scheduled to not have too many per day, and leave enough time immediately after interview for reflection. The place of the interview can be at people's home or in a neutral location. Interview is conducted using the field guide as basic guideline, and the conversation is recorded in notes, audio or video. The incentives are handed out when appropriate. The interview data is processed to find out the insights into customers (Portigal, 2013).

What are the outputs and benefits?

The kay output of an interview is a customer insight, which is an enlightening understanding of specific customer perspectives, their needs, experiences, behaviors and motivations. An example of insight is understanding of how the certain service fits into their world, and how much time, attention and understanding they bring into their interaction with the service. Another example is a a story about the customers that is produced by humanizing raw data into an appealing narrative (Reason et al., 2016). Yet another example is motivation for a certain behavior, which is not obvious and cannot be deduced directly from the behavior itself. While analyzing quantitative data has the potential to answer *who, when* and *what* questions that is seldom on the level of insight. The interviews have the power of answering *why* question and generating real insight.

Contextual Interviews

What is it?

Contextual interviews are performed in the environment or context which is as close as possible to the one where user interacts with the service. This technique allows interviewer to observe why the customer is behaving the way he or she is behaving having most of the contexts of the service of interest

How it is created?

The interview can be with any of the stakeholders that are relevant for the service. The interview is combination of both questions and observations based on which the interviewer builds final insights. The interview should essentially be performed while the interviewee is using the existing or similar service (Moritz, 2005). The key for a successful interview is to carefully create such an interview environment where the interviewees would also be at ease, so that they can share intimate insights into their lives (Stickdorn & Schneider, 2010). The recruitment is typically done through a scpecialist agency which will often offer several possible environments. It is always important to select the one which will trigger more in-depth discussion. The interview is documented with notes, audio or even video to create rich material for interpretation and gathering insights.

What are the outputs and benefits?

The key benefit of this method is that relevant service-close context will help intervieweer to remember the specific details that otherwise would not be remember in a neutral setting. Experiencing new or familiar service in familiar environment will always give more intimate insights than in an neutral environment, which then can be combined with observation in that same environment. This might help to identify unarticulated needs as well (Stickdorn & Schneider, 2010).

Stakeholder Maps

What is it?

Stakeholder Map, also known as Service Ecology Map (Moritz, 2005) is a visual representation of the various stakeholders involved with a particular service, their importance in the service acosystem as well as their relationshios. The stakeholders include staff, customers, partner organizations, to name a few examples (Stickdorn & Schneider, 2010).

How it is created?

The comprehensive list of stakeholders is listed first. This is done both by interviews and desk research. Significant amount of desk research may be required since the goal is to list the stakeholders that the service provider also did not mention or is not aware of (Moritz, 2005; Stickdorn & Schneider, 2010). It is important to identify interests and motivations of all stakeholders and mark it down in the list. It is also important to identify whether the stakeholds are internal to the service provider organization or external. A concentric circle format is often used for this purpose, with internal stajeholders being placed in the middle and external father away in theie order of importance.

After the list is layed out, the relationships between different stakeholders are identified and visualized to indicate how good or bad a relationship is.

What are the outputs and benefits?

Stakeholder map is a good way to identify issues within the service ecosystem. For example, stakeholders with similar interests can be grouped together and service provider resources deployed more effectively when responding to problems and expanding the service. Good and bad relationships indicate something to leverage and be careful with, respectively, when planning and providing the service (Stickdorn & Schneider, 2010). The visual representation can inspire new ideas in general (Moritz, 2005).

Personas

What is it?

Personas (Design Council, 2015; Stickdorn & Schneider, 2010), also known as Customer Profiles (Reason et al., 2016), are fictional profiles, developed te represent certain customer group whose members shares the same interests (Stickdorn & Schneider, 2010). They represent a *character* which the service design team and business itself can use to engage and empathize with. They are the means for the business to not lose touch with the human side of the customer (Reason et al., 2016). Personas differ from the character profiles in that they are based on the qualitative research (Moritz, 2005) unlike the later which are based mostly on desk research.

How it is created?

The most common way to create personas is to aggregate research insights obtained from interviews, observations and shadowing into a common-interest groups.While personas can be created without user research, their usability greatly improves when they are based on qualitative research (Design Council, 2015). These groups should be formed so that they are possible to give their own different characters. For the persona to be useful it should be engaging, and visualizations and narratives should be used to bring these characters to life (Stickdorn & Schneider, 2010). The personas should be built by first looking into background and context of the interviewed, observed or shadowed people. One should think of a journey that took the to the current state as human beings. After that, their interactions (positive or negative) with some services should be considered in orther to find out what do they value (Reason et al., 2016).

Personas can be created for both consumers and business customers. In case of business customers it is important to describe several critical key characters, from the e.g. service delivery person, over back stage person to end customer itself. Business as a whole can also be described as a persona by describing its situation, character and strategic priorities (Reason et al., 2016).

What are the outputs and benefits?

Personas are often reporesented with a sketch or a photograph with text describing key points of their character. It describes who they are, who do they value, what not, what are their needs and wants.

Personas are an important guide during service development and help to maintain the focus on the human character we design for. Different personas provide different perspective on the service, enabling to define and engage different customer groups that exist in the market. The personas shift the focus from the abstract customer pool to the characters with wants and needs. Even though the characters are fictional, their needs are real and enable service designer to design for meeting the needs that really exists.

Brainstorming

What is it?

Brainstorming and idea generation methods in general are a tool to generate large amount of alternative opportunities and solutions quickly with a group of people. With brainstorming the traditional patterns of thinking are intentionally broken and new ways of looking at things are identified (Design Council, 2015). At the same time the brainstorming techniques provide structure and framework for the group to generate large amount of ideas (Design Council, 2015; Moritz, 2005; Stickdorn & Schneider, 2010).

How is it created?

Branstorming is typically organized as a workshop or similar type of session. It is the facilitator's role to decide on the structure of the workshop and methods to be used. It is important to not have too many people in the session and to limit the time used for the session. Not more than twelve participants and sessions not longer than one hour is suggested best practice (Design Council, 2015). Furthermore, it is important to choose individuals from different backgrounds and with different perspectives in order to ensure richness and volume of the ideas.

Before the actual brainstorming the idea generation techniques could be used to stimulate discusions and creative thinking. Examples are Six Thinking Hats, Mindmapping and S.W.O.T. analysis (Stickdorn & Schneider, 2010). There are many branstroming techniques that can be chosen from. For example, participants can first write ideas individually on post-its, explain them in order and the participants can then vote on the ideas of their preference. The discussion could also be conducted on the reasons for the rankings enabling creation of hybrid ideas. The most prominent ideas could be sent back to the team for further branstorming using them as a basis. Another method is that where people write down an idea, then pass it over to a neighbour which writes own ideas on top of that. By the time one full cycle is completed each idea should have generated fair amount of additional ones. This method is suitable for the groups having introvert persons so that they would have their say as well, and is also known as Brainwriting (Gray, Brown, & Macanufo, 2010). The third method could be to write the ideas on postit notes and put them on the wall. The participants then read what is available on the wall and bring additional ideas basd on them. The fourth method could be a 3-12-3 brainstorming method, where the group first writes ideas for three minues in terms of nouns and verbs that come to mind related to the topic. For the next twelve minutes the participants work in paris. They draw randomly three ideas from the pool and based on thse generate presentable concepts. During the last phase every pair has three minutes to present their ideas (Gray et al., 2010). Another method is that of Object Brainstorming, where participants first collect physical objects or "things that do things". By first observing them and playing with them the team answers the question "How will the next generation of [a thing that does

thing] work?", writes down the ideas, votes, selets the favorites and decides on the next actions.

While there are many branstorming techniques, most of them share share some common properties (Design Council, 2015). First, judgment of ideas should be deferred, since the emphasis is on quantity and not quality. Second, one should build on the ideas of others, since it again, encourages volumes and diversity of ideas. Third, the branstorming session should focus on the given topic and not diverge from it. Fourth, only one question should be addressed within a session, since multiple questions lead to inefficient sessions. Fifth, wild ideas should be encouraged.

There can also be multiple sessions each addressing the sub-topic of one main topic. There can also be a multiple groups looking at the same topic at the same time in the same session. It is important to capture the ideas visually (e.g. with post-its) in order to visualize the progress and stay focused.

What are the outputs and benefits?

Brainstorming is useful in the divergent phases of the servide design process. It will result in a large number of ideas on the considered topic. They are then used as an input for the convergence phase of the service design process. Out of these ideas the most promising ones can be selected and developed further. They can also be clustered around similar concepts to be used either as the basis for the next round of brainstorming or as basis for converging towards the most promising concepts.

Storyboards

What is it?

Storyboard is a series of drawing illustrating particular sequence of events. It is a step by step explanation of a service experience or a journey (Moritz, 2005; Stickdorn & Schneider, 2010). Unlike customer journey map which shows experience purely from the customer perspective the storyboard can also show events other than those touchpoint related. For example, a storyboard of the back stage can also be shown to better understand service provider point of view. It can be drawn to illustrate a set of events or a story where an existing service is used but can also be used for a set of hypothetical events illustrating future service proposal (Stickdorn & Schneider, 2010). A Storyboard is to a service designer what Wireframes are to an user experience (UX) designer (Reason et al., 2016).

How is it created?

Storyboard is typically made in a comic strip format, in which a designer creates a series of illustrations that tell the story of the situation being analyzed. Etiher real-life or imaginary scenarios can be analyzed. In the former case one can use photographs where available, while

sketching is used in the latter case. In any case, the designer can try to add as many context details to the individual sketches as possible to describe service experience. Despite that, storyboard is seldomly alone enough to describe that experience. For that reason it can be combined with text to explain the story in more detail.
In a service design workshop group setting the storyboard can be used to quickly illustrate the idea behind the service concept to convey the idea or identify opportunities. Visualizing the idea in this way and sharing it with the wider group or with a customer can reveal early on what in the idea might work and what not. They also enable to assess whetehr the idea is worth pursuing in the first place, and to do it early during design phase.
Storyboard is very flexible due to the fact that individual sketches can be easily removed, edited or added. Since it is a high level, rough representation fo the service proposal it leaves room for interpretation and new ideas. For exactly same reasons it can lso lead to the wrong conclusions. The fact that it is most often a sketch in new service proposal case emphasizes that it is an unfinished concept, while the photoghraphs attached to the real service case emphasize that it is a real service (Moritz, 2005).

What are the outputs and benefits?
Storyboards allow stories about the user experiences to be brought into the service design process. With that they can be used to provoke meaningfull analysis, and discussions about potential problems and areas of opportunity. By creating the storyboard designer is put into the shoes of people using and delivering the service which is an invaluable perspective to have during the service design process (Stickdorn & Schneider, 2010).

Service Blueprint

What is it?
Service Blueprint is a way to represent a service from the perspective of all the involved parties, including customer, sevice provider, partners and other relevant parties that are part of the service. The blueprint details everything from customer contacts to behind-the-scenes enabling processes.

How it is created?
Ideally the service blueprint is created collaboratively by involving representatives from several departments of the company that together take part in the service delivery. In this way the common understanding of the service is co-created by all the relevant parties, and documented in form of a living document. The reason behind having the living document is that it should be reviewed periodically in order to verify that the service always meets the changing customer needs in the best possible way.

The blueprint is typically laid out in five horizontal lanes. The top lane indicates physical evidence, i.e. artifacts that the user sees/meets/uses when using the service (web page, brochures, receipts, invoices, e-mails etc.). The next lane illustrates user actions during service consumption, in chronological order. It is essentially the same as the top lane of the corresponding customer journey map, in case blueprint is used to map the existing service (Design Council, 2015). In case it is used to map the future service, it represents the desired customer journey map. The blueprint ideally shows all possible customer journeys thorugh the service (Moritz, 2005). User action ane is separated from the front stage lane by the line of interaction. The next lane is front stage, and it illustrates customer-visible service provider actions (of customer facing personel or digital user interface) that are perfomed in response to the user actions. The next lane downwards, separated by the line of visibility from the previous one, illustrates activities of the non-customer facing personel required to support customer-facing personel in supporting the customer. The last lane, separated from the previous one by the line of internal interaction, illustrates backstage processes requiread to support all the lanes above in ultimately supporting the customer.

What are the outputs and benefits?

By creating service blueprint the overall service delivery is understood better. The bottlenecks in the service provider organization are identified, as well as parts of the organization that work well. When combined with the customer journey map service blueprint can identify the root causes behind pain-points identified in the customer journey map, and how to remove them. In case service blueprint is used to design the new service, the service organizations processes can be created collaboratively in order to ensure as smooth of a customer journey as possible and crate sense of ownership. Co-creating the document in general promotes cross department collaboration and joint ownership of the service (Design Council, 2016; Moritz, 2005; Stickdorn & Schneider, 2010).

Prototyping

What is it?

Prototyping is a way to test new service ideas (Design Council, 2015). It works as a simulation of the service experience (Stickdorn & Schneider, 2010). The exact form can range from desktop walkthroughs, roleplays, over 3D models of service touchponts to a theater-like service staging. Regardless of the method it is important for the service prototype to visualize service experience of interacting with multiple touchpoints and how it unfolds and develops over time (Polaine et al., 2013).

How it is created?

Service prototype usually requires a mock-up of the real service delivery system to be created. This can be done with Legos, 3D cardbox models or in fact any material available and appropriate for the task at hand. In practice most prototypes will consist of a combination of some physical or digital mockups illustrating touchpoints and some sort of role play illustrating human interactions and experiences during service consumption. Whatever the way, the effectiveness of the prototype will be measured solely by its ability to test various service scenarios in an environment that is approaching the real world. The complexity of ptototypes varies greatly. Sometimes this requires a lot of effort with appropriate physical space, several 3D mockups and extensive roleplay while sometimes it requires only a mobile phone (Moritz, 2005).

Prototype should also enable potential service users and delivery staff to provide feedback to the service designers. Based on the feedback the prototype will be updated and changed iteratively until common understanding is achieved, pitfals identified and vision of the final service cristalized (Stickdorn & Schneider, 2010). The service prototypes and the process of role playing can be documented by using photos, audio and video for future references (Design Council, 2015).

Depending on the level of risk associated with the service, one can choose different levels of prototyping, namely discussion, participation, simulation and piloting. Each level will have growing order of realism level but will also require correspondingly higher budget (Polaine et al., 2013).

What are the outputs and benefits?

Most will agree that the devil lies in details when in comes to roling out new service. Details can impact the service so negatively that they can lead even to its failure. Detecting these details early in the design stage are of crucial importance for the overall feasibility of the service. The details cannot be easily predicted and realized in advance purely based on the abstract analysis. Therefore it is very important to stage such an environment where these details are discover and become visibile and obvious. By means of prototyping one can reveal these details early enough and work ways around them in order to improve the overall concept feasibility (Design Council, 2015; Moritz, 2005; Polaine et al., 2013; Stickdorn & Schneider, 2010).

In summary, prototyping can answer some or all of the following questions (Polaine et al., 2013): Do people understand the service? Do people see the service fitting into their life and providing them value? Do people understand how to use it? Which touchpoints are instrumental for prviding the service? Which ideas and suggestions do the testers of the service concept have for improvement?

Business Simulations

What is it?

Business simulations are a method to visualize and understand dynamics (i.e. behavior over time) of the underlying system of interest, by unitilizing power of computer. Through causal loop diagrams and stock and flow diagrams one can perfrom what-if analisys to test hypothesis before doing the same experiemnts in the real world. (Senge, Kleiner, Roberts, Ross, & Smith, 1994, Chapter 22).

How it is created?

One typicaly strats by creating causal loop diagram. Key variables of interest are identified and causal relationships between them illustrated. After that the reinforcing and balancing loops are identified to understand dynamic behavior of the system and form the hypotheses to later validate. After this one usually proceeds to creating stock-and-flow diagrams for computer simulations. The links and variables of the causal loop diagram typicaly turn into flows and stocks/variables of the stock and flow diagram. Simulation is then performed with various values of the model parameters. A number of simulation tools exist on the market (InsightMaker, 2010).

What are the outputs and benefits?

The main benefit is that of visualizing mental models realted to dynamic behavior of system of interest, in a collaborative way. Thereby one typically aims at understand the possible leverage points of a system (i.e. points which when modified may have a significant positive or negative effect of the ystem behavior) (Senge et al., 1994).

Business Model Canvas

What is it?

Business Model Canvas is a visual tool for describing, analyzing and designing business models. It was introduced and popularized by Osterwalder (Osterwalder & Pigneur, 2010). A version that is further adapted for the service logic is developed by Ojasalo & Ojasalo (Ojasalo & Ojasalo, 2015). It can be used both for analyzing and redesigning existing business models as well as for designing new ones (Design Council, 2015; Stickdorn & Schneider, 2010).

How it is created?

The canvas is typically filled in as a collaborative exercise in a workshop, documenting the varios ascpests of business through nine building segments. For example, a sticky notes are placed during the workshop on each of the segments. The first segment, *Customer's World and Desire for Ideal Value* in addition to identifying different customer segments analyzes

customer's world, and sources of value as well customer needs in detail. The second segment, *Value Proposition,* summarizes the company offering and should ideally be made to match the findings identified in the first segment. The third segment, *Value Creation*, describes how does the customer use the value proposition to create value for him/herself. It describes how does the service fit into the customer's world. The fourth segment, *Interaction and Co-Production*, details how does the customer interact with the copany during the service. The fifth segment, *Revenue Streams and Metrics,* illustrates the company's earnings logic, what the customer is willing to pay for and what are the key performance indicatiors with which to measure the value created for the company and the customer. The sixth segment, *Key Resources,* lists necessary operant and operand resources. The sevent segment, *Key Partners*, illustrates the partners necessary to realize value proposition. The eigth segment, *Mobilizing Resources and Partners,* illustrates how is the integration of resources realized to enable value creation. The ninth segment, *Cost Structure,* illustrates the sources of costs of running the business (Ojasalo & Ojasalo, 2015).

What are the outputs and benefits?

The canvas can be used in a variety of ways. Its key benefit is to bring clarity to organizations core aims and identify its strengths, weaknesses and priorities. It gives a holistic insight into how organization operates its business (Stickdorn & Schneider, 2010). As such it provides a high level overview of the business, inlucsing its customer focused, operational and financial elements (Design Council, 2015).

3 Development project

3.1 Project description

The service design project was based around the relatively broad topic of automation of knowledge work. The motivation for the topic is multifold. First, my professional background is in process automation and practical problems and the current trends in the area are familiar from daily work. Therefore the existing experience as well as tacit knowledge in this domain serves as an excellent source of the practical problems to be solved. Furthermore, I wanted to channel this existing domain knowledge and experience through a controlled service design process in order to come up with a solution for the real, relevant problem. In other words, I have chosen to follow effectual reasoning, especially during the early stages of the project. Second, the topic of the knowledge work and its future is a very relevant one nowadays. The trends or *Atomization of Work*, *B2WE*, *Project Work and Freelancing* and *Mobility*, discussed in Section 2.1, are all proofs of a significant changes in how the knowledge work is performed today and will be performed in the future. Third, automation is seen as one of the major factors influencing, shaping and enabling the future of knowledge work. The

trends of *Work Automation* and *Data Diversity*, as well as potentially disruptive impact of automation (Manyika et al., 2013) are all proofs of the importance of the topic. Fourth, we live in a network society which reflects to the way businesses are done. Busenesses are realizing that the strategic environment is not something uncontrollable to be barely reactive to. The concept of *environment* is replaced by the concept of *context* where one can choose parties to enagage with in a relationship. The context can be influenced and shaped. It is through that context that business ecosystem is created and used to create value for all holders as and thereby tipping points for the service to succeed.

3.2 Used service design process and tools and their mapping onto phases

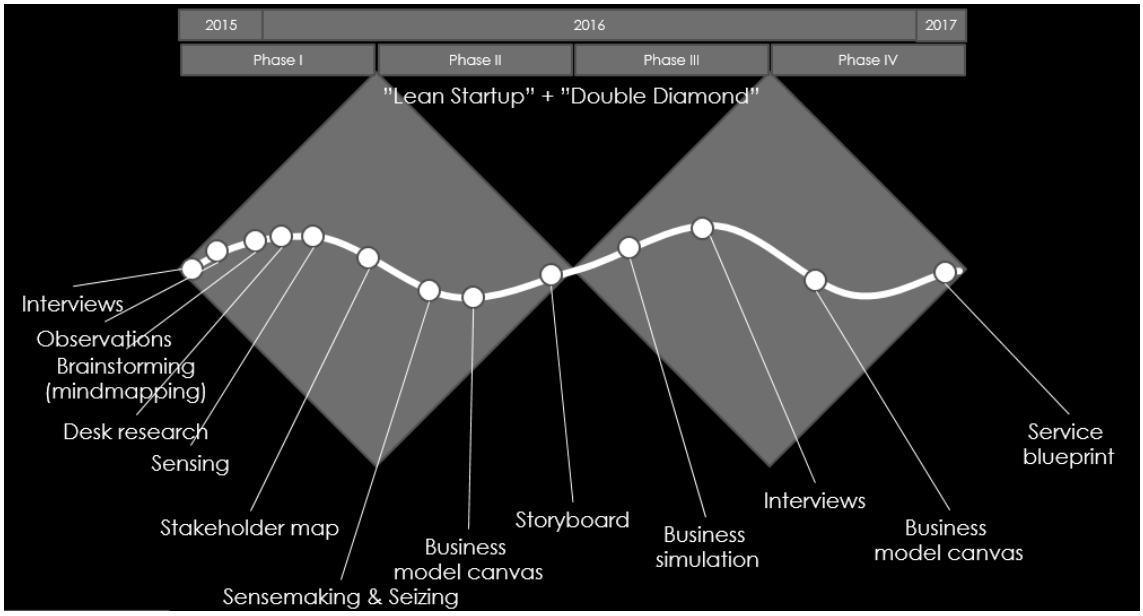

Figure 5: Service design process used in this thesis

The service design process used in the thesis is a combination of Lean Startup (Blank, 2013) and Double Diamond (Design Council, 2015) models. The various phases of the project, methods used as well as outcomes produced have been presented in the rest of this section.

3.3 Summary of performed empirical work and generated empirical material

The following empirical work was performed during the project:

- An unstructured interview, with one interviewee, and duration of one hour. The interview resulted in possible areas of development in the example knowledge work organization.
- Two observations, with approximately ten participants, each of one hour duration. The observations resulted in possible concreate areas of development in the example knowledge work organization.

- Mindmapping around the topic of automation of jobs-to-be-done. This was a single person activity, which resulted in possible service areas that could be developed around the considered topic.
- Desk research, resulting in improved understanding of the example knowledge work organization's business model and quality system.
- Sensing, collection of multiple sources of information from news articles, social network posts, individual discussions, seminars and conferences, performed in team of two persons, with duration of two months. This has resulted in the collection of pins on a Pinterest board on a selected topic.
- Craetion of stakeholder map, a chart illustrating typical roles in the example knowledge work organization as well as qualitative relationship between them. This was done as a single person activity and has resulted in a stakeholder map.
- Sensemaking, a creation of trend card, an artifact illustrating the identified trend and its main characteristics. This was performed in team of two persons in an approximately four-to-five hours long session, and has resulted in two trend cards.
- Seizing, a process of 1) identifying needs created by the selected trends and 2) generating ideas that are likely to match the identified needs. This was done as a single person activity in several sessions of various durations, and has resulted in a number of ideas for the service concept.
- Creation of business model canvas, a tool for summarizing key elements of a proposed business model. This was done as a single person activity in several sessions of various durations. This activity was performed twice during the project and has resulted in two versions of the business model canvas for the proposed service concept.
- Creation of the storyboard, a visual cartoon-like tool for communicating service concept from the customer perspective. This was done as a single person exercise in several sessions of various durations, and has resulted in a two-page storboard.
- Creation of causal-loop and stock-and-flow diagram, tools for identifying leverage points in the service ecosystem. This was done as a single person activity in several session of various durations, and has resulted in a set of identified leverage points of the service ecosystem.
- Ten semi-structured one-on-one interviews, each of 1-2 hours duration, which were audio-recordered, literated and analyzed. This was done as single interviewer activity, and has resulted in a number of insights.

3.4 Phase I : gathering observations - divergence phase

Phase I of the project took place in the period between November 2015 and April 2016. During that period a number of activities, divergent by nature, have been performed to identify

the problems to be solved by means of a service design project. These activities, used methods and their outcomes are illustrated in more detail in the sections below.

3.4.1 Initial interviews and observation (participation in discussion group in an example knowledge work organization)

As mentioned in Section 3.1, the aim was to use the the existing experience and knowledge built through daily work so far as a starting point for the service design project. The project was started by performing an interview with a representative of the SW product vendor organization, a typical example of an average knowledge work organization. The aim of the interview was to identify potential strategic development projects within the organization. The interview took place in early November 2015, lasted one hour, and was of unstructured form. The interview has revealed three potential areas of development for the current organization, as follows:

- improving organization capability to rapidly respond to the customer requirements and at the same time improve customer centricity of the product development processes,
- making business processes in general more flexible and adaptable to change of business requirements,
- improving employee satisfaction in general.

After this initial step the permission was granted by the organization to observe several discussions of an internal discussion group that tried to tackle the first development area above. Observation of two one-hour-long meetings and related e-mail discussion was done during November 2015. Participants in the physical and email discussions were representatives from project management, engineering management and engineering. The objective of the observation was to further clarify the concrete issues faced by the organization within the first development area mentioned above. The observation was semi-structured and its attention was focused mostly on:

- current status of the product development processes and considered improvements,
- current organizational structure and considered improvements,
- currently required skills and considered improvements.

The key findings of the observation were as follows:

- All involved parties realized that there was a value in strengthening customer centricity and improving ability to quickly react to changing customer requirements. The currently used product development process is built mostly around waterfall project management method (Papadopoulos, 2015). The engineering perception of waterfall development method is strongly associated with quality system and often perceived

as a burden to productivity. The currently considered and piloted methods are various forms of agile development as used in service design (Stickdorn & Schneider, 2010), namely practical frameworks like Scaled Agile (Scaled_Agile, 2016) and Large Scale Scrum (The_LeSS_Company, 2016).

- Organization is currently organized in functional teams that act as resource pools for various projects. Project management arranges and drives resources from various resource pools as per project needs. The agile development process has been piloted in two different ways. First, where one or more agile development teams have been built around the function (i.e. as subteams within the functional teams themselves), with teams thereby consisting of people with the same competences. Second, where agile teams have been built from representatives from each function necessary to build a complete product feature, as suggested by all practical agile frameworks (Scaled_Agile, 2016; The_LeSS_Company, 2016). The second approach was indicated as more favorable by the pilot participants, since it reduces communication burden necessary to get the product feature completed. Several concerns were however raised by the project and engineering management related to: 1) underutilization of certain resources within the team, 2) how to handle product maintenance and other regulatory obligations in practical terms with agile methods, 3) whether to make transition to agile process step by step or as one large transition.
- The current organization does not require extensive competence stretches into neighboring competence areas, due to clear division of work. The considered agile methods require competence stretching into neighboring comptetence areas, since division of work is not that strict within an agile team. This is also to avoid underutilization of a particular resource.
- Automation in general was indicated several times as both a tool to reduce repetitive tasks (and thereby improve employee satisfaction) but also as one of the key enablers of agile processes. It was indicated that some of the agile process principles, like e.g. fast feedback from the testing to the development within the agile tem are not possible without automating continuous software integration, software deployment and software testing processes.

One of the key outcomes of the above interview and observations was an important role of automation as both enabler of the customer centric agile processes and employee satisfaction. At this point the decision was made to focus the rest of the service design project on the *automation* as one possible enabler of *flexible and adaptable business processes* and *happier employees*.

3.4.2 Desk research – initial literature survey, understanding customer business model and mindmapping

The phase of initial interviews and observations was followed by the intial literature survey. This activity took place during December 2015 and January 2016. The literature survey has covered the areas of the future of knowledge work, business process management, robotic process automation, artificial intelligence as well as major company product and service offering in this area. The initial literature survey resulted in most of the content of the Sections 2.1 and 2.2. As a conclusion of the initial literature survey the mind-map around the topic of automation of the jobs-to-be-done (JTBD) was created during January 2016. The mindmapping was a single person activity at this phase and created by myself. The mindmap has identified several potential areas in this domain that can be offered as a service. The areas of *discovering JTBDs*, *training robots to perform JTBDs*, *validating robots for intended use* and *providing proofs of validation* were kept for the future consideration. The mindmap is given in Appendix 3.

The first part of the value–based selling method, *understanding the customer's business model*, proposed by Terho et al (Terho, Haas, Eggert, & Ulaga, 2012) was also conducted in this phase, as desk-research. The research was performed on the example knowledge work organization. The company produces return on invested capital for shareholders by producing SW products for various markets globally. It operates in regulated environment. This results in process-driven operations and significant effort invested in quality assurance and control processes and corresponding tools. At the same time the company operates under increasing competition requiring more efficient operations, shorter time to market and faster response to business change. The quality assurance and control processes were also analyzed as part of desk research to identify concrete processes that could benefit from the proposed service concept. Several concrete processes that would potentially benefit from automation were identified. The examples are SW tool validation, product verification and validation and part of project management processes, which all contain repetitive tasks done on a regular basis.

3.4.3 Gathering of weak signals

During Phase I of the project a *sensing* (Koskelo & Nousiainen, 2016a) of weak signals was also performed. The selected area for sensing was a broad area of *science and technology*. The sensing was performed by gathering weak signals in form of a Pinterest board (Salonen & Veselinovic, 2016). To track the level of comprehension of sensing across various dimensions a monitoring tool (Koskelo & Nousiainen, 2016a) was used. Due to expected large amount of signals and relatively small team of two persons (inclusing other student and myself), a simple digital version of the monitoring tool was created by using R programming language

(R_Project, 2016) (the source code is provided in Appendix 1), and used from a free web hosting platform (Veselinovic, 2016). The signal gathering was performed mostly by reading relevant news and journals, following trend influencers in the science and technology arena through social media and attending an international conference on interaction design (IxDA, 2016).

3.4.4 Creating stakeholder map

In order to provide yet another perspective to the area of knowledge work automation in a typical organization a stakeholder map was created. The typical SW product vendor was used as an example customer and as a starting point for stakeholder map. It should be noted, however, that the stakeholder map is very likely to be fairly generic for an average large organization.

We place the average knowledge worker perfroming a business task in the middle of the stakeholder map. The business task is a concept having following attributtes:

- Trigger
    - Describes what initiates an instance of a business task.
- Input
    - Artifact (i.e. formatted raw input data) that contain data based on which an Output is produced, can be described as “(Input Format,Input Data)” pair.
- Action, which consists of
    - Extract function, which extracts raw data relevant for the business task from the Inputs. It can be described as “Input Data = Extract_Function(Input Format,Input Data)”.
    - Transform function, which produces raw output data based on the raw input data. It can be described as “Output Data = Transform_Function(Input Data)”.
    - Load function, which puts the created raw output data into its final formatted form. It can be described as “(Output Format, Output Data) = Load_Function(Input Data)”.
- Output
    - Artifacts (i.e. formatted raw output data) that are produced by the specific task, given the input artifacts. It can be described as “(Output Format, Output Data)” pair.
- Work instructions for humans
    - Instructions, in human understandable form, on how to perform the business task by using specific 3rd party SW tool. The instructions are tool specific. They can be represented as “Output = Human_Instruction(Tool, Input, Action)”.

- Work instructions for robots, aka automation content
    - Machine executable logic which, when placed on a robot platform, can automatically (without human intervention) or semi-automatically (with human intervention) execute multiple instances of a business task (aka job-to-be-done).
    - Automation content is 3rd-party-SW-specific, since the same business task can be performed by using several different tools. It is also robot-platform specific since the same task can be perfomed by using different robot platforms. They can be represented as “Output = Robot_Instruction (Platform, Tool, Input, Action)”
    - Asuming RPA and AI as enabling technologies, the content that automates Extract- and Transform- and Load Functions is typically a combination of RPA workflows and predictive models in a markup language format (e.g. Extensible Markup Language, Predictive Modelling Markup Language) as well as underlying binary files or source code. RPA workflows are typically used for performing the actual operational part of the business tasks (i.e. invoking user interface controls) whicle predictive models are used to automatically make operational decisions.
    - Automation content in both cases can be manually created by apriori specifying rules of behaviour. This is the typical way RPA-workflow-based content is created. They can also be automatically created by letting computer select automation content which best fits existing set of manually performed instances of a business task. This is how predictive-models-based content is created. Although various process mining tools exist on the market it is still not very typical for RPA-workflow-based content to be created fully automatically.

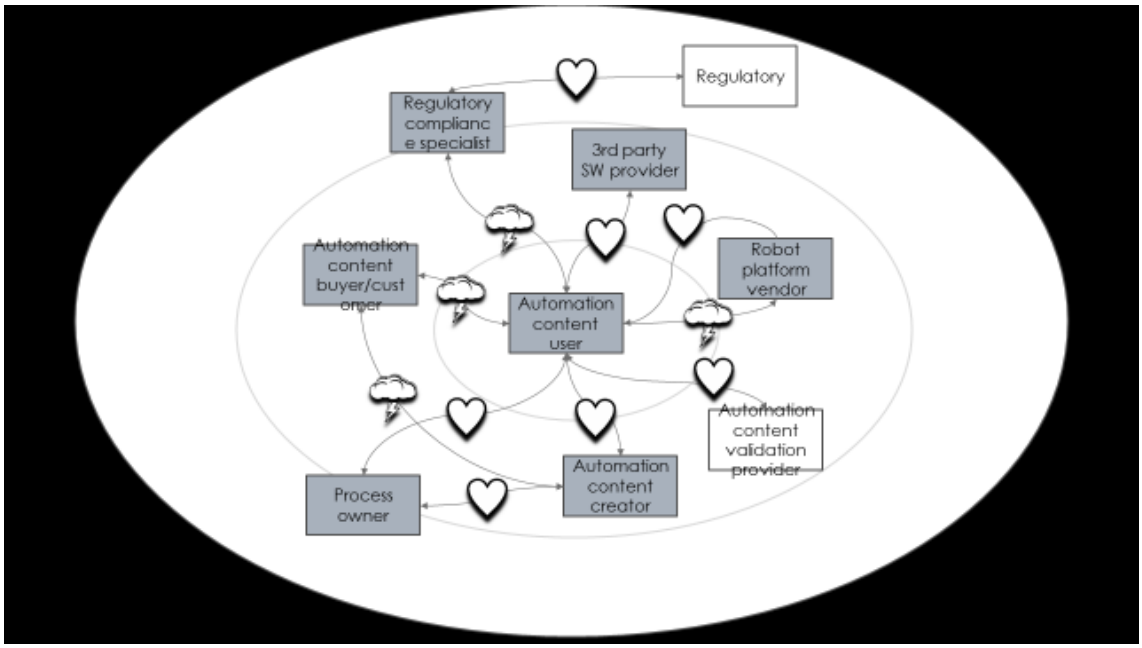

Figure 6: Initial version of the stakeholder map

The knowledge worker typicaly follows the instructions given in the decription of the business task and performs them manually, or (partly or fully) assisted by the automation content. Therefore, the following key stakeholders were identified during the processs:

- ***Automation content user***: The person that performs possibly repetitive knowledge work (business process tasks/activities) by using various SW tools, a.k.a. process perfromer. The person can choose to reduce the amount of own repetitive work by delegating (completely or partially) this work to SW robots empowered with selected automation content.
- ***Process owner***: The owner of a business process according to which the process performer acts on a daily basis.
- ***3rd party SW provider***: Provider of SW tools that the process performer currently uses to perfrom daily tasks. The SW robot empored with automation content uses existing SW tool interfaces to perform the tasks automatically.
- ***Robot platform vendor***: Vendor of the SW robot platform.
- ***Automation content provider***: Creator of the automation content that is used to instruct SW robots to perform certain tasks automatically.
- ***Automation content buyer***: Typically the procurement organization of a large company, but can be anyone that holds the necessary budget.
- ***Regulatory compliance specialist***: A person which makes sure that the company quality management system and related processes comply with requirements specified by the regulatory bodies.

- ***Automation content validation provider***: An actor which provides evidence that the automation content complies with its intended use within the company, and is thereby compliant with the quality management system.
- ***Regulatory body***: An actor outside of the organization which specifies regulatory requirements and makes sure that the company complies to those requirements by performing company audits.

The stakeholder map in Figure 6 also illustrates the typical quality of relations between different stakeholders.

3.5 Phase II – forming the hypothesis – convergence phase

3.5.1 Sensemaking

The *sensing* activity performed in Phase I was followed by a *sensemaking* activity (Koskelo & Nousiainen, 2016b), which has resulted in two *trend cards*, *Outsourcing intelligence* and *Human 3.0*. The cards are illustrated in Figure 7 and Figure 8, respectively. The former one indicates a trend of transferring decision making to personal assistants, and a rising issues related to whose (personal assistant's) decisions we can trust. The latter one indicates a continuing trend of humans extending their physical and cognitive capabilities through technology. In other words both of identified trends indicated the increasing automation (by partly or fully outsourcing to machines) of physical and knowledge work and increasing reliance on intelligent technologies.

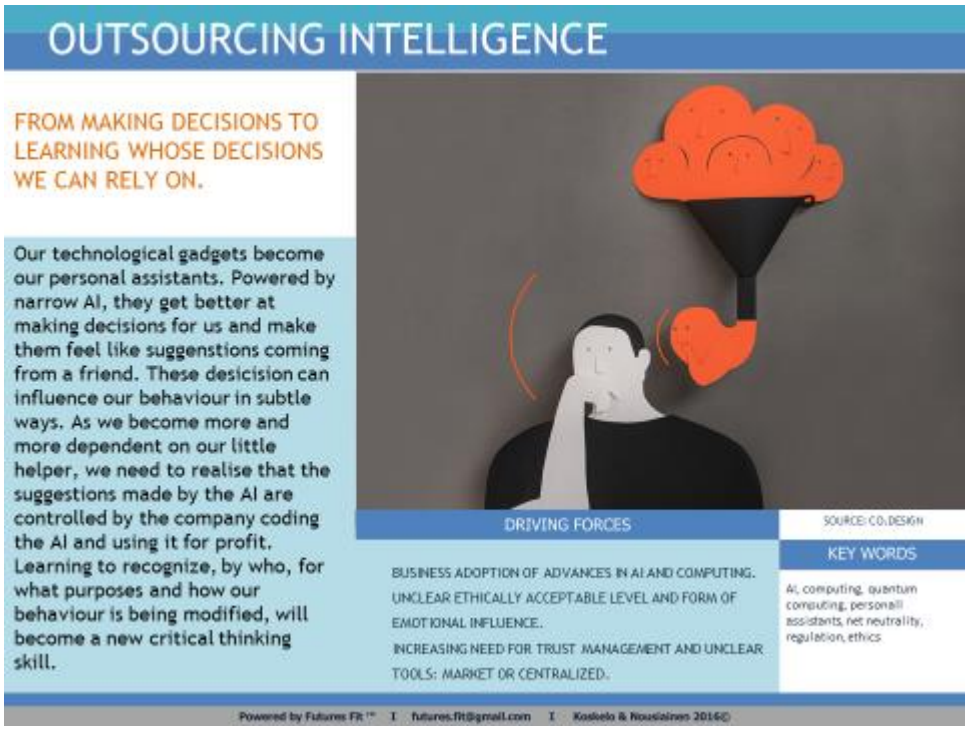

Figure 7: “Outsourcing intelligence” trend card

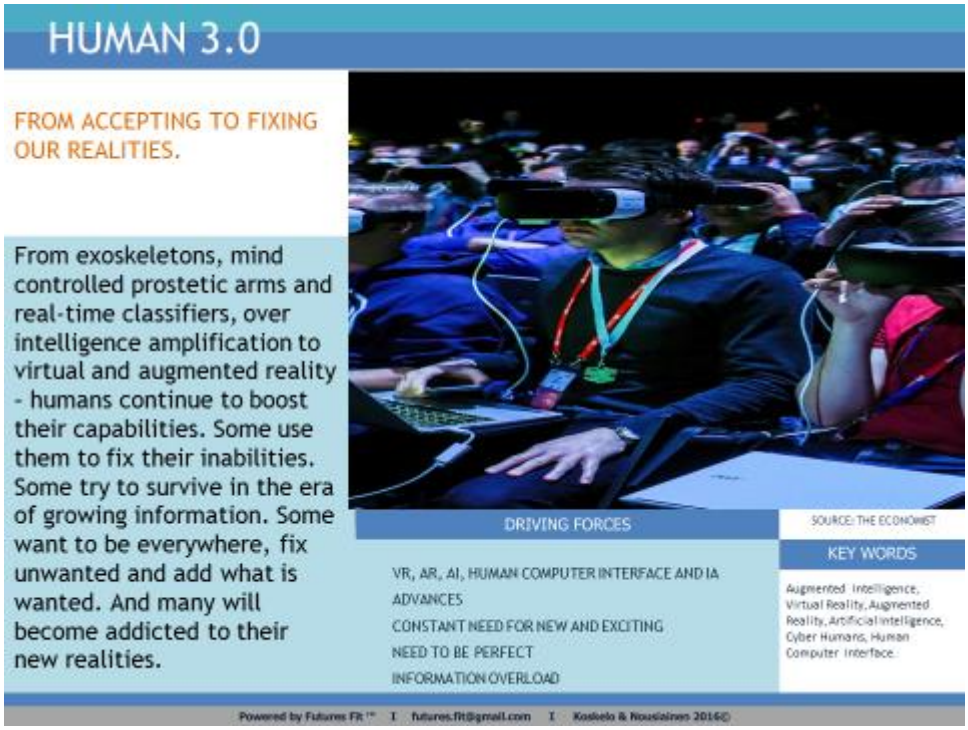

Figure 8: ”Human 3.0” trend card

3.5.2 Seizing

The Sensemaking phase was followed by the Seizing phase. The trends related to knowledge work and automation have been listed first. After that the needs that the tools used by the

knowledge worker has been listed (Lehtiniemi et al., 2015). The ideas identified in brainstorming phase have been listed next. They are then refined and further broken to meet some of the listed needs (to be satisfied by the 3rd party SW tools) in the context of the example knowledge work organization and selected persona. The most promising ideas (that have potential to meet one or more needs in the given organizational and persona context) have been kept and grouped into few clusters. E.g., the ideas in the "Atomization" cluster meet "Interoperability", "Autonomy and mobility" and "Collaboration needs". The ideas in the "Inclusion" cluster meet the needs of "Collaboration", "Sense of control" and "Teambuilding". The ideas in the "Reusability" cluster meet the needs of "Organizational memory" and "Lifelong learning". Therefore the names of the clusters were selected to represent the key high level functionalities of the service to be developed. The process is presented in Figure 9.

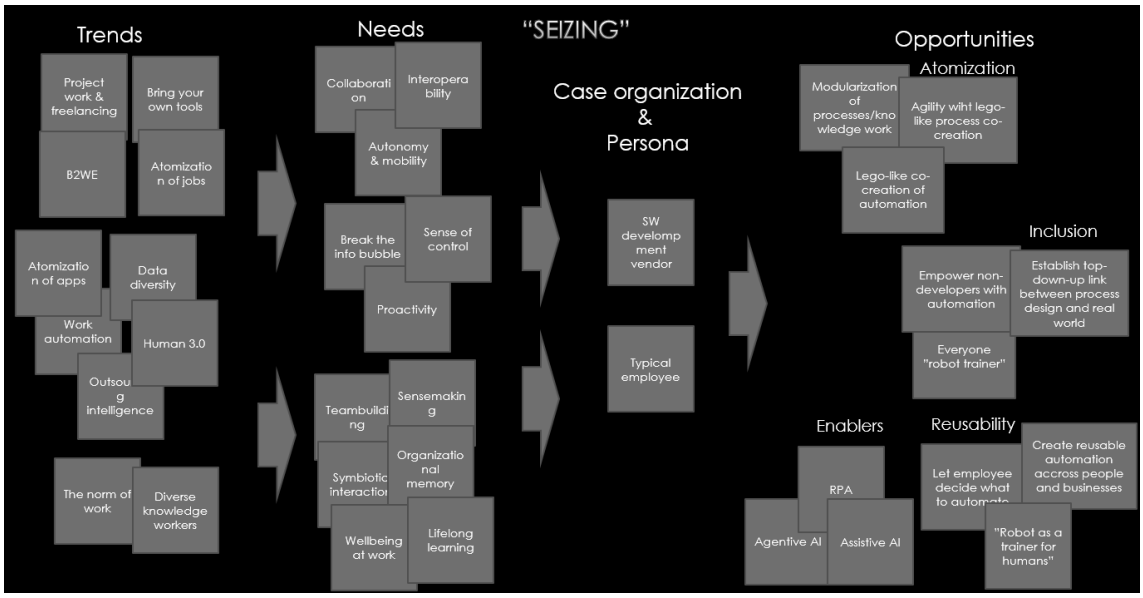

Figure 9: Seizing process

3.5.3 Creating initial version of the business model canvas.

Based on the information gathered during Phase I of the project an initial version of the Business Model Canvas was created. The canvas was created having automation content user as the customer. The story summarizing the service is created as follows:

"Reusability" of automation content ensures that different people within the organization and across organizations can learn from and utilize knowledge built into the content. They can choose bits and pieces of knowledge that is relevant to them and create new knowledge in form of new automation content specific only to their business. They can also offer the newly created content back to the community, in case it is generic enough for others to use. The content is built based on "Inclusion" principle, where workers can contribute to the cre-

ation based on the knowledge they possess. They can contribute by taking part in coordinated crowdsourcing campaigns. They can also contribute providing access to their existing business specific anonymized content so that service provider can facilitiate creation of reusable content from that. To cater for project- and atomization- attributes of work as well as foster "Reusability" the content is built on the "Atomization" principle. The "Atomization" is achived by finding intersections between Output = Robot_Instruction (Platform, Tool, Input, Action) functions, separating those intersections in the reusable atomic components.

The concept of reusable content is best illustrated on an example. Consider an instruction for a robot running on UIPath robot platfrom to filter email residing in Microsoft Outlook Inbox. The email is filtered based on the value of the From field into important or less important. The filtering logic is such that it treats customer emails as being of higher priority than internal emails. In other words, the task and the corresponding automation content can be described as

- Input
    - A specific email in Inbox having value in From field
    - A table descirbing mapping of email addresses on whether they are a customer or not
- Action
    - Extract: extract value of From field from email in Microsfot Outlook
    - Transform: check whether the address belongs to a customer, and if yes declare it as important, otherwise as non important
    - Load: Copy the email into the folder depending on how it is classified
- Output
    - email in specific folder.
- Robot instruction (aka automation content)
    - A workflow for extraction of value of the From field from the Microsoft Outlook message
    - A workflow for classifying the sender as customer or not
    - A binary file that returns importance classification and workflow invoking that file
    - A workflow that copies the email into the destination folder
    - A workflow orchestrating the above workflows in a linear sequence.

Given that several people within the same or different organizations apply the same logic when filtering their emails, the robot instruction that covers the above task would be reusable. This piece of reusable content can be combined with other such content to create more complicated and business specific content.

All nine parts of the canvas were considered at this point to a certain level and they are presented in the sequel and in Appendix 4.

Part1: Customer's World and Desire for Ideal Value

From our point of view:

- Understand what is SW tool used for in general in a certain industry and across industries
- Understand what is SW tool used for by each customer and specific industry

From customer point of view:

- SW tool is needed to get the job done and keep core business running
- Robots assists with jobs of employees (assistive mode)
- Robots automatically execute repetitive, boring and error prone tasks (agentive mode)
- Robots need to be flexble to support process rewiring
- Robot validation is needed by regulation but is not in core business
- Robot would ideally be bought validated
- Robot user should pay only for what is used

Part2: Value proposition

From our point of view:

- We discover and atomize cross-company generic business tasks, as well customer specific tasks
- We "train" the robot to peform atomized generic business tasks as well as customer specific tasks
- We make it possible for the customer to combine, select and use only the needed robots
- Unique proposal: We make it possible for our customers to build their own robots in a Lego-like fashion
- Unique proposal: We make it possible for the customer to sell us own robots

From customer point of view:

- Provider gives us ready atomic robots to build more complex robots as we need them
- Provider takes robot training burden from us
- Provider takes robot validation burden from us
- Provider saves us time to focus on what is important for our own business
- We pay only for used robots
- We can sell our own robots to the provider

Part3: Value creation

From our point of view:

- We discuss with the customer to discover their tasks that can be automated
- We work with the customer to help them select the right robots and automate their tasks
- We take the cost of robot ownership and training

From customer point of view:

- We hire robots as ”consultants” and pay them on the basis of the number of acomplished tasks
- We start benefiting immediately from reduced costs and from time released for more valuable work

Part4: Interaction and co-production

From our point of view:

- Toghether with the customer we analyze the customer processes thorugh to identify tasks that can be automated
- We respond to any specifc automation need
- We provide an interface through which customer can easily create new robots out of the existing ones for own use and and offer it to us for re-sale

From customer point of view:

- We spend time with the consultant to identify processes to automate
- We build our own robots through an easy to use web interface
- We inspect the results produced by the robots
- Provider is expensive but reliable.
- Provider enables us additional revenue stream by directly sharing our operational knowledge.

Part5: Key resources

From our point of view:

- Process discovery skills
- Process automation skills (create hard coded business rules or business rules learned from data)
- General SW developmnent skills (tools to broker robots and monitor robot usage)

From customer point of view:

- General IT skills
- General level process automation skills

Part6: Mobilizing resources and partners

From our point of view:

- Customer creates value through performing its jobs

- Partners creates value by
    - selling usage of their robot platform (platform provider),
    - by training and selling their robots through our brokerage platform
- We make value by training the robots and leasing them as well as brokering the robots of other robot providers

From customer point of view:

- I can utilize robots of service provider's other customers
- I can have a dedicated robot providers that work only for me
- Other service provider's customers can utilize my robots – we can collaborate on the process, and compete on the core business

Part7: Key partners

From our point of view:

- Robot platform (SW) provider. They benefit from a share in our revenues.
- Own customers (in case they decide to sell us own robots)

From customer point of view:

- Service provider's partner is yet another SW provider for us
- Our existing HW/SW provider relationships remain unchanged

Part8: Cost structure

From our point of view:

- Cost of robot creation, ownership and development
- Cost of brokerage platform creation, ownership and development
- Personnel costs

From customer's point of view:

- I (customer) need financial resources to lease the robots
- I need time resources to spend with provider to create robots customized for me
- I need time and resources to develop my own more complex robots

Part9: Revenue streams and metrics

From our point of view:

- We are paid for the number of job instances performed by our robots
- We can e.g. price more for the robots that are used more, and apply dynamic pricing
- We can use e.g. ROI, operating profit as financial indicators

From customer's point of view:

- I (customer) am willing to pay only for what brings me value, i.e. for the job instances done
- Direct financial value comes from the percentage of work done by robots that is required to sell my product or service

- Indirect value comes from the saved time through faster execution, reduced rework and more time to focus on developing core business
- I can measure e.g. how much more I am able to sell due to robots usage.

3.5.4 Creating detailed value proposition

After the initial business model canvas was prepared, the value proposition part was created in some more detail. The motivation behind this was the intention to create more concrete description of the proposed service components that can be later validated with the target customer group. Thereby, the second phase, *crafting the value proposition*, of the *value based selling* process (Terho et al., 2012) was used as a inspiration and guidance. As suggested by Terho et al (Terho et al., 2012) both the *content* as well as *quantification* of the value proposition has been made. In terms of content, the proposed service concept is based around the following main components:

- **Component1: Atomized software applications,** that are capable of automatically performing atomic user tasks in exactly same way as human user, on top of already existing SW tools. Every underlying SW tool version would have its own atomized software applicaton version. The applications could be purchased directly as executable binares (if they are sufficient as-is) or as content for internal tailoring (e.g. as source code or metadata). In either case example data and process artifacts would be provided. **The benefits** that this approach provides for the customer are as follows: 1) Existing tool investments are preserved, 2) Current established work procedures are not disrupted, 3) Rapid automation of repetitive tasks is enabled, 4) Automatically validate and re-validate the underlying in-house or 3rd party software and reduce cost of that activity, 5) Provide dynamic and interactive training material for the business process performers.
- **Component2: Possibility for the customer to choose only needed atomized applications**, and combine them into composite applications that perform more complicated tasks. **The benefits** that this service component provides for the customer are as follows: 1) Possibility to control own costs as per company's need.
- **Component3: Possibility to automatically generate quality system documentation** from the composite applications, that then can be inspected by the regulatory specialists and iterated with application owners. **The benefits** that this service component provides for the customer are as follows: 1) Reducing cost of quality system maintenance, 2) Reducing cost of making sure that the quality system instructions match the enabling business SW tools.
- **Component4: Possibility to hire a service provider to identify atomic and composite taks to be automated** by means of an atomic or composite application, if no internal resource is available for that. **The benefits** that this service component pro-

vides for the customer are as follows: 1) Possibility to outsource part of own non-core business activity.

- **Component5: Possibility to sell own atomized applications back to the service provider,** or other interested parties, thereby also turning non-core business effort into a direct financial value. **The benefits** that this service component provides for the customer are as follows: 1) Possibility for an additional source of profit.
- **Component6: Possibility for 3rd party process software tool vendors to untap the actual usage pattern of their own tools,** and use this information in own product development.

The service provider in this case can be either an internal organization within a large company, or a separate company.

Quantification of the service proposal was also made by performing discounted cash flow analysis from the customer point of view. An example case process identified in Phase I was analyzed, cash flows from service components 1, 2 and 5 identified and net present value of the cash flows estimated. The result of the quantification is presented in Appendix 7.

3.5.5 Creating visualization of the service concept - storyboard

To further illustrate the service concept to the potential customers and assist in the process of service concept communication and validation in Phase III a visual representation of the concept was also created. The visualization of the Components 1,2,4 and 5 of the proposed service concept was created in form of a storyboard. A strong emphasis on the customer point of view was made to enable customer to emphatize with the story and recognize potential benefits for itself. The storyboard is presented in Appendix 2.

3.6 Phase III – validating the hypothesis – divergence phase

In this phase a validation of the proposed service business model was performed. In order for the service as a whole to be sustainable it is necessary for all involved parties to have value created. In order to validate whether this is indeed the case both qualitative and quantitative models of a basic service ecosystem (involving service provider and automation content user) were created.

3.6.1 Service ecosystem model and business simulation

In order to evaluate the leverage points important for the overall value creation a qualitative model of the proposed service ecosystem was created. The qualitative model is presented in

Figure 10. The model was analyzed in order to identify reinforcing and balancing loops as well as points of leverage. The following loops were identified:

- **Reinforcing loop 1**: *Number of manual jobs -> Completed manual job instances -> Customer value -> Existing and new business opportunities -> Number of manual jobs*
- **Reinforcing loop 2**: *Number of manual jobs -> Completed manual job instances -> Manual jobs repetitiveness level -> Need for automation -> Customer investment in automated execution capacity -> Capacity for executing automated jobs -> Completed automated job instances -> Customer value -> Existing and new business opportunities -> Number of manual jobs*
- **Balancing loop 3**: *Number of manual jobs -> Completed manual job instances -> Manual jobs repetitiveness level -> Customer investment in manual capacity -> Customer value -> Existing and new business opportunities -> Number of manual jobs*
- **Balancing loop 4**: *Number of manual jobs -> Completed manual job instances -> Manual jobs repetitiveness level -> Need for automation -> Customer investment in automated execution capacity -> Customer value -> Existing and new business opportunities -> Number of manual jobs*
- **Balancing loop 5:** *Number of manual jobs -> Completed manual job instances -> Manual jobs repetitiveness level -> Need for automation -> Customer investment in automation content -> Number of automated jobs -> Number of manual jobs*

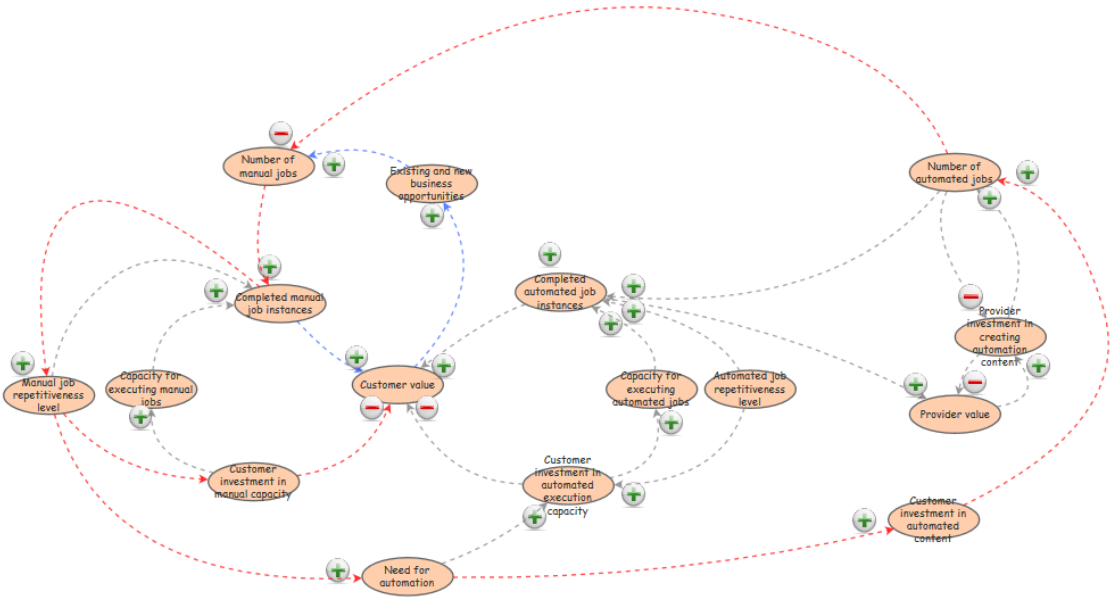

Figure 10: Service ecosystem system model, causal loop diagram

The following conclusions can be made from the above analysis:

- Increasing amount of manual jobs (from the new and existing business opportunities) leads to increased customer value. This happens through increased amount of executed manual job instances. Therefore one possible leverage point is *the amount of*

generated value that is invested in new business opportunities. Furthermore, *the amount of investment in increasing manual execution capacity* is also important, since it is of no use to increase the amount of jobs without investing in capacity to perform them.

- At the same time, this does not come without cost. Increasing amount of manual jobs leads to higher amount of executed job instances. Over time this increases routineness of the job execution, enabling even more instances to be executed. As the business grows, the current manual job execution capacity is not enough which requires increased investments in manual execution capacity, which destroys value. Increased routineness also leads to increased repetitiveness. This feeds the need for automation and thereby the need for investments in automation capacity, which destroys value. Therefore, again, *the amount of investment in increasing manual and automated execution capacity* is also an important leverage point to consider.
- The need for automation also increases the customer investments in automation content, which enables higher amount of automated job instances to be executed. This increases customer value.
- On the other hand, the value is also destroyed by the fact that increased automation leads to higher amount of manual jobs being destroyed. Therefore, it is important to compensate the loss of high-value manual jobs with *relatively higher amount of low value automated job instances*. This is also an important potential leverage point to consider.

Therefore, in order for the customer value to be positive, the cumulative net effect of the reinforcing and balancing loops needs to be positive over time. In order to gain further understanding of what are the most likely leverage points the quantitative, stock-and-flow model was created and simple business simulations were performed. The model is illustrated in Figure 11, and detailed values of the parameters in Appendix 6.

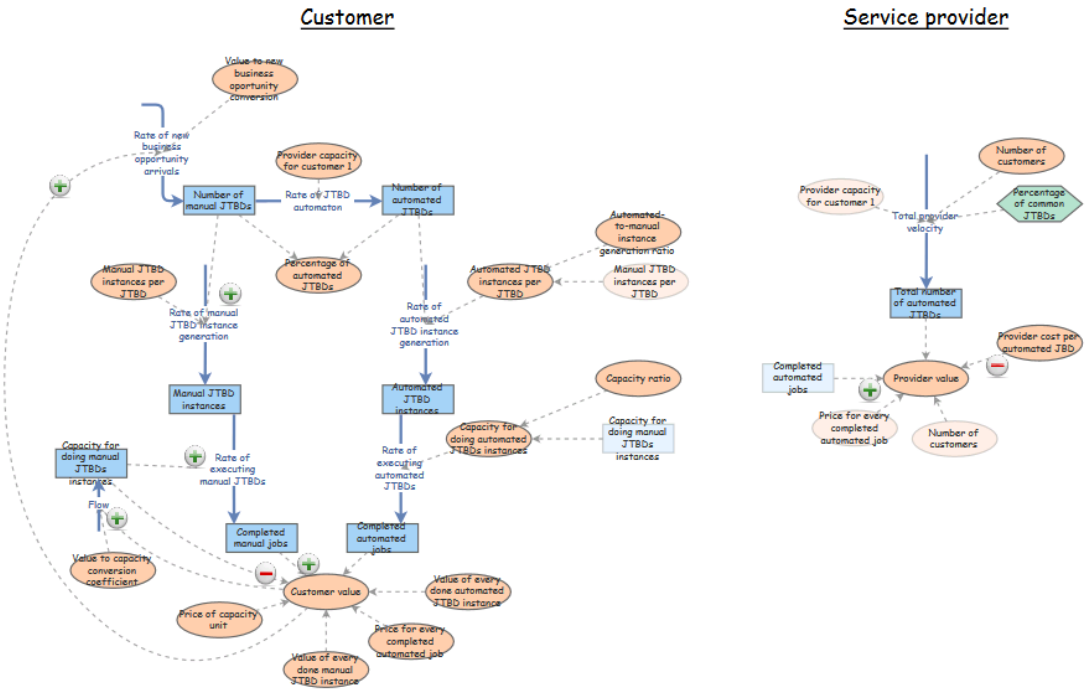

Figure 11: Service ecosystem system model, quantitative, stock-and-flow diagram

The simulation process was two-staged. First, the values of the model parameters were chosen by trial-and-error, so as to achive increasing customer value and provider value. The values are chosen so as to have meaningfull relative values to each other, as well as meaningfull positive or negative signs. For example, value of executed manual job instance was assumed to be higher than that of an automated job instance. Second, several simulation scenarios were performed to understand the impact of various parameters on the customer and provider value. The scenarios are given in the sequel. Parameters having different values in different scenarios are bolded:

- **Simulation 1 (base case)**: Manual JTBD instances per JTBD = 5, Provider capacity for customer 1 = 10, Automated-to-manual instance generation ratio = 10, Value to capacity conversion coefficient= 0.001, Value to new business oportunity conversion = 0.1

- **Simulation 2**: Manual JTBD instances per JTBD = 5, **Provider capacity for customer 1 = 20**, Automated-to-manual instance generation ratio = 10, Value to capacity conversion coefficient = 0.001, Value to new business oportunity conversion = 0.1

- **Simulation 3**: **Manual JTBD instances per JTBD = 10**, Provider capacity for customer 1 = 10, Automated-to-manual instance generation ratio = 10, Value to capacity conversion coefficient = 0.001, Value to new business oportunity conversion = 0.1

- **Simulation 4**: Manual JTBD instances per JTBD = 5, Provider capacity for customer 1 = 10, Automated-to-manual instance generation ratio = 10, Value to capacity conversion coefficient = 0.001**, Value to new business oportunity conversion = 0.5**

- **Simulation 5**: Manual JTBD instances per JTBD = 10, Provider capacity for customer 1 = 20, Automated-to-manual instance generation ratio = 10, **Value to capacity conversion coefficient = 0.005,** Value to new business oportunity conversion = 0.1

- **Simulation 6**: Manual JTBD instances per JTBD = 10, Provider capacity for customer 1 = 20, **Automated-to-manual instance generation ratio = 20**, Value to capacity conversion coefficient = 0.001, Value to new business oportunity conversion = 0.1

Simulation results are presented in Figure 12 and Figure 13 for customer and provider values, respectively.

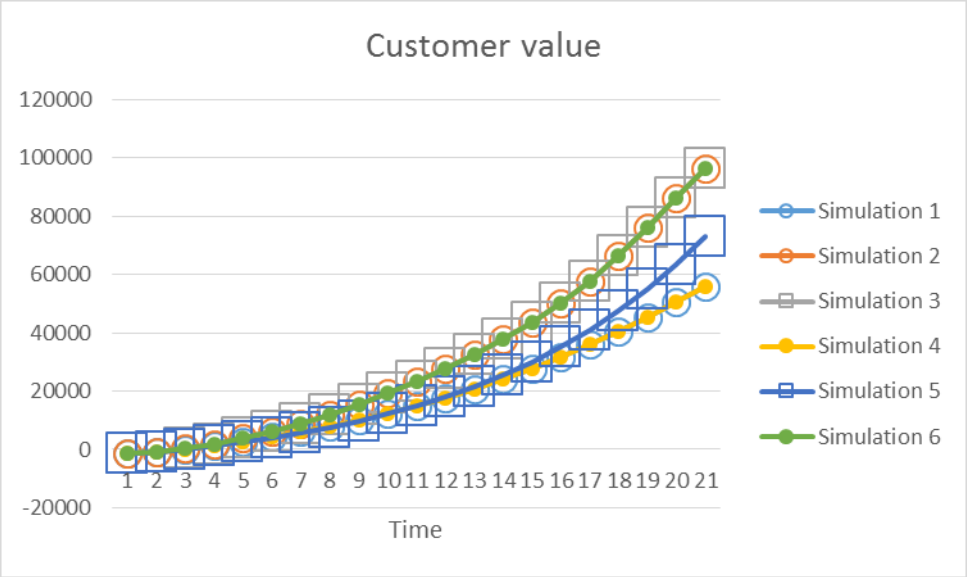

Figure 12: Simulation results for customer value

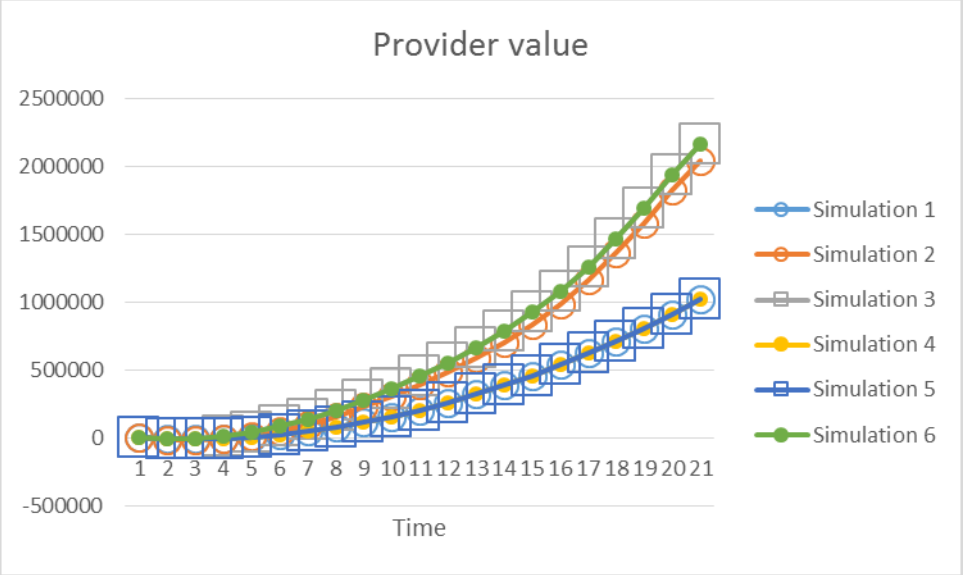

Figure 13: Simulation results for provider value

The following can be concluded from the above simulations:

- From Simulations 4 and 5 it can be concluded that neither *Customer value* nor *Provider value* increase *when increasing investments only in new business opportunities*, without *investing more simultaneously in manual execution capacity*. On the other hand, the *customer value* does increase if investments are made in *manual execution capacity*, everything else being constant. This growth is expected to continue until capacity becomes sufficient to handle current rate of manual jobs remaining after automation.
- From Simulations 2, 3 and 6 it can be concluded that both *Customer value* and *Provider value* increase when there are *more and more instances of the same manual job to be performed*, there is *increase of instances of the same job after job is automated*, and *provider increases own effort to help the customer automate existing jobs*, everything else being constant. The third result most likely leads from the fact that in the base case the manual job execution capacity of the customer was not high enough to match the rate of manual job instances generation. Therefore, automation in this case helped to untap the unrealized potential.

The above findings were further used when creating interview field guide. For example, it was made sure that the interview questions attempt to reveal whether a customer 1) has such manual jobs which, when automated, would bring more value by being performed more often, 2) whether the customer is willing to allocate time to work with the provider in order to identify jobs for automation, 3) what is the customer's opinion of investing in manual vs automated execution capacity with respect to the amount of job instances, and 4) whether the jobs performed by machines typically bring lower value than those perfromed by the human.

3.6.2 Interviews

To validate the porposed business model interviews were performed within 1) an organization which could be the potential user of a service and 2) process automation service provider. Ten interviews in total have been performed during September and October 2016. The interviews were audio recorded and literated afterwards. Duration of the interviews was between one and two hours.

The emphasis of the interviews was on validation of the first four parts of the proposed business model. The interview field guide is presented in Appendix 8. Recruitments in the potential service user organization were conducted so as to achieve as high coverage of different functions in the organization as possible. Therefore it is mostly the level-two and -three managers were chosen for the interviews since they have sufficiently deep knowledge of the tasks that their immediate reports perfrom. A representative of the process automation service provider was intervieweed in order to gain insights in commonality of atomic tasks as well as in interactions with third party software providers.

The interview data is analyzed in the following way. First, the most relevant literated raw statements are listed. Second, the raw statements are clustered around key findings. Third, the key findings are further clustered around eight key high-level insights, that will be used in the later stage of the service design process.

Summary of findings

There seems to be no shortage of tasks that can be automated, regardless of the considered company function. The tasks are such that they can be automated either by explicitly implementing an existing business rule or by letting robot learn the rules from the past executions of the task. There were few tasks that were perceived as not automatable. The task of innovating was one of them.

Having virtual personal assistant (i.e. software robot) was perceived as positive and desirable by all the persons interviewed. The current 3rd party SW tools are almost always perceived as cumbersome and not always up to the task. They are most often used because they are imposed by the corporation and not because they are chosen by the employee itself. On their part, 3rd party SW providers are certainly interested in why the user is willing to put the SW robotics on top of their SW.

The software robots are not perceived as a threat. The major concerns are about whether the robots are secure (in terms of handling personal information) and whether they can be trusted to do what they are supposed to do. However, some employees might be feeling that their competence is questioned. A way to handle this concern as well as provide support for job description transformation would be of great value.

It was understood that personal assistants and agentive robots would bring value in terms of saved time on repetitive tasks, released time to innovate, improving ability to do more in case of work overload, improving HW and SW equipment up time and having more fun at work. Some employees might also feel accomplished by perfroming the repetitive tasks and they might be satisfied with such a job. The threats to value creation identified from the proposed brokerage service are that sharing own automation content would enable better operational capability of the competitors which could disrupt own business. Another threat is that (machine learning based) automation is based on the current and past ways of working and dooes not necessarily directly contribute to innovation. Yet another, related, concern is that automation could remove the apetite for improving underlying business critical applications.

The users are doubtfull regarding reusability of the automation content, even on the atomic task level. This is especially true for reusing between different companies and it was seen that reusability within a single company is more realistic. Even though the users agreed that there a lot of similarities in business logic between similar companies, the understanding is that there are a lot of differencs as well. In general the users perceive that humans tend to do the same task in different ways. Other sources of skepticism are different 3rd party SW tools, their different versions, configurations and customizations. However, it was not completely excluded that such a reusability is possible. Even though domain knowledge was perceived as critical, persons having SW development mindset are seen as key resource for creating widely reusable automation content.

In case it is sufficiently easy to build more complicated automation content from the existing atomic content the users would do it themselves. In other cases they would prefer a service provider to do it on their behalf. In case that users have some technical background they would be more likely to also create automation content themselves.

Key high-level insights

The findings are grouped around the following key insights:

- (**#NoShortageOfMundaneTasks**) There is no shortage of tasks to automate in any part of a typical organization, even though not everything can be automated.

- (**#RealityIsCumbersome**) The current 3rd party SW tools are often imposed by the company and they are not always up to the task.
- (**#(Not) EveryoneContentCreator**) Every business domain expert can herself quickly create non-reusable automation content for own use. Depending on their background some would do it and some not.
- (**#ReusableContentNotEasy**) Special skill is required to create reusable content. Common tasks are there but it is not easy to find them and they are done with different tools, configurations and tool versions. Purely centralized service is therefore not scalable, while purely distributed has maintenance guarantee issues since someone needs to take responsibility for maintaining the content. Furthermore, in a big company commitment to content co-creation community is smaller and many people only work for salary.
- (**#SecurityAndTrust**) Co-creation of trust as well as security is very important
- (**#AutomationAloneKillsValue**) Automation content creation will compete for resources with core business and thereby drain value. Furthermore sharing own content will empower competitors, also having negative effects on value creation. Finally, automation might decrease apetite to innovate in the already automated process.
- (**#DifferentPeopleDifferentValues**) Customer value is multidimensional concept based on saved own time, having fun, feeling good, not getting bored, decreasing time to market, getting a discount on the automation content, improving quality nd enhacing own service up-tme. One important consideration is that some knowledge workers actualy enjoy performng repetitive tasks and measure value as the amount of taks instances performed.

Key findings

Customer's world and desire for ideal value

Finding 1. (**#NoShortageOfMundaneTasks**) Regardless of the company function covered by the interviews there seems to be no shortage of tasks that can be performed automatically, at least on some level. Based on the interviews the following potentialy automatable tasks have been identified:

- Project management: create of project status documents from data (i.e. reporting), execute and follow up on checklists, allocate tasks to resources in order to get the project on track, suggest which activity in the project to emphasize in order to get the project on track, interpret data from e-mails and suggesting action points.
- Decision making: challenge human's decision based on similar decisions of other humans, give several options to human from which to choose, navigate

human through daily routine tasks, completely automate mundane tasks to release time for innovation.

- Operations: provide sufficient information to the customer through HelpDesk, perform root cause analysis of customer complaints, perform reset of user passwords in existing systems, determine severity of the complaint (and whether it requires notification of regulatory body), suggest likely audit questions based on the selected complaint.
- Customer support: warn in advance when maintenance is needed, perform HW and SW fault root cause analysis, install and update SW products, perform document reviews (desired but not perceived as possible), training customers.
- Financial management: match invoices with purchase orders and approvals which are in multiple formats, fill out travel and expense reports correctly by non-financial experts(i.e. structure data when entering it into the system), decide on the level of approvals required according to business rules, reporting.
- Testing: perform impact analysis (what needs to be tested given the product change), drive system under test into a state where creative testing work can be performed, get information on how the users currently use the product.
- Regulatory/Quality assurance: training employees.
- IT management: Employee onboarding and offboarding.

Finding 2. (**#NoShortageOfMundaneTasks**) Since the interviews were run with the objective to discover the tasks that can be automated, there were not that many tasks that were perceived as not possible to automate. These are as follows:

- Innovate (products, services, processes and business models).
- Perform document reviews (for content and format).
- Motivate humans to get the job done.

Finding 3. (**#RealityIsCumbersome**) There is a very clear message from majority of the interviewees that the currently used 3rd party SW tools are often cumbersome and are not always usable. It is often that the actual job is performed with another tool (due to the original one being cumbersome) and only the end result copy-pasted into the original tool for archiving purposes. However, the cumbersome tools have to be used since investments are already made in them.

Finding 4.(**#AutomationAloneKillsValue**)There is a very clear message that the tasks that are of critical importance for the organization should be automated not by the automation content on top of robots but by the proper dedicated tool.

Finding 5. (**#AutomationAloneKillsValue**) There was also a concern that by training robots with historical data we do not innovate, but we teach robots to do things in the same way as humans did it before, or at best, are doing it currently. On the other

hand, it was perceived as necessary for the human to get rid of mundane tasks in order to have time to innovate, and automation is seen as key enabler of that.

Finding 6. (**#(Not)EveryoneContentCreator**, **#RealityIsCumbersome**) It was also concluded that the service has a potential to establish a bottom-up feedback link from process perfromers to process designers. A typical quality management system is designed in a top down way. The process designers create the process to satisfy regulatory requirements. The process desriptions as well as instructions on how to perfrom the process with specific SW tools are then used to train the users. The users then perfrom process tasks as instructed by using the SW tools. SW tool is validated for intended use as a separate effort, not connected to the process desriptions. This results in duplicate work, which is caused by organization structure. The service could elimintate this duplicate work by providing atomic process tasks that can be used to create process workflows that correspond to how the process is actually performed. The same content could be used for validation purposes therby reducing duplicate work. Furthermore, automation content could be used for training thereby eliminating the need for the separate tool instrucions.

Value proposition

Finding 7. (**#RobotsAreWelcome**) A virtual personal assistant is perceived positively and acceptable by all interviewees to have in the workplace. Majority of interviewees are seeing *the assistant as something that helps, i.e. acts as an assistant, instead of something that runs fully on its own, unattended*. For some it is important that it can run in the background as well and does not disrupt human's work.

Finding 8. (**#SecurityAndTrust**) Most concerns raised are about *security* (leaking of personal and company proprietary information) and *trust* (whether the robot is doing what it is supposed to do).

Finding 9. (**#AutomationAloneKillsValue**) One major concern is that automation could have negative efects on the value creation since it would hide the value created from the the interviewee's customer. Therefore the customer may wrongly perceive the interviewee's own services as not needed anymore.

Finding 10.(**#AutomationAloneKillsValue**) Another concern for the user of the brokerage service was that sharing own automation content enhances competitors' capability to perform the same tasks. This could lead to disruption of own business.

Finding 11. (**#DIfferentPeopleDifferentValues**) It was confirmed that there is interest among third party SW providers regarding how are users using their products. They were especially interested in why and which tasks have been automated on top of their software.

Value creation

Finding 12. (**#DIfferentPeopleDifferentValues**) Majority of potential users would require a clear indication that usage of the service would bring them benefit. Direct value is perceived as *saved own time*, *having fun*, *feeling good*, *not getting bored*, *decreasing time to market* and *getting a discount on the automation content*. Indirect value is perceived through interviewee's customer *enhanced up-time*, i.e. time during which the interviewee's customer can serve own customers.

Finding 13. (**#DIfferentPeopleDifferentValues**) There was an observation that some people might actually feel accomplished by performing mundane tasks. The porposed service might raise the concern with this group that their competence is being questioned and that they are not needed anymore.

Finding 14. (**#DIfferentPeopleDifferentValues, #RobotsAre Welcome**) If there is indication of future value the users would be ready to invest their resources (time and money) into creating, using and training robots, either themselves or with help of a service provider. It was also perceived as valuable to outsource mundane service tasks and focus on more value adding tasks. This was especially true for the user that is aiming at the all inclusive service contract with own customer, when outsourcing cheap, mundane service tasks to the robots (or competitors) could improve own bottom line.

Finding 15. (**#RobotsAreWelcome**) Robots are not regarded as a threat in terms of taking away human jobs. Instead, there is a general understanding that they would instead change the current jobs of humans. Since automation is changing the current work descriptions an additional service to help employees transform into new roles is seen as beneficial.

Finding 16. (**#ReusableContentNotEasy**) A general perception is that there are a lot of similarities in the ways tasks are performed in different companies but that there are a lot of differences as well. However, it was difficult to directly confirm that the the lower level tasks tend to be more similar between different companies. As stated by the process automation service provider "it must be so, but it requires effort and intelligent people to find them [similar atomic tasks]". It is possible to make quick wins with today's technology when a domain expert trained in robotic process automation records the workflows to be reused by herself. However, in order to create reusable automation content SW development mindset and skills are required. This is especially true if the robots are to work in unattended mode. The majority of differences comes from different tools, their different versions and different ways of doing things. Different people perform the same task in different ways, which may confuse e.g. machine learning algorithms.

Finding 17. (**#ReusableContentNotEasy**) Correspondingly, sharing of automation content between different companies is perceived as possible but limited. Sharing ways of working was perceived as primary source of value with sharing automation content as secondary after that. The service is also perceived as a way to share knowledge from the more experienced to the less experienced workers.

Finding 18. (**#ReusableContentNotEasy, #(Not)EveryoneContentCreator**) It was also perceived that the proposed service can be started internally within a company and then offered to external customers as well.

Interaction and co-production

Finding 19. (**#ReusableContentNotEasy**) Majority of users stated that it has to be simple and clear to create and use the robots for them to do it themselves. It has to be easy to search for the available automation content by the multiple attributes. The service could also automatically recommend content based on the search criteria given. In ny case the robot should not be perceived as additional overhead by the user.

Finding 20. (**#ReusableContentNotEasy**) There was some level of concern whether one could create complex automation workflows by simply selecting the checkboxes, especially in financial domain where there are a lot of country specific parameter variations (e.g. VAT).

Finding 21. (#**ReusableContentNotEasy , #(Not)EveryoneContentCreator**) The willingness to assemble and train the robots themselves is strongly correlated with the person's technical skills as well as habits. The lack of technical skills increases the willingness to co-create automation content with the service provider. In the presence of technical skills the user is willing to do it on her own.

Finding 22. (**#(Not)EveryoneContentCreator**) Examples of how to use and create automation content are perceived as important.

Finding 23. (**#SecurityAndTrust**) Co-creation of trust is seen as important through user ratings of automation content. Simple user rating of robots would not be enough though. Instead, a more detailed rating on different categories as well as textual comments are perceived as important. This is due to different categories being important for different users.

Finding 24. (**#(Not)EveryoneContentCreator**) Co-creation of value through sharing the ways of working was also seen as important.

3.7 Phase IV - updating the hypothesis – convergence phase

The findings from the interviews are used to improve the original business model and detailed service proposal.

3.7.1 Improved business model

Based on the insights gathered in Phase III the original version fo the business model canvas was refined in this phase. Below are the key identified impacts that the insights have on the original service proposal as well as modifications made to the original concept.

- **#NoShortageOfMundaneTasks**
  - In principle this finding works in favor of the proposed business model. There is clearly a real need wich is addressed by the proposal. However, the identified tasks are spread across varius functions of the organization, from finance, over human resources and IT to operations and research and development. It might be difficult to serve all the functions with the single business model and further **focusing might be beneficial**. This might be subject of further research which is outside of scope of this thesis.
- **#RealityIsCumbersome**
  - Even though one of the identified trends is b*ringing your own tools* it appears that this trend has not yet significantly impacted the example knowledge work organization. This is mostly due to the centralized way of choosing and administering tools, due to regulatory reasons. This finding also works very much in favor of the proposed concept since the siloed and cumbersome tools can be **easily bridged by means of proper automation content**.
- **#(Not)EveryoneContentCreator**
  - The original business model has to be adjusted to support at least two (extreme) groups of automation content creators. On one side of the spectrum is an expert in specific business domain but without automation skills. On the other side is an expert skilled in automation but with no skill in any specific business domain. The first group requires tools for training the robot that are easy to use. This is ideally supported by *the AI powered tools that enable the user to train the robot while perfroming their task as they usually do it without automation*. The tools with this capability (though with focus on some specific tasks) already are and will increasingly be available on the market (WorkFusion, 2016). Another option is to use simple web-based tool envisioned in the original storyboard which enables creation of simple linear workflows from existing atomic content. After this initial stage the users can also use record-and-playback feature in most RPA tools to create somewhat more advanced, but still not reusable content. All the tools we will comple-

ment by the corresponding traning offering. The second group is already well supported by the variety of tools and trainings offered by the robot platform vendors. The impact on the business model is addition of **training services** as well as **partnership with multiple robot platform vendors**.

- **#ReusableContentNotEasy**
    - To address the challenge of training robots to work with variety of tools **the support for crowdsouring** is added to the business model. Crowdsourcing is used to train either predictive models or create RPA workflows. Crowdsourcing predictive models could be done by using methodology proposed by WorkFusion (2016). Crowdsourcing RPA workflows is done by methods traditonally used in SW development (developing based on specifications, or matching existing implementations with later discovered specifications). **3rd party SW providers, our own customers as well as freelancers would be the most obviuos members of the crowdsourcing community**.
    - Service provider's own automation content creators would create content that is identified to be of the strategic value and would not be crowdsourced. In order to make training predictive models possible in this case a partnership with selected customers would be established. Partnership would require access to either 1) customer's in-house anonymized (manual and automated) task execution logs, RPA workflows or existing predictive models or 2) business domain experts' time which could do on-the-job training of the predictive models. In return, partnership woud offer discounted usage of all brokered content owned by the service provider.
    - The challenge of business specific needs is inherently handled by offering atomic, reusable content that can then be combined in a desired way. This way we make sure that the **knowledge flow is two-directional**, both from humans to the robots and back from robots to the humans.
- **#SecurityAndTrust**
    - This finding clearly indicates that service needs to support the co-creation of trust in the offered automation content. I have decided to solve it by simply adding **rating and commenting capability to the service web portal**, which is common in today's digital marketplaces. Security is handled by choosing **mature enough robot platform**. There is a wide variety of mature and certified RPA platforms on the market, whih will increasingly have AI support as well.
- **#AutomationAloneKillsValue**
    - To make sure that the innovation does not suffer in the client organization a process consulting service component is added to the business. The purpose of this component would be to continuously work with the customer on opti-

mization of their business process as well as help with mapping of identified processes on humans and robots. A service would also include investigation on whether it makes business sense for the customer to invest in own automation centre of excellence (and thereby indirectly empower own competitors in return for usage revenue).

  - A service of training customer on how to create reusable content would also help in preparing their own personnel for the inevitable changing of their job descriptions caused by automation. This would be another indirect source of value creation for the customer.

- **#DIfferentPeopleDifferentValues**
  - Proposed business model by default enables companies to reduce time to market and free time for more innovative work. Thereby the creation of value for people that do not want to feel bored and have fun is indirectly supported. In order to handle the users that draw value from doing repetitive tasks we offer them **capability to themselves choose what to automate by building assistive content in a Lego-like fashion**.

The improved version of the Business Model Canvas is given below and in the Appendix 5.

Part1: Customer's World and Desire for Ideal Value

From our point of view:

- We constantly work to understand the mapping of tasks on manual and robot resources and SW tool
- We do the above for specific customer, business and across businesses

From customer point of view:

- We (customers) would pay for saved time, having fun, not getting bored, reducing time to market, improving own product or service quality
- We would like to use proper tools, SW tool is often imposed, unfinished and cumbersome
- We would love if robot would do cumbersome tasks
- We appreciate safe and trustfull tools
- We would love to get out of tool and organization siloes
- We like to see how others are doing what we are doing
- I am domain expert but not necessarily tech-savvy and would appreciate help from IT expert

Part2: Value proposition

From our point of view:

- We sell (our own) or broker (customer's and crowd's) **usage** of reusable content

- We train and empower customer to build own automation content in a Lego-like fashion from content offered by us
- We empower customer to use their own or content offered by us for performing own work
- We offer discounted **usage** of reusable content in return for access to their ”raw” automation content and usage logs
- We create (ourselves, crowdsource) **reusable** automation content
- We empower the customer to sell **usage** of own reusable automation content (binaries) to other parties, against brokerage fee
- We empower customer to sell us own **reusable content** workflows/models)

From customer point of view:

- We (customers) buy outcomes produced by existing safe, trustful automation content
- We buy guarantee that automation content will be fixed when broken
- We buy knowledge built in the automation content
- We buy place in the market where we can sell usage of our own content
- We buy information on how others are doing the same work
- We need to work together, with tools that make our work easy
- We need something to do cumbersome work on our behalf and handle high volumes of work

Part3: Value creation

From our point of view:

- Automation content offered by us and through us performs part of customer’s daily work
- We facilitate crowdsourcing of content creation

From customer point of view:

- We (customer) benefit every time we sell outcome produced by automation content
- We benefit every time our own automation content is used by others
- We benefit from the flexibility of growing automation content base
- We benefit when we share our “raw” content and when training robot while doing work

Part4: Interaction and co-production

From our point of view:

- We identify reusable atomic tasks with the customer
- We map the tasks on humans, robots and tools with the customer.
- We train and empower customer to build own automation content in a Lego-like fashion
- We interact with customer’s raw data

- We provide maintenance and suport

From customer point of view:

- We (customers) train the robots by allocating dedicated teaching time
- We train the robots by perfroming useful work at the same time
- We spend time with the provider to explain them how we perform our work

Part5: Key resources

From our point of view:

- Process discovery skills
- Process automation skills (create hard coded business rules or learn business rules from data)
- General SW developmnent skills (tools to broker robots and monitor robot usage)

From customer point of view:

- General IT skills
- General level process automation skills

Part6: Mobilizing resources and partners

From our point of view:

- Customer creates value through performing its jobs
- Partners creates value by selling usage of their robot platform (platform provider), or by training and selling their content usage through our brokerage platform
- We make value by training the robots and leasing them as well as brokering the robots of other content providers

From customer point of view:

- I can utilize content of service provider's other customers
- I can have a dedicated content provider that work only for me
- Other service provider's customers can utilize my content – we can collaborate on the process, and compete on the core business

Part7: Key partners

From our point of view:

- Robot platform (SW) provider. They benefit from a share in our revenues.
- Developers used for crowdsourcing content creation
- Own customers (in case they decide to sell us own content or use us as a broker)

From customer point of view:

- Service provider's partner is yet another SW provider for us
- Our existing HW/SW provider relationships remain unchanged

Part8: Cost structure

From our point of view:

- Cost of own content creation, ownership and maintenance
- Cost of brokerage platform creation, ownership and maintenance
- Cost of brokerage
- Personnel costs

From customer's point of view:

- I (customer) need financial resources to lease the content
- I need time resources to spend with provider to create content customized for me
- I need time and resources to develop my own more complex content

Part9: Revenue streams and metrics

From our point of view:

- We are paid for the number of job instances performed by robots owned or brokered by us
- We can e.g. price more for the robots that are used more, and apply dynamic pricing
- We can use e.g. ROI, operating profit as financial indicators

From customer's point of view:

- I (customer) am willing to pay only for what brings me value, i.e. for the job instances done
- Direct financial value comes from the percentage of work done by robots that is required to sell my product or service
- Indirect value comes from the saved time through faster execution, reduced rework and more time to focus on developing core business
- I can measure e.g. how much more I am able to sell due to robots usage.

3.7.2 Service blueprints

The service blueprints for the several critical customer journeys have been developed next. They are illustrated in the sequel.

Customer journey: "User creates and uses content"

This is the basic use-case of a service, where the customer browses through available content and combines it in its own specific way. The content is then consumed a number of times and the service fee is payed periodically based on consumption. The blueprint is illustrated in more detail in Figure 14.

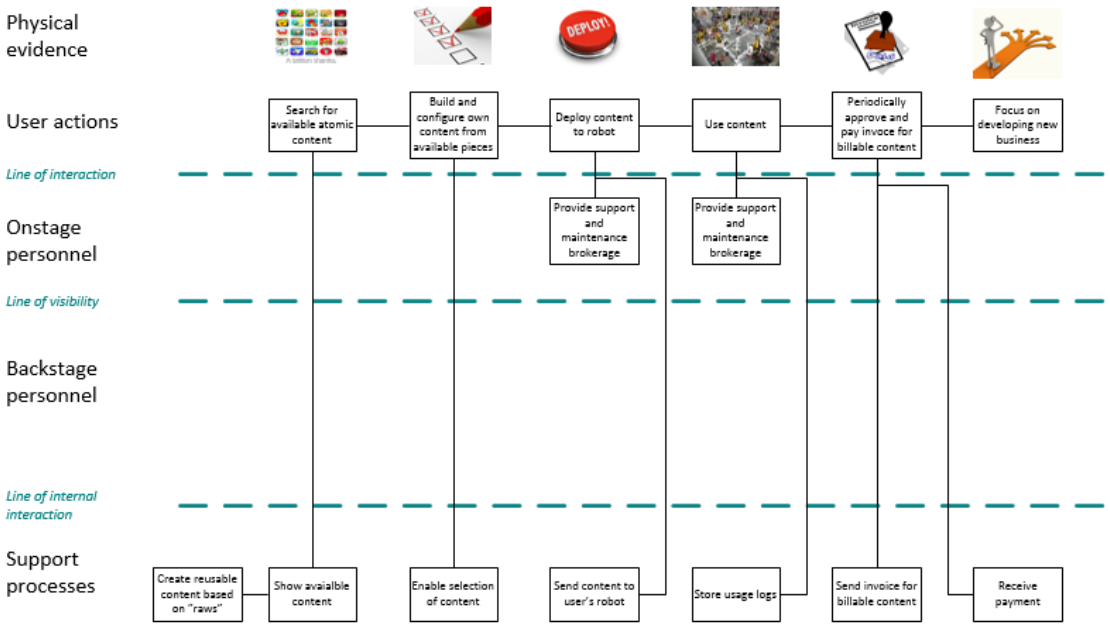

Figure 14: Blueprint 1: User creates and uses content

Customer journey: "User, 3rd party SW provider or feelancer sells usage of reusable content"

In this use-case the user wants to make use of a brokerage service component. The content is uploaded to the marketplace with necessary descriptions and pricing information. User can follow usage statistics during content use. The user periodically receives, reviews and approves invoces to be sent to content users for payment. In case of content malfunction the service provider mediates (due to the possible interaction between competitors) between content user and content owner to facilitate fixing of the broken content. The blueprint is illustrated in more detail in Figure 15.

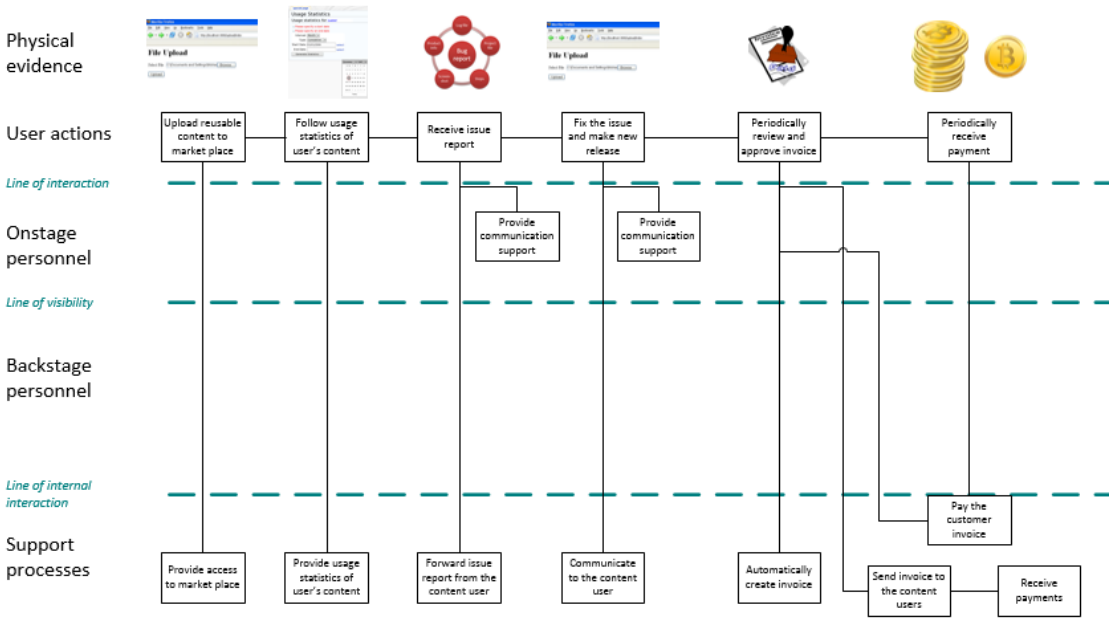

Figure 15: Blueprint 2: User, 3rd party SW provider or feelancer sells usage of reusable content

Customer journey: "User requests new content"

The user can initiate or request creation of new piece of automation content. The request is reviewed by the service provide and specified in more detail to ensure that the resulting piece of content is as reusable as possible. The service provider then facilitates crowdsourcing to get the content createaed. Depending on the nature of the content the crowdsourcing is performed with the approvpriate methodology, as described in Section 3.4.4. The blueprint is illustrated in more detail in Figure 16.

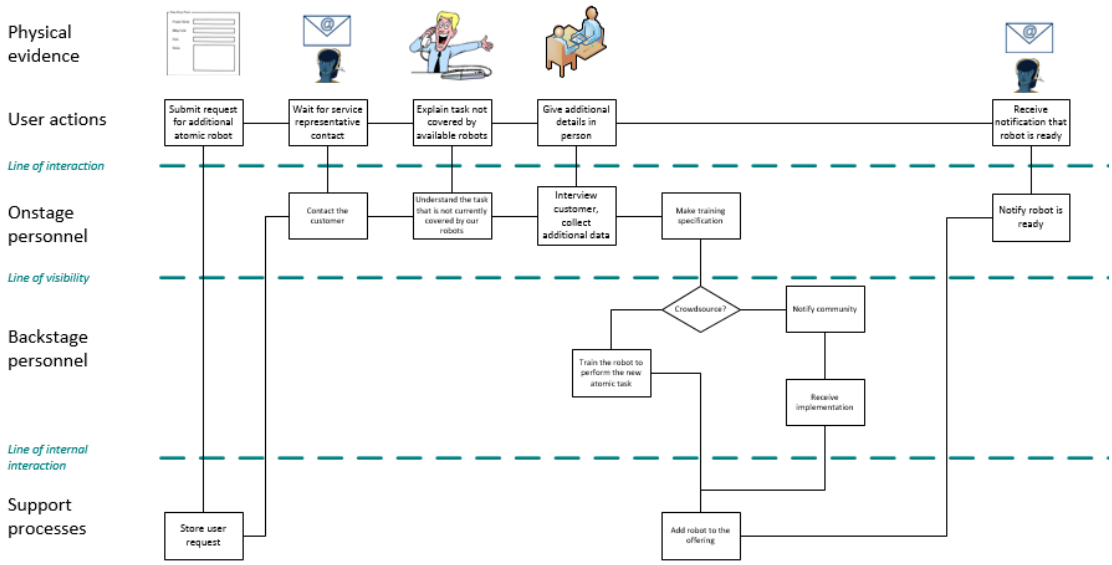

Figure 16: Blueprint 3: User requests new content

Customer journey: "User rates existing content"

After using the content for a while the user provides comments and rating on the used content for the other users to use. The blueprint is illustrated in more detail in Figure 17.

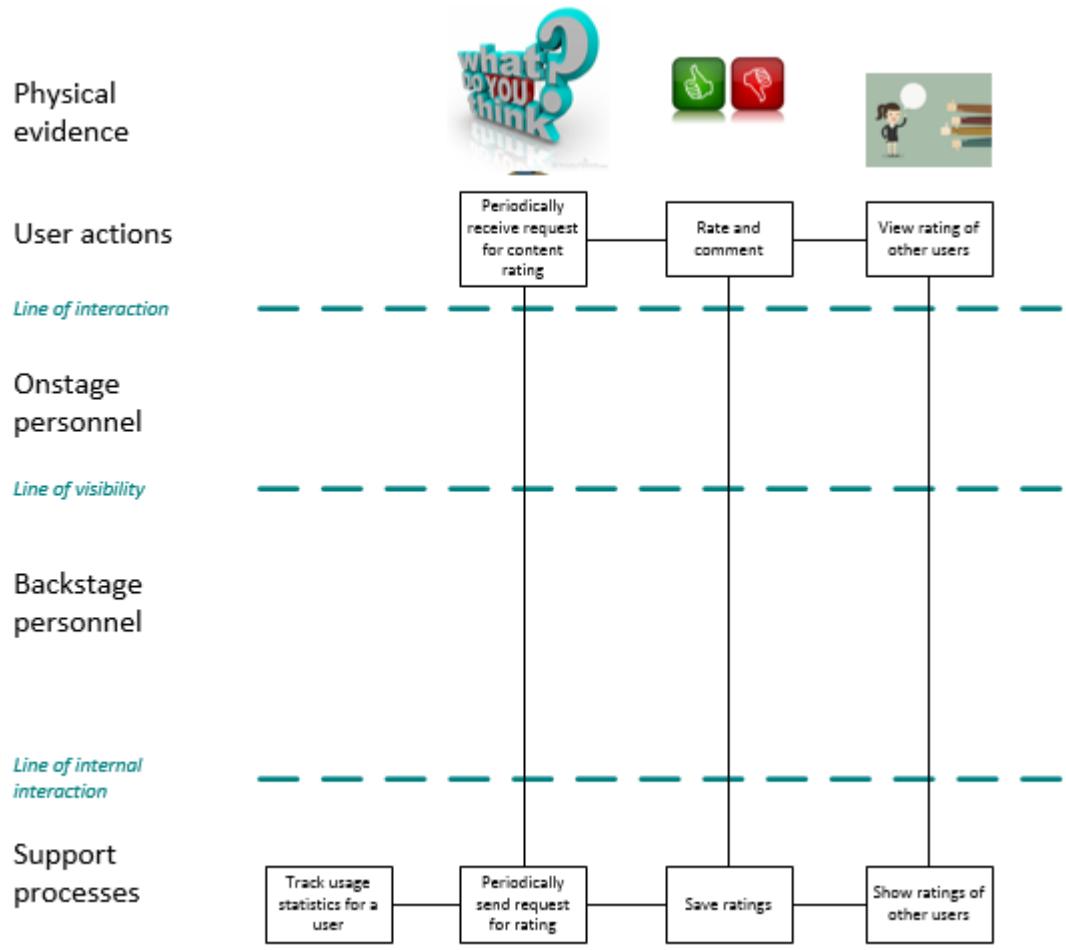

Figure 17: Blueprint 4: User rates existing content

4 Conclusions and future work

The objective of this thesis was to 1) explore possibilities and threats beyond different trends affecting knowledge work and 2) utilize some of the identified possibilities by creating a service business model that would fit into the existing organizational landscape and enable creation of shared value. The above was to be done within a context of an average organization in which knowledge (i.e. white collar) work forms significant proportion of the job done.

The literature survery of the future of knowledge work was perfromed. The trends affecting the knowledge work have been identified, revealing that the work will be increasingly done as a project work of fixed duration instead of permanent employment. The human resources

used to accomplish the work are increasingly hired through crowdsourcing platforms. The bigger portions of work are thereby broken into smaller pieces and then crowdsourced. In other words, the work is getting increasingly atomized and done by freelancers by using their own tools, on their own time. Knowledge work automation was also identified in the literature as one of the most significant trends of the decade. Despite its significance, this trend is of a very subtle nature and did not receive significant headlines. Therefore, if we perceive a trend in general as an ocean wave, the trend of knowledge work automation most probably corresponds to a tsunami. If undetected, the consequences can be unpredictable, and often disastrous. Furthermore the opportunities and threats that result from collision of the identified trends are of extreme importance to consider when building sustainable business.
State of the art in the automation technologies is reviewed as well. Robotic process automation and artificial intelligence were identified as the most promising enabling automation technologies currently available. This is due to their potential to not only automate but also "informate", i.e. keep human in the loop while working and enable synergic co-operation and learning between human and the robot.
A brief overview of the literature on the shared value as well as service design processes and methods was presented as well. The service concepts that enrich the ecosystem and think beyond short term benefits of few stakeholders are becoming increasingly important.

The main result of the thesis is the service business model that makes use of automation to empower knowledge worker to

- Focus on the high value adding tasks by outsourcing mundane tasks to robots
- Be in control in what to automate and what not
- Share own knowledge with other knowledge workers by directly or indirectly creating automation content
- Learn from other knowledge workers by consuming automation content created by others
- Connect designers of business tasks with perfromers of business tasks
- Prepare in time for the constantly changing job descriptions impacted by automation

and empower SW tool provider to

- Prepare for the fact that the robots are and will increasingly be using their tools to work alongside humans in the office
- Make better tools by better understanding usage of own tools by the humans and robots.

The side result of the thesis is a method to evaluate sustainability of the service business model by evaluation of value creation potential of the service ecosystem.

A combination of Double Diamond *(Design Council, 2015)* and Lean startup (Blank, 2013; Ojasalo & Ojasalo, 2015) service processes was used in this thesis. The research approach chosen was mostly abductive by nature. I.e. the proposed service concept was based on the best effort thinking. This is reflected in trying to find the best fit between the service concept and 1) the particular needs of the example knowledge work organization, 2) identified trends as well as 3) needs for SW tools that resulted from the collision of the identified trends.

The chosen service design process and methods appeared to be appropriate for the problem at hand. Te use of visual tools (storyboard and stakeholder map) was extremely useful to make the stakeholders, their relationships as well as related opportunities and threats visible and concrete. The tools were also extremely useful in clarifying the concept to the potential customers in the interview phase. The use of *Persona* to illustrate typical knowledge worker in an organization would have been even more beneficial, but was out of the scope of this thesis.

The main topic of interest originaly identified in the example knowledge work organization (modularization of processes) can readily be addressed by engaging as a customer with the proposed service concept. By automating and atomizing processes with information given by the business task performer the mundane tasks are outsourced to the robot, leaving happier employees. Furhtermore doing so creates a real picture of how the jobs are performed. This can then be confronted by the corresponding descriptions given in the quality system. Possible discrepancies can then be investigated for root causes and sorted out. The same, real information can be used to adjust, further develop and optimize the processes. The modifications are then followed up by updating automation content and human work instructions. The communication loop is thereby eventually closed in a continuous cycle of improvement. Furthemore, by using content of other organizations, even competing ones, the organizations eventualy learn from each other as well. However, to ensure realistic deployment of the concept it is crucial to initially focus on certain business, i.e. certain category of business tasks. Only then the expansion to other tasks should be done.

Even though the concept was validated in a single example knowledge work organization, it was by no means restricted to only that organization. It is very likely to be generic enough to apply to any organization where knowledge work prevails. In principle, there is no limitation to certain business either. However it is likely that different business domains will need some tailoring of the concept. This was out of scope of this thesis and it is left or the future work.

Some additional promising topics for the future research are as follows. First, additional stakeholders from the stakeholder map could be considered and business model could be fur-

ther adjusted to take them into account. Second, as already initialy mentioned earlier, the 3rd party SW providers play significant role in the process of crowdsourcing of automation content creation. Their role could be studied further since they are probably the essential source of the automation content related to their own tools. Third, the proposed business concept can be a basis for do-it-yourself SW applications, where any domain expert could create a SW application needed for a particular job, without help from an IT expert. The applications could then be created as per domain experts' need and their usage could be paid only for as how long as they are needed. This would have a great potential to further meet the need of increasing amunt of project work, atomization and freelancing. Finally, it would be interesting too explore possibility to go beyond collective knowledge and build a collective wisdom. This would require not only sharing the automaton content as instructions on how to do a certan business task, but also reasoning behind.

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Appendix 1: Source code of the simple digital version of the monitoring tool

File: Ui.R

```
library(shiny)
# Define UI for application that plots random distributions
shinyUI(fluidPage(
  # Application title
  titlePanel("Futures Statistics"),
  fluidRow(
    column(12,tabsetPanel(
      tabPanel("CATEGORY HISTOGRAM", plotOutput("histPlotCATEGORIES", width = "100%",
height = "600px")),
      tabPanel("CATEGORY WORDCLOUD", plotOutput("wordCloudPlotCATEGORIES", width =
"100%", height = "600px") ),
      tabPanel("STEEPLED", plotOutput("histPlotSTEEPLED", width = "100%", height = "400px")),
      tabPanel("FARAO", plotOutput("barPlotFARAO", width = "100%", height = "400px")),
      tabPanel("NOVELTY", plotOutput("barPlotNOVELTY", width = "100%", height = "400px"))
    )
    )
  )
)
)
```

File: Server.R

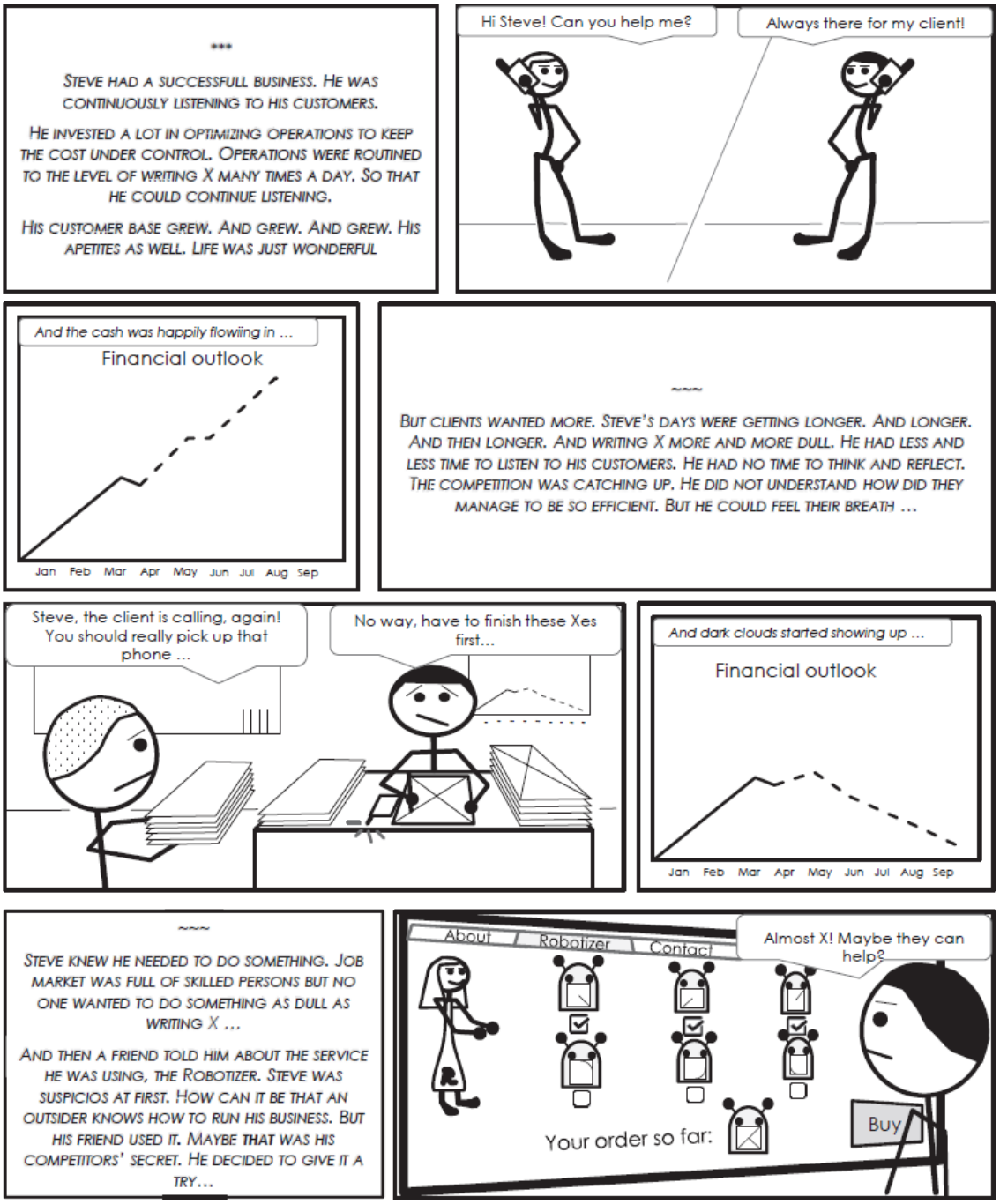
```
library(shiny)
library(jsonlite)
library(tm)
library(wordcloud)
library(curl)
library(plotrix)
{
  pinsAll <- fromJSON("Your Pinterest URL with access code")
  pinsAll1 <- fromJSON(as.character(pinsAll$page["next"]))
  pins<-rbind(pinsAll$data, pinsAll1$data)
  pinNotes<-paste(pins$note,sep = " ", collapse = " ")
  cleanPinNotes<-unlist(strsplit(pinNotes,split = " "))
  tags<-grep("#.*",cleanPinNotes,value = TRUE)
  d<-data.frame(tags)
  steepled<-
c("#societal","#technology","#economic","#environmental","#political","#legal","#ethical","#de
mographics")
  farao<-c("#faraoask","#faraoread","#faraofollow","#faraoattend","#faraoobserve")
  novelty<-c("#innovators", "#niche", "#experts", "#local")
  allCategories<-cbind(steepled, farao, novelty)
}

# Server logic
shinyServer(function(input, output) {
    output$wordCloudPlotCATEGORIES <- renderPlot({
    tags<-as.character(d[!(tolower(d$tags) %in% allCategories),])
    corpus<-Corpus(VectorSource(tags))
    wordcloud(corpus, scale=c(4,1), min.freq = 1, random.order=FALSE, rot.per=0.0, col-
ors=brewer.pal(8, "Dark2"))
  })

  output$histPlotSTEEPLED <- renderPlot({
    corpus<-Corpus(VectorSource(tags))
    term.matrix <- TermDocumentMatrix(corpus)
    term.matrix <- as.matrix(term.matrix)
    term.matrix <- as.data.frame(term.matrix)
    freqs<-sort(rowSums(term.matrix),decreasing = TRUE)
```

```
  dFreqs <- data.frame(word = names(freqs),freq=freqs)
  steepledPins<-matrix(dFreqs[steepled,"freq"],1,length(steepled))
  colnames(steepledPins)<-steepled
  par(las=2)
  par(mar = c(10,4,5,4) + 0.1)
  barplot(steepledPins,col = "#FE9A2E", ylab = "Number of pins per STEEPLED category")
})

output$histPlotCATEGORIES <- renderPlot({
  tags<-as.character(d[!(tolower(d$tags) %in% allCategories),])
  corpus<-Corpus(VectorSource(tags))
  term.matrix <- TermDocumentMatrix(corpus)
  term.matrix <- as.matrix(term.matrix)
  term.matrix <- as.data.frame(term.matrix)
  freq<-rowSums(term.matrix)
  freq<-sort(freq,decreasing = TRUE)
  par(las=2)
  par(mar = c(10,4,5,4) + 0.1)
  barplot(freq, col = "#FE9A2E", ylab = "Number of pins per category")
})

output$barPlotFARAO <- renderPlot({
  corpus<-Corpus(VectorSource(tags))
  term.matrix <- TermDocumentMatrix(corpus)
  term.matrix <- as.matrix(term.matrix)
  term.matrix <- as.data.frame(term.matrix)
  freqs<-sort(rowSums(term.matrix),decreasing = TRUE)
  dFreqs <- data.frame(word = names(freqs),freq=freqs)
  faraoPins<-matrix(dFreqs[farao,"freq"],1,length(farao))
  colnames(faraoPins)<-farao
  par(las=2)
  par(mar = c(10,4,5,4) + 0.1)
  barplot(faraoPins,col = "#FE9A2E", ylab = "Number of pins per FARAO category")
})

output$barPlotNOVELTY <- renderPlot({
  corpus<-Corpus(VectorSource(tags))
  term.matrix <- TermDocumentMatrix(corpus)
  term.matrix <- as.matrix(term.matrix)
```

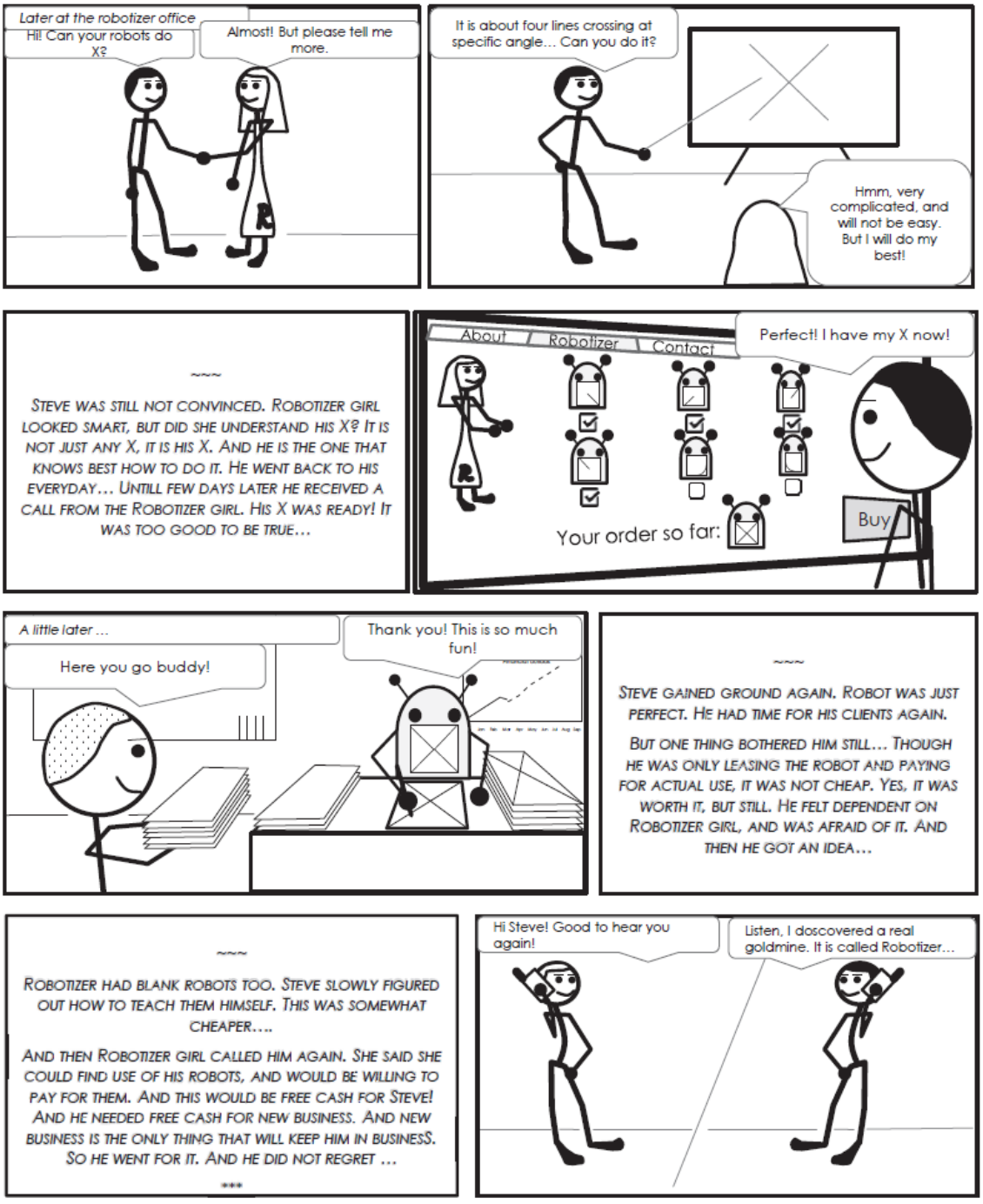
```
    term.matrix <- as.data.frame(term.matrix)

    freqs<-sort(rowSums(term.matrix),decreasing = TRUE)
    dFreqs <- data.frame(word = names(freqs),freq=freqs)
    noveltyPins<-matrix(dFreqs[novelty,"freq"],1,length(novelty))
    colnames(noveltyPins)<-novelty
    par(las=2)
    par(mar = c(10,4,5,4) + 0.1)
    barplot(noveltyPins,col = "#FE9A2E", ylab = "Number of pins per NOVELTY category")
  })
})
```

Appendix 2: Storyboard illustrating proposed service concept

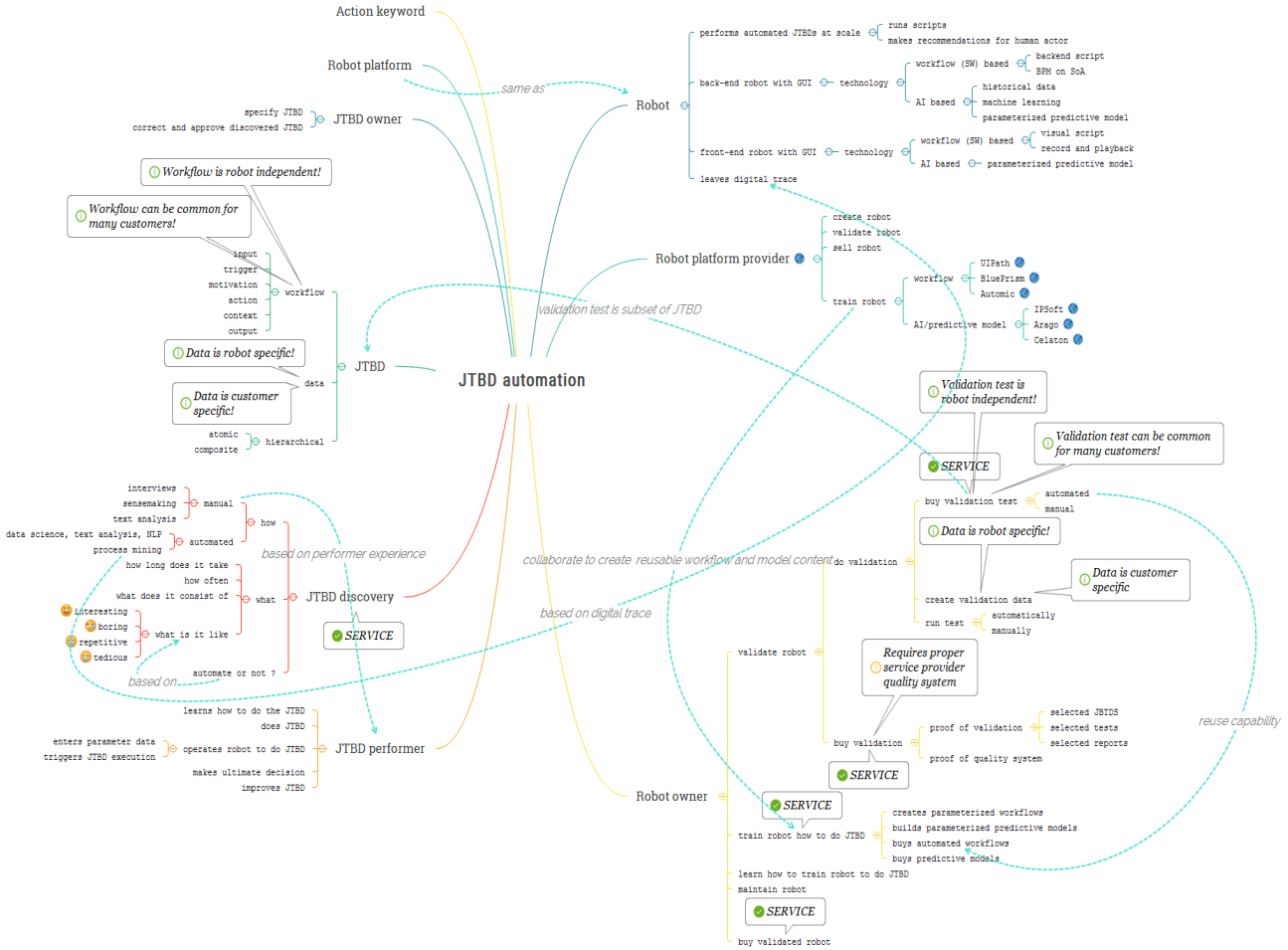
Part 1:



Part 2:


Later at the robotizer office
Hi! Can your robots do X?
Almost! But please tell me more.
It is about four lines crossing at specific angle… Can you do it?
Hmm, very complicated, and will not be easy. But I will do my best!
~~~
STEVE WAS STILL NOT CONVINCED. ROBOTIZER GIRL LOOKED SMART, BUT DID SHE UNDERSTAND HIS X? IT IS NOT JUST ANY X, IT IS HIS X. AND HE IS THE ONE THAT KNOWS BEST HOW TO DO IT. HE WENT BACK TO HIS EVERYDAY… UNTILL FEW DAYS LATER HE RECEIVED A CALL FROM THE ROBOTIZER GIRL. HIS X WAS READY! IT WAS TOO GOOD TO BE TRUE…
About
Robotizer
Contact
Perfect! I have my X now!
Your order so far:
Buy
A little later …
Here you go buddy!
Thank you! This is so much fun!
~~~
STEVE GAINED GROUND AGAIN. ROBOT WAS JUST PERFECT. HE HAD TIME FOR HIS CLIENTS AGAIN.
BUT ONE THING BOTHERED HIM STILL… THOUGH HE WAS ONLY LEASING THE ROBOT AND PAYING FOR ACTUAL USE, IT WAS NOT CHEAP. YES, IT WAS WORTH IT, BUT STILL. HE FELT DEPENDENT ON ROBOTIZER GIRL, AND WAS AFRAID OF IT. AND THEN HE GOT AN IDEA…
~~~
ROBOTIZER HAD BLANK ROBOTS TOO. STEVE SLOWLY FIGURED OUT HOW TO TEACH THEM HIMSELF. THIS WAS SOMEWHAT CHEAPER….
AND THEN ROBOTIZER GIRL CALLED HIM AGAIN. SHE SAID SHE COULD FIND USE OF HIS ROBOTS, AND WOULD BE WILLING TO PAY FOR THEM. AND THIS WOULD BE FREE CASH FOR STEVE! AND HE NEEDED FREE CASH FOR NEW BUSINESS. AND NEW BUSINESS IS THE ONLY THING THAT WILL KEEP HIM IN BUSINESS. SO HE WENT FOR IT. AND HE DID NOT REGRET …
***
Hi Steve! Good to hear you again!
Listen, I doscovered a real goldmine. It is called Robotizer…
~~~

Appendix 3: Mindmap on the topic of automation of jobs-to-be-done



Appendix 4: Initial version of the business model

BUSINESS MODEL V1– ROBOT USER AS CUSTOMER

Key Partners

From our point of view:
- Robot platform (SW) provider. They benefit from a share in our revenues.
- Own customers (in case they decide to sell us own robots)

From customer point of view:
- Service provider's partner is yet another SW provider for us
- Our existing HW/SW provider relationships remain unchanged

Key Resources

From our point of view:
- Process discovery skills
- Process automation skills (create hard coded business rules or business rules learned from data)
- General SW developmnent skills (tools to broker robots and monitor robot usage)

From customer point of view:
- General IT skills
- General level process automation skills

Mobilizing resources and partners

From our point of view:
- Customer creates value through performing its jobs
- Partners creates value by
  - selling usage of their robot platform (platform provider),
  - by training and selling their robots through our brokerage platform
- We make value by training the robots and leasing them as well as brokering the robots of other robot providers

From customer point of view:
- I can utilize robots of service provider's other customers
- I can have a dedicated robot providers that work only for me
- Other service provider's customers can utilize my robots – we can collaborate on the process, and compete on the core business

Value Proposition

From our point of view:
- We discover and atomize cross-company generic business tasks, as well customer specific tasks
- We "train" the robot to peform atomized generic business tasks as well as customer specific tasks
- We make it possible for the customer to combine, select and use only the needed robots
- Unique proposal: We make it possible for our customers to build their own robots in a Lego-like fashion
- Unique proposal: We make it possible for the customer to sell us own robots

From customer point of view:
- Provider gives us ready atomic robots to build more complex robots as we need them
- Provider takes robot training burden from us
- Provider takes robot validation burden from us
- Provider saves us time to focus on what is important for our own business
- We pay only for used robots
- We can sell our own robots to the provider

Value Creation

From our point of view:
- We discuss with the customer to discover their tasks that can be automated
- We work with the customer to help them select the right robots and automate their tasks
- We take the cost of robot ownership and training

From customer point of view:
- We hire robots as "consultants" and pay them on the basis of the number of acomplished tasks
- We start beneffiting immediately from reduced costs and from time released for more valuable work.

Interaction and co-production

From our point of view:
- Toghether with the customer we analyze the customer processes thorugh to identify tasks that can be automated
- We respond to any specifc automation need
- We provide an interface through which customer can easily create new robots out of the existing ones for own use and and offer it to us for re-sale

From customer point of view:
- We spend time with the consultant to identify processes to automate
- We build our own robots through an easy to use web interface
- We inspect the results produced by the robots
- Provider is expensive but reliable.
- Provider enables us additional revenue stream by directly sharing our operational knowledge.

Customer's World and Desire for Ideal Value

From our point of view:
- Understand what is SW tool used for in general in a certain industry and across industries
- Understand what is SW tool used for by each customer and specific industry

From customer point of view:
- SW tool is needed to get the job done and keep core business running
- Robots assists with jobs of employees (assistive mode)
- Robots automatically execute repetitive, boring and error prone tasks (agentive mode)
- Robots needs to be flexble to support process rewiring
- Robot validation (medical device business) is needed by regulation (FDA, EU) but is not in core business
- Robot would ideally be bought validated
- Robot user should pay only for what is used

Cost Structure

From our point of view:
- Cost of robot creation, ownership and development
- Cost of brokerage platform creation, ownership and development
- Personnel costs

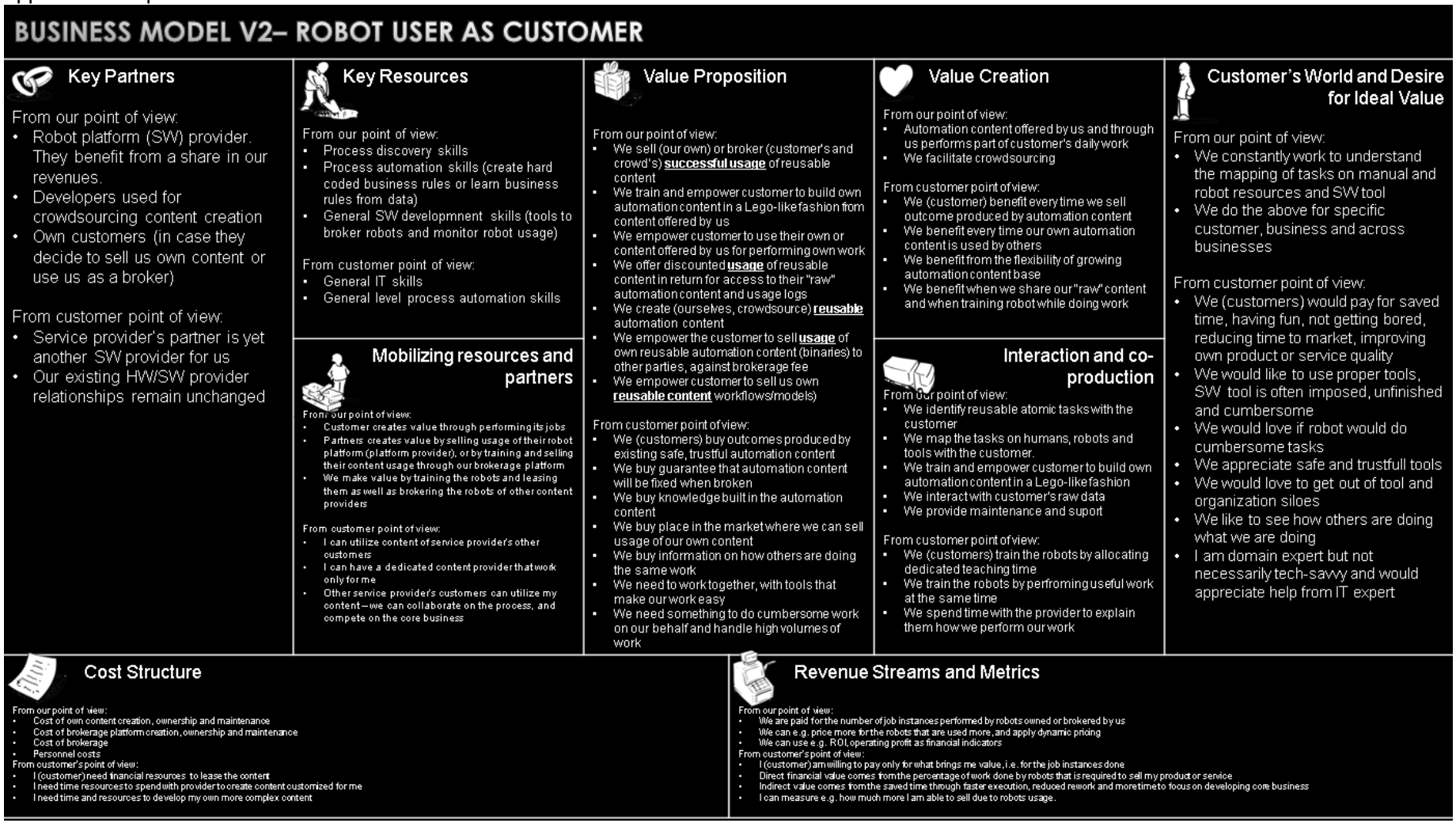
From customer's point of view:
- I (customer) need financial resources to lease the robots
- I need time resources to spend with provider to create robots customized for me
- I need time and resources to develop my own more complex robots

Revenue Streams and Metrics

From our point of view:
- We are paid for the number of job instances performed by our robots
- We can e.g. price more for the robots that are used more, and apply dynamic pricing
- We can use e.g. ROI, operating profit as financial indicators

From customer's point of view:
- I (customer) am willing to pay only for what brings me value, i.e. for the job instances done
- Direct financial value comes from the percentage of work done by robots that is required to sell my product or service
- Indirect value comes from the saved time through faster execution, reduced rework and more time to focus on developing core business
- I can measure e.g. how much more I am able to sell due to robots usage.

Appendix 5: Improved version of the business model



Appendix 6: Business simulation variables, equations and values (exported from Insight maker stock and flow model)

Simulation Settings	**Time Start:** 0 **Time Length:** 40 **Time Step:** 1 **Time Units:** Months **Algorithm:** RK1
Model Variables	
Automated JTBD instances per JTBD	**Value:** [Automated-to-manual instance generation ratio]*[Manual JTBD instances per JTBD] **Units:** Unitless
Automated-to-manual instance generation ratio	**Value:** 10 **Units:** Unitless
Capacity for doing automated JTBDs instances	**Value:** [Capacity for doing manual JTBDs instances]*[Capacity ratio] **Units:** Unitless
Capacity ratio	**Value:** 40 **Units:** Unitless
Customer value	**Value:** [Value of every done manual JTBD instance]*[Completed manual jobs]+([Value of every done automated JTBD instance]-[Price for every completed automated job])*[Completed automated jobs]-[Capacity for doing manual JTBDs instances]*[Price of capacity unit] **Units:** Unitless
Manual JTBD instances per JTBD	**Value:** 5 **Units:** Unitless
Number of customers	**Value:** 20 **Units:** Unitless
Percentage of automated JTBDs	**Value:** 100*[Number of automated JTBDs]/([Number of automated JTBDs]+[Number of manual JTBDs]) **Units:** Unitless
Price for every completed automated job	**Value:** 0.6 **Units:** Unitless
Price of capacity unit	**Value:** 10 **Units:** Unitless
Provider capacity	**Value:** 10

for customer 1	**Units:** Unitless
Provider cost per automated JBD	**Value:** 40 **Units:** Unitless
Provider value	**Value:** [Completed automated jobs]*[Price for every completed automated job]*[Number of customers]-[Total number of automated JTBDs]*[Provider cost per automated JBD] **Units:** Unitless
Value of every done automated JTBD instance	**Value:** 1 **Units:** Unitless
Value of every done manual JTBD instance	**Value:** 5 **Units:** Unitless
Value to capacity conversion coefficient	**Value:** 0.001 **Units:** Unitless
Value to new business oportunity conversion	**Value:** 0.1 **Units:** Unitless
Model Stocks	
Automated JTBD instances	**Initial Value:** 0 **Non-Negative:** Yes **Units:** Unitless
Capacity for doing manual JTBDs instances	**Initial Value:** 150 **Non-Negative:** No **Units:** Unitless
Completed automated jobs	**Initial Value:** 0 **Non-Negative:** No **Units:** Unitless
Completed manual jobs	**Initial Value:** 0 **Non-Negative:** No **Units:** Unitless
Manual JTBD instances	**Initial Value:** 0 **Non-Negative:** Yes **Units:** Unitless
Number of auto-	**Initial Value:** 0

mated JTBDs	**Non-Negative:** Yes **Units:** Unitless
Number of manual JTBDs	**Initial Value:** 100 **Non-Negative:** Yes **Units:** Unitless
Total number of automated JTBDs	**Initial Value:** 0 **Non-Negative:** No **Units:** Unitless
Model Flows	
Flow	**Rate:** [Customer value]*[Value to capacity conversion coefficient] **Alpha:** *None* **Omega:** Capacity for doing manual JTBDs instances **Positive Only:** Yes **Units:** Unitless
Rate of automated JTBD instance generation	**Rate:** [Automated JTBD instances per JTBD]*[Number of automated JTBDs] **Alpha:** *None* **Omega:** Automated JTBD instances **Positive Only:** Yes **Units:** Unitless
Rate of executing automated JTBDs	**Rate:** [Capacity for doing automated JTBDs instances] **Alpha:** Automated JTBD instances **Omega:** Completed automated jobs **Positive Only:** Yes **Units:** Unitless
Rate of executing manual JTBDs	**Rate:** [Capacity for doing manual JTBDs instances] **Alpha:** Manual JTBD instances **Omega:** Completed manual jobs **Positive Only:** Yes **Units:** Unitless
Rate of JTBD automaton	**Rate:** [Provider capacity for customer 1] **Alpha:** Number of manual JTBDs **Omega:** Number of automated JTBDs **Positive Only:** Yes **Units:** Unitless
Rate of manual JTBD instance gen-	**Rate:** [Manual JTBD instances per JTBD]*[Number of manual JTBDs] **Alpha:** *None*

eration	**Omega:** Manual JTBD instances **Positive Only:** Yes **Units:** Unitless
	Rate: [Customer value]*[Value to new business oportunity conversion]
Rate of new business opportunity arrivals	**Alpha:** *None* **Omega:** Number of manual JTBDs **Positive Only:** Yes **Units:** Unitless
	Rate: [Provider capacity for customer 1]*[Number of customers]*(100-[Percentage of common JTBDs])/100
Total provider velocity	**Alpha:** *None* **Omega:** Total number of automated JTBDs **Positive Only:** Yes **Units:** Unitless
Model Converters	
Percentage of common JTBDs	**Data:** 0,10; 5,20; 10,30 **Source:** Time **Interpolation:** Linear **Units:** Unitless

Appendix 7: Discounted cash flow analysis of the service value proposition from the customer perspective

Example target process						
Year	0	1	2	3	4	5
Target process savings	0	3600	9450	19800	24750	24750
Production process savings	0	252000	277200	358800	374400	390000
Reinvestments	0	-255600	-286650	-378600	-399150	-414750
Increase in earnings - core business operation	0	43452	48731	64362	67856	70508
Increase in earnings - selling automation content	0	0	0	1000	2000	3000
Fixed costs - physical PCs						
Fixed costs - robot platform licenses	-21000	-30000	-50000	-50000	-50000	-50000
Free cash flow	**-21000**	**13452**	**-1269.5**	**15362**	**19855.5**	**23507.5**
Cumulative cash flow	-21000	-7548	-8818	6545	26400	49908
NPV	33,155.21 €					
IRR	47.20%					
Number of SW tool releases per year	4	4	7	11	11	11
Manual effort per release[person days]	15	15	15	15	15	15
Cost of person per year [USD]	60000	60000	60000	60000	60000	60000
Number of working days per year	200	200	200	200	200	200
Target process saving with automation	30%	20%	30%	40%	50%	50%
Production process saving with automation	20%	20%	21%	26%	26%	26%
FTEs in production	20.00	21.00	22.00	23.00	24.00	25.00
Assumed discount rate (operational improvement projects)	8%	8%	8%	8%	8%	8%
ROIC	17%	17%	17%	17%	17%	17%

Appendix 8: Field Guide

Interviwees:

- SW Development organization: IT Manager, Operational Support Manager, QA Manager, Finance Manager, Customer Support Manager, Program Manager, Test Manager, Process Design Manager, DevOps Manager.
- Process automation service provider: Head of Department

Background and Introduction

The objective of the interview is to validate the proposed business model with this particular user .

This part is recorded as audio.

Planned duration: 4 min

- Interviewer introduces himself and the purpose of the interview.
- Interviewee gives basic information about herself (name, organization, own role).
- Interviewer shows the service storyboard, stakeholder map and optionally discounted cash flow analysis to the interviewee to get her to know about the service.

Customer's world and desire for ideal value

Here we try to discover the current tasks the cusutomer performs, how repetitive they are, and is there a task that can generate more value by perfroming it more often. We also assess potential for AI automation.

This part is recorded as audio.

Planned duration: 2 min

- What tasks are typically done on a daily basis?
- What SW tools are used to accomplish these tasks?
- Are there any repetitive tasks that require both precision and speed?
    - Tester: going through a slightly modified piece of SW many times,
    - Tester/Manager/Developer: going through the same document many times
    - IT/Testing/Development/Customer Service: installing/uninstalling same SW many times with different parameters
    - HR/finance: entering data into the forms
    - HR/IT: onboarding/offboarding/looking for the latest regulation
    - QA: checking customer complaints
- Are there any tasks that require analyzing some/a lot of information and making a decision based on analysis, without involving emotional judgment?

  - Tester/Developer: analyzing changes to discover SW code change that may have caused a bug, or a real root cause out of existing ones
  - Tester/Developer: Finding tests that are likely to fail based on already executed tests
  - IT: taking an application/network failure syndrome and going through a database to find possible root causes
  - Manager: Reviewing documents for format correctness
  - Tool expert: trying that the tool is capable of perfroming something
  - Manager: checking the consistency of data
  - Operational support: finding the possible set of root causes based on the correlation with available historical data.
- Is there such a task which, if performed more often than currently, would bring more value to either the company or to the interviewee?

Value proposition

We ask users of their opinion about our value proposition, from various perspectives.

This part is recorded as audio.

Planned duration: 2 min

- What do you think of having a personal virtual assistant that would perform repetitive tasks on your behalf? Based on the results of the previous part of the interview use concrete task examples.
- What do you think of having a personal virtual assistant going through/analyzing data for you and giving you recommendation or possible actions?
- Would you mind "training" the assistant yourself on how to perform the task? Or would you rather have someone do the training according to your instructions?
- Would you trust such a virtual assistant if it were autonomous or you would rather supervise it constantly?
- What do you think of having pieces of an assistant that you can assemble yourself into a working robot according to your needs, in a Lego-like fashion (Give some examples of pieces like sending e-mail, opening an instance of a certan word document template, filling out document headers etc.). Or would you rather have an expert assemble it for you?

Value creation

We compare our understanding of value creation to the customer understanding of it. We try to find out if they perceive there is actually value created during the process. E.g. what would be the judgment criteria.

This part is recorded as audio.

Planned duration: 2 min

- Do you think you would have time to allocate to identify tasks that can be outsourced to the personal assistant?
- Would you rather do the above alone or with a help of consultant? Why, could you elaborate on that?
- What would you use as a criteria to judge if a virtual assistant has done a good and valuable job for you or your organizaton? Why, could you elaborate on that? What would you expect from the assistant management system? What is the value of every task performed bythe robot?
- Do you think that the way you do your repetitive tasks here is much different from how it is performed in other companies? Why, could you elaborate on that? How about micro tasks (sending e-mail, checking for legal information, etc.)?
- Do you think that selling your assistants that are able to perform micro (or higher level) tasks to other (possibly competitive) companies thorugh a service provider would do a harm or generate more value for you? Why, could you elaborate on that?
- Do you think that buying the assistants that are able to perform micro (or higher level) tasks from other (possibly competitive) companies through service provider would do a harm or generate more value for you? Why, could you elaborate on that?

Interaction and co-production

We compare our understanding of interaction and co-production with the customer perspective.

This part is recorded as audio.

Planned duration: 2 min

- What kind of interaction with the service provider would you expect? I.e. knowledge transfer/training workshops (at your or service provider's location), a person sitting in your office to shadow you on what you are doing, a person answering support calls, QA page, robot building page, or something else?
- What kind of interaction would you require with the virtual assistant? A supervised interaction or remote interaction/control of a robot?
- What kind of support would you expect in case of a problem or robot malfunction?
- Who should be responsible for the robot management system, what kind of right would you expect to have over a robot?
- Anything else?

Thank you and next steps

- We thank the interviewee and explain the next steps.

Appendix 9: Selected raw extracts from the interviews

Customer's world and desire for ideal value
- "Creation of any document can be automated at least to some level." - "Yes I believe there is potential when allocating tasks to resources. Same for bugs, they may be too high from our target. It can recommend to do bug fixing week, or bug closing week. That is currently done manually." - "Robot could follow up what is in the weekly e-mail reports and recommend some action." - "In SW customer service much automation can be used. E.g. SW upgrades." - "Ideally this [log search] is done online and in predictive mode. Finding the root cause may last from few minutes to 2 days. The more specialized person the faster it is to find." - "Often we can say that this fault occurs when we get this message. But many of faults require service guy to go to the machine and fix it. Would be nice if the service guy next door [to the customer] would get a message to the smart phone to go and fix it." - "There is a potential for knowledge based, search based automation." - "I cannot do [document] reviews with this. But I will keep this in mind. I have a lot of food for thought now." - "Resetting passwords for external users doing external valuation is another use case." - "The tools are cumbersome and the jobs are often done in one tool and then copy pasted to the other system." - "You need to distinguish between innovative and repetitive tasks. You cannot automate innovation." - "The people should not just copy paste existing data but use their brain. By copy-pasting we do not innovate." - "We get invoices in multiple forms (main, e-mail) and they still need to be processed. Everything should be preapproved but it is not always and approvals can be in e-mail or electronic signature etc. Finding approvals and matching them with invoice is a lot of work. There are several ways to get an approval, electronic signature, get signature manually, by e-mail etc." - "This would enable better understanding of how the processes are performed. It is clear that it does not make sense to have the same information in different places. We might have only high level guidelines and detailed instructions in tool guides. Why do we need work instructions if the tool/system itself is guiding us in the way the work should be performed." - "We have different people responsible for the tools and their validation and for the processes. There is currently no clear connection between the two. It is clear we need this connection, but we simply have different perspectives which makes things difficult." - "If you take very modular [atomic] approach the key thing is that you have intelligent people building those modules." - "But reusing between different customers can also be much more difficult. They all

use different tools, versions, configurations, customizations, and ways of working. E.g. the rules for matching payments with receivables might be different. In one company it can be based on a car registration number, while in other it can be based on some tag. “

- “Even though it is difficult it must be possible to identify common tasks, especially on a micro level. But you need intelligent people to discover them.”

Value proposition

- “Most probably I would use the robot on my machine. But there is always the security question, would it know my password?”
- “I could see the benefit [of the proposed service]. I have very experienced guy and a guy that just started. An experienced guy could share his knowledge with the less experienced guy through this kind of service. We have a very long learning curve.”
- “There could be a downside of this service businesswise. If everything is automated and woks perfectly, customer would not see that. Customer might get the feeling that we are not needed anymore.”
- “Value is in being more efficient (less resources).”
- “I would feel open to it since I see the benefit of this.”
- “The trick is to make search for atomic tasks intelligent enough. All the data is available, it is how easily you can find the answer. I do not care where does the atomic macro [automation content] come from. It would be needed to ensure that IPR is protected and not leaked. It needs to be verified that it does what is supposed to do and some proof of it.“
- “The robot can propose you pieces of atomic workflow that you might need.”
- “The tool should guide you to do the brainwork and not just force you to blindly follow the current orders.”
- “Robot would be great, if it works.”
- “I would rather have expert do the robot than myself, since there is no time for me to focus on this. I am used to IT resources doing the work for me, I provide them needs and they give me solution.”
- “Self-service needs to be simple. It depends on how simple it would be to do the checkboxing. In the finance world there is always a lot of country specific stuff. I would not be able to create such a system which would be that simple by doing the checkboxes.”
- “Hitting enter for every step is tedious. I prefer when it works until the error is hit, then you get notified, correct the error and then it can proceed on its own. Just looking at the robot doing something does not make sense.”
- “We need something in between of robot doing everything and human doing everything. I would not pick either extreme. There is clearly room for both workflow based and AI automation.”
- “I think this [service] would help out. But people might feel that they are losing control. Some people would see it as a major change, but it is the direction we are heading anyway.”
- “If we use more and more robotics, where do you need people anymore? It might trig-

ger discussion about costs saving."

- "Some might feel accomplished by doing things manually. Those might not want to ask for the robot help. Is my competence being questioned? But I think majority will be happy to get something to help them in their work."
- "Humans are doing the same things in different ways which confuses machine learning."

Value creation

- "I would allocate time to train the robot if it is obvious that it will bring me benefits. Payback for me is important. It is not only saving time but having fun or some other value. It is really case by case. I would not use it just to say that I am at the edge of the technology. But if it [training the robot] makes me feel better, and if it is fun then I would do it."
- "I would train the robot myself if I would understand how it would behave next time. I do not see the reason why I would not feel comfortable with it if robot observed what I do and learned from me."
- "No I am not concerned about AI taking away our jobs. It will change jobs, not take them away."
- "If it is relevant and really shortens the service time it would be beneficial."
- "[In some cases] I can outsource many of the mundane tasks [to subcontractor or machines] in order to improve the margins."
- "It is inevitable step for me to spend time to teach machine to do something on my behalf. I see the potential benefit. "
- "It is time to market that we want to speed up."
- "Who cares about old data? Definitely not the future generations. *Innovation* is not in the past but in the future. "
- "Having the ability to use machines to get us faster to the point where we need to achieve our objectives would be great. That can be help with decision making or help to focus on the actual and not side tasks."

Interaction and coproduction

- "Simple rating of robots 1-5 is not enough. Similar to TripAdvisor, it is the text comments that are also very important. Only comments reveal that rating might be on something that is not relevant at all[for me]."
- "It depends how easy it is to understand and configure I would use it [as a self service], and how does it work behind, on a high level."
- "In this option [IT installs things ready or IT gives me a choice to assemble an app myself], is both yes and no. I want to be in control on what is on my PC. But if it goes through IT it means it is secure, and I understand it as well. It is good if it is ready installed by IT but I decide whether to use it or not."
- "It has to be easy to use and run in background."
- "Examples would be important. Something that shows me how other people have

been using this and help me get started."

- "I prefer self-service portal due to my technical background".
- "It is important that the people do not see robot as additional overhead."
- "Could not think of anything in addition to this. Looks too good to be true."
- "Trust is important to handle. Human needs to trust the robot. Building that trust is important as integral part of the service."
- "Support when they need it, building trust, training people to transfer into the new, robot teacher, role. How quickly can I get help in case of problems and get back to production state."
- "Service continuity, disaster planning, what if the robot is broken."

Figures