Sustainable Value Creation in Commercialisation of Innovation : The Case Auria Biobank

Lehtimäki, Hanna

2019-07-04

Lehtimäki , H , Helén , I , Snell , K , Eriksson , P & Montonen , T 2019 , ' Sustainable Value Creation in Commercialisation of Innovation : The Case Auria Biobank ' , International Journal of Entrepreneurship and Innovation Management , vol. 23 , no. 5 , pp. 451-465 . https://doi.org/10.1504/IJEIM

http://hdl.handle.net/10138/308986
https://doi.org/10.1504/IJEIM.2019.102035

unspecified
acceptedVersion

Sustainable value creation in the commercialisation of innovation: the case of Auria Biobank

Hanna Lehtimäki* Business School, University of Eastern Finland, P.O. Box 1627, FI-70211 Kuopio, Finland Email: hanna.lehtimaki@uef.fi *Corresponding author

Ilpo Helén Department of Social Sciences, University of Eastern Finland, P.O. Box 111, FI-80101 Joensuu, Finland Email: ilpo.helen@uef.fi

Karoliina Snell Helsinki Collegium for Advanced Studies, University of Helsinki, P.O. Box 4, FI-00014, Finland Email: karoliina.snell@helsinki.fi

Päivi Eriksson and Tero Montonen Business School, University of Eastern Finland, P.O. Box 1627, FI-70211 Kuopio, Finland Email: paivi.eriksson@uef.fi Email: tero.montonen@uef.fi

Abstract:

The purpose of this study is to examine how different logics of commercialisation are part of sustainable value creation in an emerging area of healthcare. This paper presents an inductive interpretative case study to examine the emerging field of personalised medicine from the perspective of a biobank seeking to create value on its depository of tissue samples, patient records, and digitised data. This study increases our understanding of the challenges and opportunities faced by a company when developing innovations in healthcare. It contributes to the literature on the commercialisation of innovation by exploring how sustainable value creation in an emerging industry builds on both planned and emergent commercialisation activities and how different logics of commercialisation are a part of sustainable value creation in personalised medicine.

Keywords: healthcare; innovation; commercialisation; value creation; stakeholder; biobank; personalised medicine.

Reference to this paper should be made as follows: Lehtimäki, H., Helén, I., Snell, K., Eriksson, P. and Montonen, T. (2019) 'Sustainable value creation in the commercialisation of innovation: the case of Auria Biobank', *International Journal of Entrepreneurship and Innovation Management*, Vol. 23, No. 5, pp.451–465.

Biographical notes:

Hanna Lehtimäki is a Professor of Management in the Business School at the University of Eastern Finland. Her research areas are strategic management, stakeholder management, social networks, and leadership. She has worked as a Senior Fulbright scholar at the George Mason University, USA and as a visiting scholar at the University of Toronto, Canada. Her research articles have appeared in high-quality academic journals internationally. She is an author of the book The Strategically Networked Organization: Leveraging Social Networks io Improve Organizational Performance.

Ilpo Helén is a Professor of Sociology at the Department of Social Sciences, University of Eastern Finland and an Adjunct Professor (docent) in Sociology at the Department of Social Research, University of Helsinki. His current research is focused on biopolitics and political economy of contemporary biomedical technology, genomics, biobanking and neurosciences in particular. He is the Director of Good(s) for Health research consortium, funded by Personalised Health Program of the Academy of Finland. He published widely about these topics, for example, Economy and

Society, Distinktion: The Scandinavian Journal of Social Theory, Science Studies, Genomics, Society and Policy and Public Health Genomics.

Karoliina Snell is a university researcher at the Department of Social Research, University of Helsinki. Her background is in sociology and science and technology studies. Her research interests include social and ethical issues in biobanking, genomics and health data. She has published articles on public opinion in biobanking and health data, governance of biobanks and on privacy and social responsibility related to new technologies.

Päivi Eriksson is a Professor of Management in the Business School at the University of Eastern Finland. Her research areas include innovation management, critical management research and qualitative research methods. She published a number of high-quality academic journals and co-authored the book Qualitative Methods in Business Research (Sage, 2016).

Tero Montonen is a university researcher in the Business School at the University of Eastern Finland Business School. His background is in social psychology, which he applies to management and innovation research. His research interests include research-based spin-out companies and the identities of managers with a background in academic research.

This paper is a revised and expanded version of a paper entitled ‘Commercialization of biobank data: the case Auria Biobank’ presented at International Conference for Management Cases (ICMC), Greater Noida, India, 1–2 December 2016.

Introduction

Effective commercialisation of innovative products and services in healthcare is a globally pressing issue due to changes in demographics in both developing and developed countries. Bringing a new product or service to the market is challenging in any field, but it is particularly challenging in healthcare and medicine, where it may take years to create a successful business based on an innovation. Experts believe future healthcare will be “predictive, personalised, preventive, and participatory” [Hood and Friend, (2011), p.184]. A new healthcare paradigm, personalised medicine, is expected to provide revolutionary improvements in healthcare and medicine in the future (Tutton, 2014). It relies on the use of genome data in combination with a variety of personal health-related data (e.g., Topol, 2012). Biobanks are considered central actors in the development of personalised medicine. They collect and process health-related data from various sources to be utilised for academic and commercial research and development (R&D) purposes in hospitals and pharmaceutical companies.

The term biobank refers to a variety of social and technical arrangements for the collection, storage, and exchange of biological materials and associated medical and lifestyle information. Biobanks collect, store, and circulate data that are vital for biomedical research; therefore, they are becoming a key element of the biomedicine infrastructure (Yuille, 2011; Yuille et al., 2008). In the context of personalised medicine (ESF, 2012; Tutton, 2014), the combination of data from tissue samples, clinical data, and digitised personal health records is expected to provide more effective and precise means for curing and preventing diseases and for reducing the costs of healthcare (NAS, 2011; Topol, 2012).

Drawing on the literature on commercialisation in innovation management (Datta et al., 2014), strategic management (Teece, 2009), marketing (Vargo and Lusch, 2004; 2008), and stakeholder

management (Roloff, 2008; Rühli et al., 2017), this study addresses the commercialisation of innovation in personalised medicine. It examines how sustainable value creation in an emerging field builds on both planned and emergent commercialisation activities, and how different logics of commercialisation are a part of sustainable value creation in personalised medicine. For healthcare innovations, sustainability needs to be addressed from not only economic but also social and ethical perspectives (Rühli et al., 2017). By drawing on different approaches to commercialisation and examining commercialisation in an empirical context, this study seeks to contribute to the literature on the commercialisation of science-based (Shore and McLauchlan, 2012) and health innovations (Nicolini, 2010).

The empirical case study presented in this paper offers a description of commercialisation in a real-life context in personalised medicine and thereby provides conceptual insight into commercialisation in an emerging field. The subject of study, Auria Biobank, was the first clinical biobank in Finland and a pioneer in commercialising personalised health-related data. Finland is among the most advanced countries in terms of biobanking, with extensive collections of tissue samples, well-organised and easily accessible health data in hospital medical records, public health registers and longitudinal epidemiological studies, and the proper legal and administrative regulatory framework for biobanking (STM, 2015). Although the biobanks in Finland are among the leading biobanks in the world, their operations are still in early development. Using an inductive and interpretative case study, this study increases our understanding of the challenges and opportunities faced by a biobank when developing an innovative healthcare business.

The first section of this paper presents a literature review on goods-dominant logic, service-dominant logic (SDL), and the stakeholder approach in the commercialisation of innovation. The second section describes the methodology of the study and provides details about the inductive case study method and the research material collected in this study. The third section presents the results of the empirical study, providing a rich description of the development of the case organisation and reporting the findings on commercialisation in Auria Biobank. This section also looks at how the biobank seeks to create sustainable value through the commercialisation of its depository of tissue samples and patient records. The paper concludes with a discussion of how three approaches to the commercialisation of innovation identified in the literature contribute to sustainable value creation in science-based health innovation.

Theoretical background

Commercialisation strategies introduced in the literature discuss how, when, and with whom an organisation aims to compete and cooperate (Gans and Stern, 2003). Most of the literature on the commercialisation of innovation presents commercialisation as the process of introducing an innovation to the market and accruing income and strategic advantage based on that innovation (Aarikka-Stenroos et al., 2014; Datta et al., 2014). Research on technology transfer has explored the role and activities of institutions such as universities and other public organisations, startups, and established companies in the commercialisation of innovation (Kirchberger and Pohl, 2016). This line of research builds on a goods-dominant logic (GDL) of value creation (Vargo and Lusch, 2004, 2008). GDL is based on the ideal of a linear innovation process in which researchers, a research organisation, or a company engage in creating ideas and inventions and then seek out customers interested in buying their innovations. This assumes a value exchange in which the customer receives a product or service and makes a payment in return. The relationship between the innovator

and customer is that of exchange of value; the focus is on the process of creating an innovation and making a product or service, and the price that a customer is willing to pay for the innovation. In innovation management, GDL highlights the value creation opportunities of the innovator and the owner of the innovating firm.

Another framework for considering the commercialisation of innovation is SDL, which seeks to better understand how customer value is created and what the value in use is for the customer (Vargo and Lusch, 2004, 2008; Vargo et al., 2008). In this approach to innovation, a company with an innovative offering creates a value proposal for the product or service; the final value is created in collaboration with the customer. This approach calls for interaction and trust between a company and customer beginning in the early stages of innovation, as the customer is treated as a co-creator of value. The underlying idea is that the producer of the product or service and the customer create value together with a new solution. This approach highlights innovation and value creation as synchronic and interactive processes instead of treating them as linear and transitive. It calls for a reconsideration of the roles, actions, and interactions of economic actors (Ramirez, 1999). SDL supports the creation of collaborative business arrangements and makes long-term relationships between customers and producers viable and important. The ability to cooperate and create value together is considered to be the primary source of competitive advantage in the commercialisation of innovation (Montonen et al., 2014).

A stakeholder perspective calls for an examination of value creation with a variety of stakeholders, including citizens, legislators, policymakers, the media, employers, and employees. This approach considers the term value to comprise not only economic value but also social value (Szmigin and Rutherford, 2013). In stakeholder theory, value creation is the ability to create long-term, mutually beneficial relationships with a broad set of stakeholders (Freeman et al., 2004; Kujala et al., 2017). The core idea of stakeholder theory is that mutual benefit and stakeholder satisfaction are ensured by operating so that stakeholder interests are balanced over time (Freeman et al., 2007; Näsi, 1995). Stakeholder theory promotes the establishment of favourable and productive relationships with stakeholders because serving the interests of a broad set of stakeholders creates more value over time and thus increases the sustainability of operations (Harrison et al., 2010; Post et al., 2002; Svendsen et al., 2002). In an emerging field, stakeholder theory provides a useful perspective for viewing the varying and sometimes conflicting interests of stakeholders. Stakeholder theory also provides tools for addressing the multiple ways in which an innovation, and the activities leading to it, creates economic and social value for different stakeholders (Harrison and Wicks, 2013).

Methodology

This study is an inductive case study that aims to increase the understanding of commercialisation in an empirical context (Eriksson and Kovalainen, 2016; Gioia et al., 2012). An inductive case study approach uses rich details to produce a narrative interpretation of the case from the perspective of the people involved in it (Eriksson and Kovalainen, 2016). It also allows researchers to determine the meanings that people in an empirical setting ascribe to commercialisation (cf. Rynes and Gephart, 2004). The inductive case study focuses on interpreting and understanding rather than explaining or testing, as a deductive, theory-driven case study method would (Eriksson and Kovalainen, 2016; Rynes and Gephart, 2004).

The collection of research material for this study spans seven years. Two of the authors have engaged in dialogue with Auria Biobank since 2013 and followed the emergence of the personalised medicine industry since 2006. They have held regular meetings at the company, participated in writing national reports on biomedicine, and engaged in discussions with a broad base of actors involved in developing the field. The data used in this study comprise meeting minutes, two recorded and transcribed interviews, and company materials. The first interview was with the CEO of Auria in November 2013 and the second was with the CEO of Auria in February 2016. News articles and other publicly available material on the development of biobanks and personalised medicine have also been used as data in this study.

Qualitative interpretive content analysis was used as a method of analysis (Eriksson and Kovalainen, 2016). In the process of analysis, the research material was read several times in a cyclical research process that included analysis of the research material, reading theory on the topic, and gathering more data. Compared to quantitative content analysis that focuses on frequencies and deductive coding of the text, qualitative content analysis involves a broader, more careful reading of the text and inductive coding to explore themes, patterns, and meanings in the text. This approach allows for the exploration of novel theoretical and conceptual ideas without relying on preconceived categories or theories, and it is particularly useful when studying a new phenomenon with little existing research (Eriksson and Kovalainen, 2016). This approach was chosen for the study because of the novelty of commercialisation in personalised medicine.

The case organisation

Auria Biobank is a clinical biobank closely linked with the Turku University Hospital. The city of Turku is located in southern Finland, and it is Finland's original university town. Currently, the City of Turku is focusing on investing in health technology innovation and the area's business ecosystem. Auria Biobank was founded in 2012 by the University of Turku and three hospital districts, and it was registered as a biobank by the National Supervisory Authority for Welfare and Health in March 2014.

Auria is one of the eight biobanks in Finland. It was the first clinical biobank in Finland, and it has been the most active in supplying its data to outside research institutions and pursuing collaborations and commercial activity. There are five other clinical biobanks in Finland: Helsinki Biobank made fast advances in the collection of clinical databases and in collaborations with medical corporations in 2016, while the rest are just beginning to arrange their sample and patient data depositories. In addition to Finland's six clinical biobanks, the country also has a population-based, epidemiological biobank run by the National Institute for Health and Welfare, and a biobank focused on blood diseases. All biobanks in Finland have to undergo a registration process as defined in the 2013 Biobank Act (§688/2012).

The core of Auria Biobank is the depository of medical data, which consists of biological samples (blood, urine, biopsies, etc.), related bio information like DNA sequences, and patient data from hospital clinics. The biobank maintains and expands its depository, delivering data to appropriate medical research projects and partners, both public and private. Auria's objective is to capture all incomers, which means getting new samples from every patient enrolled in the hospitals of the three districts that founded it. The collection of new samples started in the spring of 2015. Most of Auria's samples are, however, old diagnostic samples transferred from the hospital collections to

the biobank. During the first three years of its operation, Auria managed to extend its depository to over one million samples, of which the biggest group is cancer-related samples. Auria is engaged with dozens of research projects with universities, pharmaceutical companies, and diagnostics and information and communication technology (ICT) enterprises. Collaborators include pharmaceutical giants Bayer, Roche, and Novartis. Some 40% of Auria's projects are with private companies.

Findings

Commercialisation in Auria Biobank

Auria Biobank is a public and academic institution, and its main purpose is to advance Finnish biomedical research. Auria collaborates closely with universities and research centres. It is also involved in developing commercial activity from biobanking. Auria's key actors reason that business activities and profitable collaboration with private enterprises and pharmaceutical companies are important, if not a necessity, in sustaining and developing biobanking activities. This is reflected in a comment by the CEO of Auria: "At least a half of the annual expenses of the biobank should be covered by our own funding received from business collaboration with private enterprises".

For Auria, the biobanking business is explicitly instrumental. This means that commercial success and profits are sought only to serve the maintenance of the crucial biomedical infrastructure and the development of better medical treatment. Despite this emphasis, many of Auria's activities focus on dealing with commercial collaboration and marketing biobank services. Thus, the commercialisation of biobank data and relevant aspects of data management in a manner that makes Auria competitive in the medical research business has become one of the biobank's key tasks. This emphasis emerged after Auria spent two years operating as a biobank, during which time "biobanking has appeared to be different in many ways from what we expected when founding it" as expressed by the CEO of Auria.

What makes Auria competitive and successful? According to interviews and public documents, Auria believes that becoming an 'attractive' partner for private enterprises and a target of private investment is the core of the biobank business. In this context, collaboration means sharing R&D activities with partners and investors. A biobank becomes attractive to a partner or investor if it has something unique to offer in medical R&D. According to the company's own evaluation, Auria is unique compared to its competitors around the globe for several reasons. First, Finland offers an environment for biomedical R&D not found anywhere else in the world, and Auria is the leading biobank in Finland. Finland's main assets in terms of biobanking are its public healthcare system, which maintains comprehensive patient records and medical and population registers in an electronic and easily accessible form; its extensive collections of tissue samples in biobanks; a high level of expertise in biomedical research and biobanking; citizens who are willing to donate samples and personal data for research; and popular trust in biomedical researchers and public authorities. This view is similar to those presented in documents on innovation policy relating to medical genomics and personalised medicine in Finland (STM, 2015, 2016; TEM, 2014).

Second, Auria's depository of data sets it apart in the global biobank business:

> "An essential potential for creation of value in Finnish biobanks is considered to be research data acquired by combining human tissue samples with information from electronic health records. In addition, Finland has an advanced institutional environment for carrying out such combinations of samples and health record data." (Selvitystyö, 2016)

Auria's depository of over one million data units is unique because the biobank can combine biological information (like DNA sequences) received from tissue samples with clinical data from hospital patient records. In collaborating with pharmaceutical and other medical companies, Auria's leaders learned that it is seen as an attractive partner particularly because it provides clinical data in a standard and accessible form and combined with precise biological data.

According to the Auria's CEO: "An interested researcher can see from our metadata how many breast cancer cases [with tissue samples] we have, and what ages, and what lab values attached, and what other ICD-10 diagnoses, and hormone statues, and other 458 H. Lehtimäki et al. available information". Such data are of great help in targeting biomedical research for drugs or diagnostic biomarkers. Auria's CEO noted that researchers "are particularly interested in our phenotype data. ... It is precisely the clinical data of our hospital patients which allows deep phenotyping, so that we can find exactly the right patient for the right study". This asset is embedded in and dependent on the systematic and advanced Finnish public healthcare system and public record keeping.

Third, Auria's expertise in managing its data collections makes it unique. Pharmaceutical and other medical companies are believed to be interested in datasets pulled from sample collections, patient records, and national healthcare and population registers. Auria is poised to meet this demand because it has developed advanced practices of data management that combine sample management, bioinformatics, and administrative expertise. Auria provides tailor-made and co-designed data from its depository to commercial partners. According to interviews and documents, Auria seems to consider its wide variety of flexible data management services for medical R&D to be the core (and the future) of its biobank business activity and collaboration with private enterprises. This view is reflected in Auria's public presence, as it lists, among others, real-life data analyses, consultation, feasibility studies, and tissue microarray in its services portfolio on its website (Auria Biobank, 2016). Auria's profile as a high-quality provider of sophisticated health data management services is congruent with the current emphasis on data-driven medicine in personalised medicine (Swan 2012; Topol, 2012). However, Auria's leaders believe the biobanks's competitiveness lies in one particular area:

> "What pharmaceutical companies might be very interested in is our potential to identify patients for clinical drug studies. ... I think that this stratification of research patients is almost the only thing that we can compete [in pharmaceutical trials with India or China]."

Sustainable value creation in biobanking

Auria's leaders believe that, despite being ahead of other clinical biobanks in Finland, the institution is still in an early phase of development and needs to change its activities to sustain biobanking successfully in the future. Many studies have pointed out that problems of sustainability are looming in the development and maintenance of biobanks and biobank networks worldwide (Albert et al., 2014; Caulfield et al., 2014; Tupasela et al., 2015; Vaught et al., 2011). Although the future

of medical genomics and personalised medicine is, to a great extent, built upon biobanks and their transnational networks, many biobanking experts and executives are concerned about whether biobanks will be able to maintain quality and expand their activities to meet scientific, ethical, and social standards in the future. They identify the following critical sustainability issues in biobanking: continuation of sufficient financing after the foundation and starting periods are over; means and resources to keep the data in biobank depositories usable, of high quality, and attractive for scientific and commercial users in an emerging situation with abundant genomic data available; maintenance of donor recruitment on a high enough level to keep biobank data extensive; and capability to maintain sufficient data protection and ethical standards. While Auria's key actors acknowledge these challenges, they consider commercialisation of biobank data and activities to be the primary way to respond. Accordingly, they tend to see commercial sustainability as the most crucial question of maintenance for biobanking. In their view, extensive and solid collaboration with affluent medical enterprises brings financial resources to Auria, justifies the company's requests in the eyes of public funders, and indicates the usability and quality of Auria's data. Therefore, in order to sustain biobanking in the future, Auria Biobank needs to develop commercial collaboration.

Auria's leaders emphasise that a major change in its business model is a move from single collaborative projects to strategic partnerships with big medical corporations. In concrete terms, this means establishing longstanding contracts in R&D collaboration between Auria and medical corporations, and investment in research facilities associated with Auria by big corporations or venture capital investors. In interviews with Auria's leaders and documents of their activities and plans for the future, four prerequisites for this phase of the biobank business become clear.

First, Auria must continue to extend its sample and data depositories into a nationwide collection or link the collections of the Finnish biobanks under a national biobank organisation. This is the main objective of the Finnish biobank policy and 'genome strategy' (STM, 2015, 2016). Such national centralisation is expected to make Auria and other Finnish biobanks more competitive in the global medical R&D business. Uniting or linking the depositories of Finnish biobanks, especially clinical biobanks, would multiply the available biological and clinical data, and extending the databases would make Finnish biobanks more attractive to commercial partners. In addition, a single national biobank centre – or 'joint operator' (STM, 2017) – would provide potential partners with simple, flexible access to the extensive yet manageable databases and data management services of Auria and other Finnish biobanks.

For regional biobanks like Auria, a merger with other regional clinical biobanks and, eventually, a national integration toward a Biobank Finland are complicated, problematic developments. Planning and negotiations about the management and utilisation of biobank and health data on a national scale are under way. This increases uncertainty about the development of Auria's activities and business model and halts its efforts at reform. The future is somewhat unclear: Will the domain of Auria's action remain more extensive than just the collection and storage of biobank data? What will be the role and power of the national genome center or joint operations in terms of accessibility to biobank data and commercial collaboration? What will the actual practices in commercial collaboration be, and will Auria be able to keep its autonomy when doing business with medical companies?

The second prerequisite for Auria's next phase of biobanking is the evolution of the company's structure. To take a step toward a strategic partnership with medical enterprises, Auria must adopt a

structure compatible with business collaboration. Auria is currently administered as a public institution in the framework of public bureaucracy. This is far from ideal for running and extending business activities. Alongside the ongoing integration process of biobank operations, Auria has started to change its organisational and legal structure. A major challenge in this change is matching its essentially public character with its commercial activities and making the company's new structure suitable for the organisation of the national joint operator. Interestingly, a cooperative company organisation is presented as beneficial in reports and discussions on biobank merger and operational integration (Selvitystyö, 2016; STM, 2016).

Third, because data management services associated with combining biological and clinical data are a major asset in the commercialisation of Auria's biobank services, Auria must improve its ICT and other data management expertise when developing its activities. Recently, Auria has begun collaborating with innovative enterprises specialising in ICT solutions for biomedical databases and biobanks. It is not clear if such collaborations will play a role in Auria's business strategy and what that role might be. However, they may have manifold potential beyond simple business-to-business services. Collaboration between Auria and a company specialising in ICT would increase the competitiveness of both companies and make them more attractive to other business partners in the global biomedical data management market.

The final prerequisite for Auria's next phase of biobanking is an increase in the number of people consenting to participate in biobank data collection. Auria is aware of an emerging challenge related to the collection of new samples for its depository. In public documents and interviews, Auria and its spokespersons have declared that the existence and success of the biobank would be impossible without the willingness of patients to donate tissue samples and personal data. They believe that general public trust is a cornerstone of biobanking. Worldwide, numerous studies and biobank experts acknowledge the degree of public trust as a pivotal factor influencing biobanking activities and their success (Gaskell et al., 2013; Hoeyer, 2012; Petersen, 2005; Tupasela and Snell, 2012).

Since its founding, Auria has focused on providing transparent information on its activities and collaborative projects, making information easily accessible to the public, and actively engaging with the public through its website, open events, and street campaigns. Spokespeople for the biobank are confident that through the active management of public relations, Auria has become relatively well known to people in its catchment area; they believe that a positive attitude toward and trust in the biobank remain steady. To their amazement, however, Auria has struggled to collect new samples and patient data, and the objective of catching all incomers is far from being realised. According to a survey conducted by Auria survey in 2015–2016, only 20% to 30% of patients in hospital clinics return the consent form for participation in the biobank, though practically all consent forms are positive. Such a loss in potential participants creates a bottleneck in the collection of new data. Auria is worried that this will greatly limit the usability of its data depository in the future because data collected may be neither large enough nor representative enough for use in future biomedical studies. This, in turn, would reduce Auria's competitiveness and jeopardise the maintenance of its functions. Thus, measures to increase the number of people who consent to participate in biobank data collection are seen as vital and urgent for sustaining Auria's biobanking.

Auria is confident that the loss of potential donors is not due to negative or suspicious attitudes toward biobanking by patients and the public. Auria's spokespeople have suggested a shift to an 'opt-out' model for recruiting donors for clinical biobanks. Under such a model, informed consent would be replaced by presumed consent, so that every patient in a public hospital or receiving other

healthcare services would have a tissue sample taken for the biobank. The electronic medical record (EMR) and other patient data would be automatically attached to the sample unless the patient personally opted out of such an arrangement. The opt-out model has been debated with both eagerness and hesitance in Finland.

Discussion

The present analysis depicts Auria Biobank as a public and academic institution that seeks to create value through commercial R&D activities and alliances with pharmaceutical and other medical companies that enable it to maintain and extend its data depository for biomedical research. In many ways, Auria Biobank follows the publicprivate partnership model initiated in the 1980s to boost the knowledge-based economy in the USA and other Western countries (Etzkowitz et al., 1988). Auria can also be seen as blurring the distinction between for-profit and non-profit business activities and merging pursuits for common good and private benefits, which many studies have claimed to be a major trend in biomedical startups and data-driven and digital healthcare businesses emerging in the early 21st century (Pálsson, 2009; Parry, 2004; Tutton and Prainsack, 2011). Auria operates between research and business, performing 'third stream' activities (Shore and McLauchlan, 2012) with a focus on the commercialisation of science. Today it is typical for public research institutions to engage in third stream activities, engendered by the idea that publicly funded science should be relevant to society. In this context, the economic aspects of social relevance serve as a basis and justification for the business activities and commercial partnerships of academic institutions like Auria, whose business revenues could be directed back to science.

Auria's business model includes elements of GDL, SDL, and the stakeholder approach in value creation through the commercialisation of innovation. The view that Auria's main asset in global medical R&D is the unique Finnish biological and medical data in its depository manifests the GDL of value creation. From this perspective, Auria does business by selling combinations of biological data from its tissue samples and clinical data from its patients' records to medical companies that see a particular value in those datasets for testing new drugs or diagnostic methods.

However, Auria sees more prospects for commercialisation in data management services associated with the combination of biological and clinical data. Its views on data management services are in line with the SDL of value creation. Auria is aiming to not only sell biobank services to medical companies, but also build up partnerships in medical R&D to benefit both parties' commercial activities. Auria considers pharmaceutical and other medical companies to be its primary partners in the cocreation of medical innovations and value; other Finnish biobanks, Finnish start-up companies in biomedicine and bioinformatics, healthcare institutions, and even patients and the public (as sample and data donors) are also potentially included in the sphere of partners for the creation of innovation and value. In any case, from both the GDL and SDL perspectives, the commercial value – or rather value potential – of Auria Biobank is embodied in its clinical data, not its tissue samples.

The stakeholder approach is visible in Auria's value creation and commercialisation of innovation as a result of the concern over the sustainability of biobank operations and the inherent future orientation of medical innovations based on health-related data. It can be argued that both the GDL and SDL are nested in the stakeholder approach to value creation in operations leading to future innovation. In Auria's case, the GDL is visible in the way Auria seeks to increase economic value

through collaboration with private companies and pharmaceutical corporations. Such stakeholder value creation is intended to build long-term sustainability for operations and future potential for the commercial competitiveness of the biobank. The value of collaboration is the creation of expertise, support for continuous innovation, and potential for cocreation of value in the future.

Both GDL and SDL activities are necessary to sustain Auria's data depository and build competence that is interesting and of value to stakeholders. In a future-oriented and promissory innovation activity, it is important that a company has the capability of envisioning potential for future value creation for all stakeholders. In Auria's case, and in biobanking in general, the future potential resides in the capability to co-create and communicate value to many different stakeholders, including the public, whose willingness to donate samples and share personal health data is a prerequisite for continuous innovation. In addition, the biobank must be capable of performing its value potential for legislators, whose interest and ability to create sustainable legal and regulatory conditions for biobanking are necessary for the innovation potential to materialise in the future.

It is notable that the values and value potential of Auria's business activities and partnerships are promissory and embedded in prospects and expectations. This is typical for the commercial environments of emerging sciences and technologies like biotechnology and biomedicine, in which business models and opportunities are wrapped in interrelated promises (Borup et al., 2006; Parandian et al., 2012). The promise of value is manifold: First, Auria is marketing a promise to medical corporations that its data and data management services will add value to their prospects for drug development or other medical R&D. Second, Auria's model for sustaining its biobank is based on prospects of future commercial collaboration with pharmaceutical and other medical companies. In Auria's view, the commercialisation of biobanking justifies the demands for public funding. Thus, from a business perspective, Auria concentrates on expectations and promissory values by maintaining and extending its depository of biological and clinical data and its portfolio of data management services.

To summarise, the commercialisation strategy of Auria Biobank is focused on customer value, and it utilises both close collaboration with customers and arms-length selling to customers. A broad use of commercialisation strategies is a strength in creating viable future business. It is important to note the role of society as a context for the commercialisation of innovation. Finland is a Nordic country characterised by a steady, generalised trust in public institutions, and customers have an initial positive outlook about being forerunners in future medical innovations. Due to Finland's stable, trust-based society and national pride in education and innovation, Finnish biobanks have a unique opportunity for building sustainable commercialisation. This provides a solid basis for building a good reputation and value-creating relationships with various stakeholders in commercialisation.

Conclusions

This study has presented an inductive case study on the commercialisation of sciencebased innovation in an emerging field with great future potential for disruptive innovation in medicine and healthcare. The results of this study show that commercialisation in an emerging industry involves engagement in both planned and emergent commercialisation activities. They also demonstrate how the three logics of commercialisation – goods dominant logic, service dominant logic, and

stakeholder value creation – must be identified in order to create sustainable value for science-based operations through commercialization. This study contributes to the literature on the commercialisation of science-based (Shore and McLauchlan, 2012) and health innovations (Nicolini, 2010) by presenting an interpretive case on commercialisation and remaining sensitive to contextual conditions in biobanking and the development of personalised medicine.

Acknowledgements

The authors wish to thank the Academy of Finland for financial support (project number 292492) on this project and Auria biobank for research collaboration.

References

Aarikka-Stenroos, L., Sandberg, B. and Lehtimäki, T. (2014) 'Networks for the commercialization of innovations: a review of how divergent network actors contribute', Industrial Marketing Management, Vol. 43, No. 3, pp.365–381.

Albert, M., Bartlett, J., Randal, N., Schacter, B. and Watson, P. (2014) 'Biobank bootstrapping: is biobank sustainability possible through cost recovery?', Biopreservation and Biobanking, Vol. 12, No. 6, pp.374–380.

Auria Biobank (2016) Auria Biobank Services [online] https://www.auriabiopankki.fi/auriabiopankin-palvelut/?lang=en (accessed 15 May 2016).

Borup, M., Brown, N., Konrad, K. and Van Lente, H. (2006) 'The sociology of expectations in science and technology', Technology Analysis & Strategic Management, Vol. 18, Nos. 3/4, pp.285–298.

Caulfield, T., Burningham, S., Joly, Y., Zubin, M., Shabani, M., Borry, P., Becker, A., Burgess, M., Calder, K., Critchley, C., Edwards, K., Fullerton, S.M., Gottweis, H., Hyde-Lay, R., Illes, J., Isasi, R., Kato, K., Kave, J., Knoppers, B., Lynch, J., McGuire, A., Meslin, E., Nicol, D., O'Doherty, K., Ogbogu, U., Otlowski, M., Pullman, D., Ries, N., Scott, C., Sears, M., Wallace, H. and Zawati, M. (2014) 'A review of the key issues associated with the commercialization of biobanks', Journal of Law and the Biosciences, Vol. 1, No. 1, pp.94–110.

Datta, A., Mukherjee, D. and Jessup, L. (2014) 'Understanding commercialization of technological innovation: taking stock and moving forward', R&D Management, Vol. 45, No. 3, pp.215–249.

Eriksson, P. and Kovalainen, A. (2016) Qualitative Methods in Business Research, 2nd ed., Sage, London.

Etzkowitz, H., Webster, A. and Healey, P. (1998) Capitalizing Knowledge: New Intersections of Industry and Academia, State University of New York Press, Albany.

European Science Foundation (ESF) (2012) Personalised medicine for the European citizen. ESF Forward Look, European Science Foundation, Strasbourg.

Freeman, R.E., Harrison, J. and Wicks, A. (2007) Managing for Stakeholders: Survival, Reputation, and Success, Yale University Press, London.

Freeman, R.E., Wicks, A.C. and Parmar, B. (2004) ‘Stakeholder theory and ‘the corporate objective revisited’’, Organization Science, Vol. 15, No. 3, pp.364–369.

Gans, J.S. and Stern, S. (2003) ‘The product market and the market for ‘ideas’: commercialization strategies for technology entrepreneurs’, Research Policy, Vol. 32, No. 2, pp.333–350.

Gaskell, G., Gotweis, H., Starkbaum, J., Gerber, M.M., Broerse, J., Gottweis, U., Hobbs, A., Helén, I., Paschou, M., Snell. K. and Soulier, A. (2013) ‘Publics and biobanks: pan-European diversity and the challenge of responsible innovation’, European Journal of Human Genetics, Vol. 21, No. 1, pp.14–20.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2012) ‘Seeking qualitative rigor in inductive research: notes on the Gioia methodology’, Organizational Research Methods, Vol. 16, No. 1, pp.15–31.

Harrison, J.S. and Wicks, A.C. (2013) ‘Stakeholder theory, value, and firm performance’, Business Ethics Quarterly, Vol. 23, No. 1, pp.97–124.

Harrison, J.S., Bosse, D.A. and Phillips, R.A. (2010) ‘Managing for stakeholders, stakeholder utility functions, and competitive advantage’, Strategic Management Journal, Vol. 31, No. 1, pp.58–74.

Hoeyer, K. (2012) ‘Trading in cold blood?: trustworthiness in face of commercialized biobank infrastructures’, in Dabrock, P., Taupitz, J., and Ried, J. (Eds.): Trust in Biobanking, pp.21–41, Springer, Frankfurt am Main.

Hood, L. and Friend, S.H. (2011) ‘Predictive, personalized, preventive, participatory (P4) cancer medicine’, Nature Reviews Clinical Oncology, No. 8, No. 3, pp.184–187.

Kirchberger, M.A. and Pohl, L. (2016) ‘Technology commercialization: a literature review of success factors and antecedents across different contexts’, Journal of Technology Transfers, Vol. 41, No. 5, pp.1077–1112.

Kujala, J., Lehtimäki, H. and Myllykangas, P. (2017) ‘Value co-creation in stakeholder relationships: a case study’, in Freeman, R., Kujala, E.J. and Sachs, S. (Eds.): Stakeholder Engagement: Clinical Research Cases, pp.15–30, Springer, Dordrecht.

Mattila, M. and Lehtimäki, H. (2016) ‘Networks in technology commercialization’, South Asian Journal of Business Management Cases, Vol. 5, No. 1, pp.1–12.

Montonen, T., Eriksson, P., Asikainen, I. and Lehtimäki, H. (2014) ‘Innovation empathy: a framework for customer-oriented lean innovation’, International Journal of Entrepreneurship and Innovation Management, Vol. 18, Nos. 5/6, pp.368–381.

NAS (2011) Toward Precision Medicine, National Academies Press, Washington.

Näsi, J. (1995) ‘What is stakeholder thinking?’, in Näsi, J. (Ed.): Understanding Stakeholder Thinking, pp.19–32, Gummerus, Jyväskylä.

Nicolini, D. (2010) ‘Medical innovation as a process of translation: a case from the field of telemedicine’, British Journal of Management, Vol. 21, No. 4, pp.1011–1026.

Pálsson, G. (2009) ‘Biosocial relations of production’, Comparative Studies in Society and History, Vol. 51, No. 2, pp.288–313.

Parandian, A., Rip, A. and Te Kulve, H. (2012) 'Dual dynamics of promises, and waiting games around emerging nanotechnologies', Technology Analysis & Strategic Management, Vol. 24, No. 6, pp.565–582.

Parry, B. (2004) Trading the Genome: Investigating the Commodification of Bio-Information, Columbia University Press, New York.

Petersen, A. (2005) 'Securing our genetic health: engendering trust in UK Biobank', Sociology of Health & Illness, Vol. 27, No. 2, pp.271–292.

Post, J.E., Preston, L.E. and Sachs, S. (2002) 'Managing the extended enterprise: the new stakeholder view', California Management Review, Vol. 45, No. 1, pp.6–28.

Ramirez, R. (1999) 'Value co-production: intellectual origins and implications for practice and research', Strategic Management Journal, Vol. 20, No. 1, pp.49–65.

Roloff, J. (2008) 'Learning from multi-stakeholder networks: issue focused stakeholder management', Journal of Business Ethics, Vol. 82, No. 1, pp.233–250.

Rühli, E., Sachs, S., Schmitt, R. and Schneider, T. (2017) 'Innovation in multistakeholder settings: the case of a wicked issue in health care', Journal of Business Ethics, Vol. 143, No. 2, pp.289–305.

Rynes, S. and Gephart Jr., R.P. (2014) 'Qualitative research and the 'Academy of Management Journal'', Academy of Management Journal, Vol. 47, No. 4, pp.454–462.

Selvitystyö T. (2016) Ja Tyksin erityisvastuualueiden biopankkien yhdistämisestä, Unpublished report, Auria, Turku.

Shore, C. and McLauchlan, L. (2012) 'Third mission activities, commercialisation and academic entrepreneurs', Social Anthropology, Vol. 20, No. 3, pp.267–286.

Soini, S. (2013) 'Finland on a road towards a modern legal biobanking infrastructure', European Journal of Health Law, No. 3, pp.289–294. STM (2015) Parempaa terveyttä genomitiedon avulla. Kansallinen genomistrategia: työryhmän ehdotus (24/2015), Ministry of Social Affairs and Health, Helsinki.

STM (2016) Report of the Expert Group Appointed to Evaluate the Integration of Finnish Biobanks, Ministry of Social Affairs and Health, Helsinki.

STM (2017) Biobanks Finland: Joint Operator, Ministry of Social Affairs and Health, Helsinki.

Svendsen, A., Boutlier, R., Abbott, R. and Wheeler, D. (2002) Measuring the Business Value of Stakeholder Relationships, Centre for Innovation in Management, Simon Fraser University, Vancouver.

Swan, M. (2012) 'Health 2050: the realization of personalized medicine through crowdsourcing, the quantified self, and the participatory biocitizen', Journal of Personalized Medicine, Vol. 2, No. 3, pp.93–118.

Szmigin, I. and Rutherford, I. (2013) 'Shared value and the impartial spectator test', Journal of Business Ethics, Vol. 114, No. 1, pp.171–182.

Teece, D.J. (2009) Dynamic Capabilities and Strategic Management: Organizing for Innovation and Growth, Oxford University Press, New York.

TEM (2014) Terveysalan tutkimus-ja innovaatiotoiminnan kasvustrategia (12/2014), Ministry of Employment and the Economy, Helsinki.

Topol, E. (2012) The Creative Destruction of Medicine, Basic Books, New York.

Tupasela, A. and Snell, K. (2012) 'National interests and international collaboration: tensions and ambiguity among Finns towards usages of tissue samples', New Genetics and Society, Vol. 31, No. 4, pp.424–441.

Tupasela, A., Snell, K. and Canada, J. (2015) Patients, Business and the State: Translating Health Information into Sustainable Benefits (322/2015), Tekes, Helsinki.

Tutton, R. (2014) Genomics and the Reimaging of Personalized Medicine, Ashgate, Farnham.

Tutton, R. and Prainsack, B. (2011) 'Enterprising or altruistic selves?: making up research subjects in genetics research', Sociology of Health & Illness, Vol. 33, No. 7, pp.1081–1095.

Vargo, S., Maglio, P.P. and Akaka, M.A. (2008) 'On value and value co-creation: a service systems and service logic perspective', European Management Journal, Vol. 26, No. 3, pp.145–152.

Vargo, S.L. and Lusch, R.F. (2004) 'Evolving to a new dominant logic for marketing', Journal of Marketing, Vol. 68, No. 1, pp.1–17.

Vargo, S.L. and Lusch, R.F. (2008) 'Service-dominant logic: continuing the evolution', Journal of the Academy of Marketing Science, Vol. 36, No. 1, pp.1–10.

Vaught, J., Rogers, J., Carolin, T. and Compton, C. (2011) 'Biobankonomics: developing a sustainable business model approach for the formation of a human tissue biobank', Journal of the National Cancer Institute Monographs, No. 42, pp.24–31.

Yuille, M. (2011) 'Infrastructure vital to genome success', Nature, Vol. 471, No. 7337, p.166.

Yuille, M., Gert-Jan van Ommen, G-J., Brechot, C., Cambon-Thomsen, A., Dagher, G., Landegren, U., Litton, J-E., Pasterk, M., Peltonen, L., Taussig, M., Wichmann H-E. and Zatloukal, K. (2008) 'Biobanking for Europe', Briefings in Bioinformation, Vol. 9, No. 1, pp.4–24.