Transformation of the Business Model in an Occupational Health Care Company Embedded in an Emerging Personal Data Ecosystem: A Case Study in Finland

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Abstract—Information technology has long been used as an enabler of exchange for goods and services. Services are evolving from generic to personalized, and the reverse use of customer data has been discussed in both academia and industry for the past few years. This article presents the results of an empirical case study in the area of preventive health care services. The primary data were gathered in workshops, in which future personal data-based services were conceptualized by analyzing future scenarios from a business perspective. The aim of this study is to understand business model transformation in emerging personal data ecosystems. The work was done as a case study in the context of occupational healthcare. The results have implications to theory and practice, indicating that adopting personal data management principles requires transformation of the business model, which, if successfully managed, may provide access to more resources, potential to offer better value, and additional customer channels. These advantages correlate with the broadening of the business ecosystem. Expanding the scope of this study to include more actors would improve the validity of the research. The results draw from existing literature and are based on findings from a case study and the economic properties of the healthcare industry in Finland.

Abstract—Ecosystem, business model, personal data, preventive healthcare.

I. INTRODUCTION

THERE are many definitions for 'business model' in the current literature [4]. Keen and Qureshi [21] argue that a company aiming to become a new entrant or create new business opportunities needs a business model to articulate the changes it needs or wants to make. A convincing logic of value creation is imperative in order to succeed. Traditionally, value exchange between actors, service and the customer is seen as the flow of money, other benefits, resources and activities [29].

A service ecosystem is a complex system of resource-integrating actors that are connected by shared institutional arrangements and mutual value creation [23]. The health care service ecosystem is moving towards preventive, predictive,

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personalized and participatory care and wellbeing [20]. Misdirected care has been identified as one of the shortcomings of current health care, that is, "neglecting the potential of primary prevention and health promotion to prevent up to 70% of the disease burden and to mitigate adverse effects on health and to make the most of what other sectors can contribute to health" [42].

Just about everything that makes a human tick can now be quantified using sensors, sequencing, laboratory tests and scans. Soon we will have virtual medical assistants for doctors, physiotherapists and personal trainers who can incorporate all medical as well as wellness data of a person's lifestyle, behavior, social network, shopping behavior, finances and how they are interrelated [22]. In the future, sensors will be even more integrated in the person's daily life and can be found from clothing to home electronics [30].

From the individual perspective, the collection of a large amount of personal data can be frightening. A common fear rising out of such data collection is whether the quality of data security is sufficiently robust, in addition to the fear of misuse of personal data. *MyData* is a new approach on personal data management, and was identified by the ministry of transport and communication of Finland as one way to overcome these challenges of personal data.

The target of the MyData approach is to enable decentralized management of personal data from different sectors improving interoperability and make it easier for companies to comply with tightening data protection regulations, while also allowing individuals to change service providers without proprietary data lock-ins [33]. For this target to become reality, business models need to transform, and personal data ecosystems need to emerge that integrate their resources in order to develop service structures where citizens can participate and services are more interactive in their nature.

The aim of this study is to understand the transformation of business models in emerging personal data ecosystems. The work has been done via a case study with two case companies who are working in a small service ecosystem, and have a goal of using the MyData approach for mutual customer value creation in the context of occupational healthcare. The first studied company provides statutory occupational health services and individual wellbeing services for companies with an interest in keeping employees healthy and treats diseases

World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:9, No:10, 2015

effectively and efficiently. The second case company is a large company offering data analytic services in different sectors. The paper is structured accordingly: first, after introduction, a review of relevant literature on business models, personal data, and their connection follows. After that, how the empirical study was conducted is explained in detail. Then the results of the study are examined. Finally, we discuss the implications of our work for theory and managerial practice.

II. BACKGROUND

A. Business Models

The business model is extremely important to any organization because it provides a means to understand, analyze, communicate and manage strategic choices [1], [38], [27]. One of the most famous illustrations of the business model and its components is the Osterwalder Business Model Canvas [40], a conceptual tool that makes expressing the business logic of a specific organization easier [1]. The components of the canvas are *key partners, key activities, key resources, value propositions, customer relationships, channels, customer segments, cost structure, and revenue streams.* There are more extensive interpretations of the business model components. Onetti et al. [26] provided one of the widest analyses of existing literature of business models to date. Their analysis is based on 70 different definitions published from 1996 to 2009. The work of Onetti et al. [26] was inspired by Shafer et al. [38], providing a reduced list of 26 components of business models. According to their analysis, the most important business model components are: *value creation, value proposition, value network, competitors, differentiation, processes, resources, customers, information flow, technology, revenue, cost, profit, and financial aspects.* Despite being semantically slightly different, both interpretations study the same underlying phenomena and can answer the same questions. In this study, the authors opt to use the Osterwalder business model canvas in the analysis.

Similarly to a business model, the value-capturing model and value network analysis map are ways to model, analyze, evaluate and improve the capability of companies to understand and realize the current and future players in their business ecosystem. A value network describes agents (typically suppliers and customers) who conduct actual value-creating transactions with the company [36]. 'Value network analysis', as a term, is based on industrial business practices which were originally describing the value networks as a means to describe their resources to bring coherence to the industry clusters [2]. However, it could also be applied in the context of service ecosystems, which are systems of distributed innovation, generally consisting of various corporations, individuals and communities that share an underlying and evolving technical system [43], as this analysis provides a way to understand dependencies between organizational roles and relationships in the business ecosystem, enabling descriptions of improvements in value realization for each role. Additionally, it provides a

mechanism for systematic value analysis between the players in a company network [2]. From a resource perspective, companies can combine or exchange need and solution information or create new sources of value. By co-creating value in the business ecosystem, the company can achieve more, learn rapidly, and reach more than would otherwise be possible. This is done by sharing the risks and costs with others [24].

B. Personel Data

Personal data are important currency for companies and society. The value of personal data is huge and growing, and by 2020 is expected to be worth 1 trillion Euros annually in Europe alone [41]. The European Union's General Data Protection Regulation, set to take effect in 2018, defines personal data in a following way: "'*Personal data' means any information relating to an identified or identifiable natural person ('data subject'); an identifiable person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that person.*"

Personal data have long been collected for various benefits. Aggregating customer activity and history to understand the customer better and target marketing efforts more efficiently is a part of virtually every business. Tax data, residence, date of birth, health and educational records are all personal data that is being collected from individuals starting already at a very young age. Gaining insight, efficiency and competitive advantage are the main reasons for collecting personal data [31]. For example, competitive advantage can be gained by removing information asymmetries and facilitating efficient transactions [16]. Many companies place great emphasis in harvesting personal data.

Increasingly also mobile devices and wearable sensors are adding information (such as location data, sleeping data, running and movement data, weight, bank data and shopping data) to the vast repositories of personal data [3]. Motivation to use this kind of data is typically found in self-reflection and the help it provides in lifestyle changes [9].

Utilizing the vast amounts of personal data can bring business opportunities for service providers, helping them to cater to the needs of the individual consumers. However, harvested customer data are often seen as a competitive advantage, which is not to be shared with other organizations [32]. This is the current situation in which personal data are abundant but resides in silos. This makes most of the usable data inaccessible to the actors who could produce personalized, predictive, preventive and participatory services.

Companies do have to process personal data with sensitivity, since privacy issues and data protection can be challenging. The legality in the use and sharing of personal data depends on the context in which it is used [28].

In 2018, two data regulations will take effect in the EU, concerning also companies that do business within the EU: GDPR - General Data Protection Regulation and PSD2 –

World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:9, No:10, 2015

Payment Service Directive, both of which will effectively force organizations to give personal data back to the individual upon request by enforcing laws supporting the security and transparency of data. For business organizations, the implementation of these regulations will increase the overall costs of harvesting personal data [32]. One way of remedying the situation is to give the control of personal data back to the individual. There are many initiatives emerging around the globe with the aim of empowering the individual with their own data.

MyData is one of these human-centered data management approaches. The MyData approach simplifies data flow and opens new opportunities for businesses to develop innovative personal data-based services while preserving privacy. The aim of the MyData approach is to provide individuals with the practical means to access, obtain, and use datasets containing their personal information, such as daily wellbeing data and purchasing data and medical records. As per the MyData report ordered by the Finnish Ministry of Transport and Communication, "The term MyData refers to a new approach, a paradigm shift in personal data management and processing that seeks to transform the current organization-centric system into a human centric system, and to personal data as a resource that the individual can access and control". [33].

The identified MyData principles are the following:

"1) Usable data: It is essential that personal data is technically easy to access and use – it is accessible in machine-readable open formats via secure, standardized APIs (Application Programming Interfaces). MyData is a way to convert data from closed silos into an important, reusable resource. It can be used to create new services that help individuals to manage their lives. The providers of these services can create new business models and thus boost economic growth in society. 2) Human centric control and privacy: Individuals are empowered actors, not passive targets, in the management of their personal lives, both online and offline – they have the right and practical means to manage their data and privacy. and 3) Open business environment: Shared MyData infrastructure enables decentralized management of personal data, improves interoperability, makes it easier for companies to comply with tightening data protection regulations, and allows individuals to change service providers without proprietary data lock-ins." [33].

The idea behind MyData principles is not only to digitize services, but to transform service processes for the benefit of the individual. Personal data provides means for public and private health service providers and other private companies to offer more personalized, accurate and in-time services, and discover novel service ideas for individuals. "The key component is the individual's consent to release his/her own relevant data for a selected company to offer better services for use by the individual" [33].

C. Business Models and Personal Data

Technology has no single objective value [11]. The economic value of a technology remains unclear until it is commercialized in some way via a business model. Similar technology commercialized in different ways leads to different business value [11]. Moreover, technology should have value for the individuals, i.e., customers for succeeding.

The reason why companies are interested in personal data access is the potential value that the added information might have for their future services. However, the data are an asset similar to technology. It simply does not bring any value for a company or customers, if it is not possible to be accessed legally or commercialized through a business model.

The sharing of personal data from different sectors can be made possible through *open business models*. Originally the open business models were used by Chesbrough [10] when describing value creation in an open innovation context. In this is an approach in which an organization draws its ideas from openness such as free software, open source as well as open content and standards [17]. Open business environment means that personal data are made open with individual consent so that business benefits are distributed accordingly. This seeks to increase personal engagement and positive outcomes in an open way.

Open business models have been a frequently found concept in literature since 2006 when Chesbrough [10] published his seminal book on the topic. There is, however, a lack of consensus in the definition and understanding of the concept, which has led "open business model" to stand for two different kinds of openness. One stream of literature links it to a firm's research and development activities, while other researchers understand the open business model more broadly, i.e., locus not being in the R&D activities [17].

Business models need to be innovated constantly in a changing business environment [17]. In their article, [17] identified five antecedents that led firms to open up their business models. These antecedents and their explanations are described in the forthcoming paragraphs. 1) *Business model inconsistency*: According to researchers, firms with missing or inappropriately designed business model elements are likely to open up their business models to acquire and integrate missing resources and capabilities. Organizations aspiring to succeed in personal data ecosystems often lack consistent business models, and do need additional outside resources. 2) The *need to create and capture new value*. The very idea of services based on extensive human-centric personal data require means by which to create value from various and different datasets for the end-users' benefit. Open business modes can help capture that value by making it possible to attain resources that are otherwise unavailable. 13) *Previous experience with collaboration*: The companies that have strong experience collaborating with other actors are more likely to open up their business models in order to gain better and more personalized services for individuals. 4) *Open business model patterns*: successful examples of open business models leading to superior value creation encourage imitation of such an approach. 5) *Industry convergence* encourages open business models through technology convergence and through the power of new market entrants, requiring wider business model adjustments. Open business models can be used by the

World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:9, No:10, 2015

companies in order to understand the business opportunities the companies can gain over time by accessing personal data from different sectors.

III. RESEARCH DESIGN

The aim of this study is to understand the transformation of business models in emerging personal data ecosystems. The primary data were gathered from four workshops in which the researchers, in collaboration with case companies, conceptualized future personal data-based services by analyzing use cases from a business perspective. Secondary data included company data, the case company websites and news articles on the context of occupational health care. The workshop method consists of an introduction to personal data, end-user and business value analysis, technical and regulatory analysis as well as future plans. The qualitative case study methodology provides a solid foundation to explore and describe the studied phenomenon in context using various data sources [5], [44]. John Gerring [18] defines it as "*an intensive study of a single unit with the aim of generalizing across a larger set of units*". Despite its advantages and many examples resulting in sound theories, case studies are a debated methodology [15], [18]. This study can be classified as an *instrumental single case study* [39], wherein the case itself is of secondary interest. This method is used by the authors to gain an insight into an issue.

A. Case Context

Working people commonly experience fatigue, depression and anxiety. Burnout is a unique type of stress syndrome and is characterized by the loss of mental resources and diminished personal accomplishment [13], [34]. The effectiveness of measures to prevent workforce burnout critically depends on managers' understanding of the burnout phenomenon and of the subtle indications of its emergence [13].

The means of preventive health care are in their infancy, but they represent huge business potential. The first case company is an occupational health provider with a mission to get people to start caring for their own wellbeing, the main tenet being that the healthier people are, the better for both the employee and the employer. The second case company is a business intelligence and enterprise information management solution provider operating in the Nordic countries. Both companies' common focus is on healthcare and the wellbeing business. For easier memorization, the authors will refer to the occupational healthcare company as OHC, and the data analytics service company as DAS.

The goal of both of these companies is to create a new service that offers an analytical tool for disease prevention. This tool will be referred to as the Wellness Engine. The goal of the Wellness Engine is to identify burnout risk factors, and with data, identify the individuals with a burnout risk as early as possible in order to anticipate and guide the individuals before fatigue affects their ability to work and burnout has manifested. The holistic service, in the form of a coaching application, could direct the individual to a medical doctor or a

psychologist if the risk behavior is continuous. The service could also provide summaries of employees' overall well-being in the organization anonymously and help answer what factors make an individual an effective and valuable employee.

B. Data Collection

The use of multiple data sources is a paramount concept in case study research [5]. To limit the effects of a monotonous interpretation, the data collection for this case study was made in a series of workshops conducted together with the case companies and the researchers. During these workshops, the logic of value creation was sought with the help of three analytical tools: *Persona* model, *Journey Planning,* and *Value Network Analysis.* These tools bring the individual into the center of this analysis - a consideration to the *Osterwalder Business Model Canvas'* criticism for its lack of an individual's point of view.

End-User and Business Value Analysis is a traditional way of selecting one concrete case, where end users are profiled, potential customers and key roles are identified, and value analysis is done in both end-user and business perspectives. The four steps on the value network map [2] are defining the scope, boundaries, context and purpose; determining the roles involved; identifying the transactions and deliverables; and validating the map by sequencing transactions.

The persona model is a design technique that specifically targets user interaction developed by Alan Cooper [12]. "*Personas are fictional, detailed archetypical characters that represent distinct groupings of behaviors, goals and motivations observed and identified during the research phase*" [8]. The persona model has a specific purpose as a tool for software and product design [6]. With personas, a goal-directed designer develops a precise description of the user and what he wishes to accomplish.

The *customer journey* is a systematic approach to help organizations understand how customers use, react and perceive the various channels and contact points of the interaction cycle between the individual and the organization. It is the visual and process-oriented method for conceptualizing and structuring people's experiences. The knowledge derived from the customer journey can be used to plan an optimal user experience of major customer segments and desired customer experience objectives. [25].

Altogether four workshops were arranged. The purpose of the first workshop with the companies was to increase their understanding about MyData principles, and the plans related to the new startup plan to establish it. In the discussion, it was realized that both companies were still at a very initial phase in their solution development. In the second workshop, the goal was to identify the key aspects to take into account in the proposed joint startup from the MyData perspective. The workshop's content included profiling the actors, introducing personas [12], [8], [6] and journey planning [25], all the while reflecting on the MyData principles.

The demonstrative personas were introduced to the case companies, the purpose of which was to exemplify the various

World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:9, No:10, 2015

activities by these actors in the journey planning workshop. In the third workshop, the target was to understand the business landscape and value network [2], [24], [36] for the new service from the MyData perspective. The fourth workshop focused on technical and regulatory analysis in which the goal was to understand that technical and regulatory aspects can hinder the adoption of MyData principles.

C. Data analysis

The analysis process was iterative and as often in qualitative inquiry, also abductive with continuous interaction of empirical data and theory [14]. The data set was first thoroughly reviewed and then analyzed using *thematic analysis,* the most common technique in qualitative research [19]. In this study, the authors reflected on the convergent aspects of MyData principles and business model components as our analytical framework. Because both the individual user and the ecosystem are fundamental to the MyData approach, the case was also examined through *persona* and *customer journey* points of view, and through *value network analysis*. These constructed the theoretical lenses for the analysis. A coding matrix was constructed that enabled the systematic analysis of the data [37], first from the perspective of MyData principles, and then specifically according to business model components and their expected future evolution in the continuum of short- and long-term future.

IV. RESULTS

Next, the case companies' proposed joint-startup Wellness Engine's future business situation is analyzed through MyData principles (see Appendix).

A. Usable Data

In the first phase, the Wellness Engine will be built using the data from the working, healthy people using occupational care. The occupational healthcare company, OHC, has data from more than 2,000 of their customers. The target is to get anonymized data about the individual's situation, e.g., on a monthly basis to the occupational healthcare provider. Daily surveys can be annoying, so they are done on a monthly basis. When the Wellness Engine is completed, it could be licensed to use for other companies, generating more anonymized raw data. Currently, OHC has an outsourced health and activity data aggregation service. For this study's purposes, it can later be referred to as HADA. The most typical HADA forms of data that OHC uses are sleep, pain, and nutrition rhythm data. HADA has a solution that allows data collection from individuals: each individual fills out an electronic health check and an occupational health satisfaction survey.

In HADA, a person can identify and select the subset of relevant metrics that she/he wants to track. The sleep information comes via activity-tracking bracelets, authorized through the HADA user interface. Sleep duration and depth, and daily activity or steps, are seen as the most important data sets for the Wellness Engine. Electronic health check and satisfaction surveys are collected once a year, and perhaps soon the employer organization could offer, e.g., standing and sitting metrics.

At this stage, there is not yet a seamless transfer of data and analytics between the Wellness Engine and the end-user: the data are currently gathered from all available sources into an Excel file. HADA, for example, already provides useful information for the user, but the Wellness Engine is not yet ready to provide insightful analytics from various data sources.

OHC's and DAS's current goal is to identify the data sources for the presently developing Wellness Engine solution. When there is enough data, OHC can offer tools and status information for client companies' human resource management. The Finnish national personal health record and occupational healthcare links are undergoing planning at the moment. OHC does not have direct access to the customer organization's employee data, but can receive raw data. They can collect employee satisfaction survey results, and often people may give answers more honestly to occupational healthcare providers than to their employer organizations. There are also legal and regulatory considerations to take into account on both the national and EU-level, but in the long run, the goal is that all the data authorized by the individual can be used and analyzed in a meaningful fashion.

B. Human Centered Services

The short-term *value proposition* offered by OHC and DAS is a daily coaching service for a working age population and analytics machine that summarizes the data and then returns it back to the individual, but also to the company management and occupational healthcare players when needed. At the moment, the individual can only get un-analyzed data. This does not provide real meaning about the risk of burnout or any other risk for this person. When using the Wellness Engine, the individual will get analyzed data about his/her daily, monthly and yearly situation. When there is a high burnout risk, the system will raise a red flag and provide some guidelines to the person to slow down. When there are several red flags in the same team or the same organization, the management will get information about it and some guidelines on how to improve the wellbeing of their employees in the workplace. If there are many red flags related to the same person, the information will be sent to the occupational healthcare provider that will then suggest a doctor visit for that person.

The adoption of the MyData approach would open up data sharing between OHC and DAS, as well as third-party players. It will be possible to use different types of information - such as the customer information accumulated by retail chains, banks and biobanks - to give a person more comprehensive and holistic guidelines and advice. Other employer organizations could bring to Wellness Engine, for example, work time and other kinds of statistics that are important in the service's development. In the long run, the target of both case companies is to create a human-centric data analytic machine, the services of which can be sold to both public and private sectors, such as pension insurance companies and other public and private healthcare players and work organizations.

World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:9, No:10, 2015

C. Open Business Environment

The collaboration with the public sector will happen later in the anticipated life cycle of Wellness Engine, when the open data business environment makes it possible for third parties to send and receive relevant data. The Ministry of Social and Health Affairs of Finland is looking forward to this kind of model. In this context, it is also worth mentioning that Finnish occupational healthcare laws date back to the 1970s. Although the Finnish Centre for Pensions now compensates for occupational health e-services, it will not compensate for *preventive* occupational healthcare.

Key activities and processes in the business plan of OHC and DAS is to develop the first version of the planned Wellness Engine service. From an open business environment perspective, it is important that they take the future MyData architecture into account when planning and co-creating future services.

Key partners in the OHC and DAS value network are companies that work on time statistics as well as some identified application and measurement device providers. In the long run, it is important to search for partners that enable the *information flow* between the services, like data management organizations, and other companies with important data, such as insurance companies and private hospitals.

Insurance companies will be important *channels* in the future open business environment because they can offer personalized ways to motivate people to improve their daily lifestyle, offering more competitive insurance fees in exchange for healthier habits, for example.

Because of upcoming reformations of EU data protection rules and regulations, Nordic cooperation is seen as important in order to model where the possibilities and problems are, and to see where pseudonymized data, data authorization, etc. fits into the businesses of both OHC and DAS. Sweden, Estonia, Germany and the Netherlands are seen as future marketplaces for their service. One possible direction to sell the Wellness Engine solution is the employer organizations abroad. However, the nature of the occupational healthcare field varies in different countries.

Early development of MyData architecture would offer companies *differentiation* from their competitors for a short amount of time by being able offer one of the first services complying with the new rules and regulations. In the long run, this will enable OHC and DAS to get access to different data sets and data integration that makes it possible to create new breakthrough service innovations before anyone else in the market.

In the first phase, *the key resources* that companies OHC and DAS have in use are the customer interfaces of OHC and technical expertise coming from DAS.

Revenue stream and *cost structure* of both of the case companies is quite simple. Their target is to get service fees through direct service contracts, mainly with work organizations. In the business landscape of the future, in which the data flow will be continuous with the consent of individuals, new types of revenue fees from different players

may be important to analyze.

OHC can gain a business opportunity from the use of the Wellness Engine. They can offer their individual customers more efficient care based on continuous data analysis. In practice, employer organizations conclude a contract with a service provider (e.g., OHC), and the management level of the employer organizations can use the analyzed data as basis for decision-making. There is also a possibility that decision support via the Wellness Engine could be offered to companies that are not direct customers of OHC.

The value potential of the Wellness Engine will increase when there will be more end users, i.e., more data sources. In addition to employer organizations and the Finnish Centre for Pensions, the planned revenue for the Wellness Engine would come from a monthly fee or some kind of service payment from individual users and private companies. For DAS, being the other owner and developer of the Wellness Engine, it is imperative to discover additional business to be made aside from a steady revenue stream via OHC. For DAS, the platform provider role could provide a business opportunity. At this stage, it is just not yet known what possibilities there are and with whom. This is why it is central to understand who will benefit from the different sources of data.

DAS does not want or need personal information. Therefore, there is a need to pseudonymize the data in such a way that no one can make any personal conclusions based on it. The Wellness Engine would just process and read the information which is authorized. An individual can consent to transfer the data. There are two levels, individual personal data and the other level in which the data is pseudonymised and aggregated in such a way that it is not personable anymore. At this stage, before a MyData-based open business environment has taken hold, this pseudonymised data is the asset that is worthwhile for industry players. OHC has an ongoing collaboration with the employer organization, and permission to collect the personal data from individuals it is providing its service for. However, if the used data is collected from other players in the business network, the individual's consent is required. Further, if OHC wants to offer the data to a third party, it has to have the individual's consent and it needs to clearly indicate these purposes in its service terms. People are already using HADA, and OHC can already get information about the people's status through HADA. The Wellness Engine service could be created in collaboration with HADA.

OHC cannot yet offer its customers the services powered by the Wellness Engine, since it is not yet ready for commercial use. From the cash flow point of view, it is seen as simplest to separate the business of OHC and the business of the Wellness Engine, meaning that OHC would also have a contract to use the Wellness Engine services.

When the Wellness Engine is ready, the individual will put the solution into use when the employer organization buys the solution for their individual employees' use. It is believed that an individual will better take care of him/herself if he/she knows what the situation is. From the MyData point of view, it is also important to consider what happens to the employee's data after he/she resigns or retires. Currently, the case

World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:9, No:10, 2015

companies have no answer for this, but one solution could be that the data are preserved against a fee of some kind. Another solution is that, upon request, the individual can receive a raw-form CSV or Excel-file of his/her data. In the future, an integrated MyData solution might be a reality, wherein the data are imported to a national personal health record where each individual has basic tools to manage his/her health related data.

Table I summarizes the analyzed business model transformation that is happening from the present to the long-term future, where MyData principles are widely adopted.

V. DISCUSSION AND LIMITATIONS OF THE STUDY

A common theme can be found in both the adoption of the MyData approach and changes in the business model components, and that is the pervasiveness of the role of the service ecosystem in the future. This seems to accentuate the convergence of different industries, since in this ecosystem the health industry, insurance industry and ICT are becoming increasingly involved, each providing valuable data to each other with the consent of the individual.

While a few studies have examined the linkage between business models and personal data usage [35], [45], [7], no empirical studies have looked at how a company should change their business model due to new data access. The lack of empirical studies on this question is most likely due to the difficulty to predict what is happening in the future. This paper shows one way to think about this issue.

The paper also contributes to the literature of open business models and personal data by providing analysis of the relationship that companies articulate. The authors' work points out that the companies should move towards open business models and a human-centric personal data management approach which makes extensive data sharing possible, while fulfilling digital human rights and creating value for customers. In the long run, this could bring business value to the services and businesses of the enterprises.

The study's methodical strength is in the detailed recorded discussions that were done together with the case companies. Nonetheless, this single case study is relying on a limited amount of data that were used to predict the future of the personal data-driven business model of the two selected companies. Further research, including data from different sectors, e.g., the financial sector, could strengthen the constructs that have been empirically fleshed out by using the case study.

VI. CONCLUSION

Access to data is obviously a fundamental business benefit for many companies and business ecosystems. However, data does not bring value if it is not integrated with customer value through the business model. This article describes one example of how the business model might change in emerging personal data ecosystems in the context of occupational care.

In conclusion, it is important to point out the importance of the adoption of a human-centered data management approach in Europe. For example, it was shown how the usage of MyData principles would help OHC and DAS in the ecosystem to gain rich data from different sectors, resulting in more efficient predictive health service to their customers. However, the successful adoption of human-centered data management requires the companies to change their business models.

TABLE I
BUSINESS MODEL COMPONENT EVOLUTION DURING MYDATA TRANSITION

Business model components	Present	Future
Key partners	Data analytics provider, companies with work time statistic and metrics, activity tracking companies	Pension insurance companies, insurance companies, platform operators, private hospitals, decision support system providers, international partners
Key activities	Developing the service, technical and regulation analysis	Developing interfaces to MyData architecture for easy data access and sharing
Key resources	OHC: occupational healthcare expertise and contacts DAS: analytics expertise	Data from other actors of the ecosystem
Value proposition	Occupational health services with emphasis on preventive healthcare	A service that provides a personalized application providing meaningful analysis and recommendations
Customer relationships	Direct contracts with companies and individuals, collaboration with companies	Platform operator, insurance companies, decision support system providers, individuals, employer organizations
Channels	Employer organizations that recommend the service, existing clientele	Platform operators, health care operators, insurance companies, Finnish social security institution, state enterprises and occupational health companies abroad
Customer segments	Employer organizations	Public healthcare, cities, insurance companies, state enterprises, private hospitals, decision support system providers
Revenue streams and cost structure	Service fees, contracts, marketing, building collaboration	Contracts between Wellness Engine and work organizations, service fees via platform operators / insurance companies

APPENDIX

TABLE II
CHANGE IN THE COMPANY STRUCTURE DUE TO THE MYDATA APPROACH

MyData principles	Near future		Long term future
Usable data	-Customer data from OHC -Annual wellbeing survey -Sleep and activity data	-Daily activity data (e.g., activity and sleep trackers) -Data accrued by the employer organization combined with wellbeing and health data	All data that are authorized by individuals for the service's use
Human centric services	-OHC offers a virtual wellbeing service for end customers -Continuous analyzation of work-related burnout risks	-Personalized mentor application that advises individual in burnout prevention and warns of burnout risk among workers	An even more personalized application that can advise the user, taking into account various aspects of his/her life
Open business environment	-Work organizations pay for services that aim for healthier workers -Separate contracts with platform actors and activity tracking manufacturers	Contract with a platform operator	Receiving and sharing data enables new business opportunities

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