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Disruptive innovation in the Nordic Countries' healthcare systems

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Abstract: The Nordic Healthcare model is recognized to be one of the most innovative in the world. Here billions of USD is annually invested in developing new treatments, drugs, robots etc. to diagnose and cure diseases. However, our review determines that there is a fundamental shortcoming in the system that supports healthcare innovation: it is biased towards a myopic focus on product, process and financial innovations. Innovations are thus created as inventions *within* the system and this contributes with increased costs that are out of proportion with existing healthcare budgets. By utilizing the Vertical Innovation Process framework to analyse the current state-of-the-art in healthcare research projects, we establish that very little attention is given to disrupt the healthcare system at a macro level: here we claim that stand alone inventions should be rethought into the entire healthcare system to create a larger impact. Finally, we discuss that existing performance measures are not appropriate to foster radical or disruptive innovation: new measuring points should be explored into a vertical concept model to disrupt the system, and to avoid the existing rapid increase of costs in the Nordic healthcare system.

Keywords: Disruptive innovation; healthcare system; public private collaboration; radical innovation; best practice review, vertical innovation,

1. Introduction

The Nordic Countries, represented by Denmark, Finland, Norway, Iceland and Sweden as well as the three autonomous areas: the Faroe Islands, Greenland and the Åland Islands, need fundamental changes in their healthcare systems to cope with increased societal demands. The need for change is evident: the healthcare spending *per capita* has

increased drastically since 1998 and it has for years been above the average compared to other OECD-countries (Norden, 2010; The Economist 2011). E.g. from year 2000 to 2012 Denmark had a 43 percent overall increase in healthcare spending. It is however the only Nordic country that has experienced a slight decline in healthcare costs since 2010, whereas the Norwegian healthcare system has had large cost overruns continuously every year (Norden, 2010).

1.1 Background

The Nordic healthcare model is based on social responsibility. It was created back in the 1890s as a unique system rooted in neighborly love. Here the state took care of its citizens without expectation of, or claim of refund. Although there are differences between the Nordic countries' healthcare systems, they are founded on the same societal basis which makes them comparable. Therefore, the individual Nordic systems are often referred to as the 'Nordic welfare model' (Christiansen et al., 2006). The Nordic welfare model is not only limited to healthcare activities; it also involves education, pension, infrastructure, etc. for its citizens. Even though the model has been adjusted several times since the creation in 1890-ies, it has led to the world's highest tax rates and to the best governed countries in the world (The Economist, 2013).

1.2 The drivers of innovation in healthcare

To respond to the increase in demand and to provide equal level of service for the region's 25 million inhabitants with the same or a less amount of resources spent, policy makers have in recent years increasingly invested public funds in healthcare innovation activities. The establishment of innovation centers has assisted private organizations in diffusing their inventions. Furthermore, science incubators and technology transfer offices in have been created near university hospitals to support entrepreneurship and licensing activities of inventions to boost the level of innovation *within the healthcare system* (Norden, 2010). The problem with the current system to support healthcare innovation is that it focuses primarily on micro level initiatives and no or very limited efforts are made to integrate these inventions into the total healthcare system (Danske Regioner, 2012; Länsisalmi et al. 2006; also Eggers et al., 2012). It is governed by a myopic 'one problem, one solution' perspective.

Seen from a macro perspective, the only focus that policy makers and legislators have on innovating the healthcare system is to develop new ways of financing the offers. E.g. Eggers et al. (2012), Gillison et al. (2009) and Bertelsen et al. (2013) draw attention to delivering more and/or better services for lower costs by focusing on radical efficiency. Here pilot projects are made to rethink *the system* and not only one element *within the system* (e.g. Danske Kommuner, 2010). The strict focus on cash-flow between the regional, municipal and university hospitals (as well as the private hospitals) has promoted different payment methods in the Nordic model: private insurances complementing the public tax-paid insurance, 'Diagnosis-related Group' (DRG) payments and 'fee-for-service' payments, but no research has yet demonstrated that one model is better than the other (Kjellberg et al. 2009). Thus, focus is directed at moving cash around in the system in different ways. Alas for immense work on the financial perspective, no savings have yet been found due to the efforts and standard indicators on hospital performance show no difference when comparing the different financial systems (ibid.). Simultaneously with the work on financing the healthcare system, attention has been given to performance contracting initiatives to reduce costs in the Nordic model. Here collective procurement is emphasized to strengthen bargaining power and reduce overall prices in the context of public tendering, but mainly oriented towards conducting optimized procurement procedures defined as public-private innovation. Although a

smart initiative, it is not innovation, it is simple business acumen camouflaged as innovation.

Although significant resources are allocated to promote standalone inventions in healthcare, the main reason for a 12 percent productivity improvement from 2007 – 2011 in Denmark was the establishment of new super-hospitals. However, the 12 percent saving has not led to any significant productivity improvement when comparing it to the society's increased demands for healthcare: the public expenses for healthcare increased more than 12 percent during the same period. What has been affected positively is the improvement of curing rates and thus the contribution to overall better public health by introducing new therapies, new drugs, etc. (Norden, 2010; Danske Regioner, 2012)

1.3 Purpose and goal of the study

We claim that this strict focus on single variables (standalone inventions) in the Nordic healthcare system often is a barrier to the creation of disruptive and/or radical innovation in practice. This is a fundamental issue in all aspects of new public management and the Nordic model is no different (Gillison, Horne and Baeck, 2010; Bertelsen et al. 2013; Eggers et al. 2012). Therefore, instead of promoting the current 'one problem, one solution' innovation system, we stress that rethinking the Nordic healthcare system into a business model framework could provide researchers and practitioners with new inspiration. To some extent, this is what is done when the new super-hospitals are projected and established: all established patterns are rethought. This study consequently seeks to describe the current understanding of the Nordic healthcare system from a business model perspective. The **purpose** of doing this is to enable us to disrupt the current healthcare innovation support practices in the Nordic model. This is done by analyzing the Nordic healthcare system in the 'Vertical Innovation Process' framework (Jakobsen and Brix, 2012), which is a systematic radical innovation model that seeks macro level outcomes based on standalone inventions (see more below). The **goal** of the study is therefore to disrupt the existing support system of healthcare innovation and to develop new propositions that can 1) generate greater impact with same public expenditure; 2) inspire policymakers for radical changes; and 3) guide future research.

2. Current understanding

The current practice of developing innovations in the Nordic healthcare system is divided into two large silos: private companies and public organizations. See the sections below:

2.1 Private companies in healthcare

The Nordic countries, especially around southern Sweden and Denmark, have a very large and extensive biotechnological and technical medical device industry[1] specialized in insulin, asthma medicine, pills, stoma, blood purification equipment, hearing aids, scanners, etc. Invention activities of these companies are focused on their core business areas and there is a historic extensive cooperation between industry and universities. Two thirds of the healthcare companies in Denmark have less than 50 employees, and these small businesses account for 25 percent of the industry's turnover. The companies

[1] http://www.mva.org/about-mva

typically act on a narrow and focused technology and/or business, often based on an earlier invention which has been gradually improved, modified etc. Companies like these contribute greatly with new inventions, new products and new services.

2.2 Public support for healthcare innovation

The innovation activities in the Nordic healthcare system are, on the other hand, primarily limited to four types of organized entities that are engaged in the cure of ailments and diseases:

- **University hospitals:** have experienced rapid growth in both size and numbers in the past decades. These units have changed the overall understanding of the Nordic models for healthcare, as the creation of these units has involved at lot of new procedures, technologies, working routines etc. Moreover, there are more than 10.000 PhD students in the Nordic countries connected to the hospitals as researchers mainly inventing new ways of handling diseases
- **Public hospitals:** have been reduced in numbers in recent years. E.g. in 2012 there were 53 hospitals in Denmark which represents a reduction of 50 percent compared to 1990. However, eight new super-hospitals have been established during the same period.
- **Private hospitals:** are mainly financed through private insurances or health insurances bought by companies for their employees. Often private hospitals operate in specific and detailed treatment segments, and private hospitals and clinics are less important for the entire healthcare system in the Nordic countries. The value of private healthcare production in Denmark is estimated at 1 billion Euros, equivalent to 2.2 percent of the total disease treatment budget in Denmark.
- **Military hospitals:** to many countries a significant factor in the healthcare system. It is however inferior in the Nordic countries healthcare system.

2.3 The fall of Nordic healthcare system

We argue, that even though much attention is given to develop new healthcare products and work processes, the activities and not least the investments do not live up to their full potential. The shortcoming is due to no incentives and only very limited funding to explore meso or macro level perspectives of new inventions, and there is hence no incentive to change the overall systems based on these inventions (Rasmussen and Obel, 2012). Alas for the taxpayers in the Nordic countries no disruptions have been created (cf. Christensen, Anthony and Roth, 2004) to facilitate a more efficient or innovative system for healthcare (also cf. Ratten, 2012). It is thus safe to say that the Nordic healthcare system fails to live up to the late Schumpeterian criteria (Schumpeter, 1949) requiring the creation of innovation even though a vast amount of public fundss are invested.

To make our point clear: some of the most significant inventions incorporated in the general healthcare sector over the last 25 years are e.g. CT/MR scanners (for diagnosis), ACE-inhibitors (medicine) and Angioplasty (surgery). Fundamentally, the significant

impact of these inventions and discoveries in the healthcare system are not only based on the individual idea itself, but just as much on the way the invention is thought into an innovation system as a vertical integrated activity (see example appendix 1). CT scanning was e.g. granted patent in 1975, but it was not based on a new discovery. As early as 1895 the German physicist Wilhelm Röntgen invented X-ray technology, but the method did not become a central part of the complete diagnosis system before 1971 where the British engineer Godfrey Hausfield and South Africa-born physicist Allan Cormach used the technology to create 3d diagnosis of patients called CAT scanning. Even the CAT scanning technology improved the X-ray technology in several ways, and even the complimentary technology f-MRI scanning in 1977 again improved the possibility to make precise images of the body – a technology also based upon an old discovery done by the Hungarian-born inventor Nikola Tesla in 1882. Therefore, the scanning technology is not limited to a single invention, but have become a mainstay for diagnosing somatic diseases, new education to handle the machinery was created (radiographer), new practices and work routines were established, new software support systems to analysis the pictures were developed, doctors and nurses learned to analyze pictures across the somatic disciplines, etc. Hence, what we consider to be a state-of-the-art invention is therefore not limited to the invention itself, when referring to innovation in the healthcare sector – other more radical approaches in the vertical process need to be made to let an invention become a disruptive activity to the healthcare system.

Based on the limited funding that exists, there are projects and initiatives at meso-level that are starting to sprout. E.g. Danske Regioner's (2012) initiatives seek to increase collaboration, both at administrative and medical level, between the regional and the municipal healthcare systems in Denmark. Another example of the concrete striving for radical innovation at the meso-level is the emergency medical care, which is undergoing the largest reorganization in decades. Here new emergency departments are being established and the number of acute hospitals is reduced from more than 40 to 21 in Denmark[1].

Unfortunately, the only current tendency on macro level initiatives is, as mentioned in the introduction, directed at the way healthcare is financed by proposing different cash flow systems and evaluating pro's and con's for these. Complementing this finance perspective, the Nordic system now invests heavily in performance contracting. Here focus is on cutting costs (collective procurement) and to make the systems within the healthcare system both more efficient and more effective. Moreover, areas such as efficiency and sustainability are claimed to be revolutionized by focusing on an increased use of 1) ICT-systems in healthcare, e.g. 'Telehealth', 'E*health records', 'E*prescriptions'; 2) New technologies, e.g. surgical tools, rehabilitation robotics, diagnostic technologies as well as waste-management technologies to reduce CO2 emissions from the hospitals (LCB-Healthcare, 2012).

Hence, current innovation initiatives are camouflaged as meso- or macro level projects while focus still remains on single-variable initiatives. We claim that these innovation activities are not radical enough to rethink and create disruptions in the macro-level healthcare system. Therefore, most innovation activities still act as treatment of a symptom instead of treatment of a cause in the expensive Nordic healthcare model. It is this bias – or rather 'skilled incompetence' within the system, we seek to disrupt by analyzing and proposing a new direction for the Nordic model in this paper.

[1] http://icoa.au.dk/news/single/artikel/big-data-and-organization-design-can-create-effective-emergency-departments-at-hospitals/

3. Research method

Based on Zott, Amit and Massa's (2011) review and critique of contemprorary research on business modelling, we choose to utilize the VIP framework (Jakobsen and Brix, 2012) to analyse the Nordic healthcare system as a single casestudy (Yin, 2009; Eisenhardt; 1998). This deliberate choice is made because the VIP framework focuses on the creation of concept modelling which can lead to business model *innovation*. Other business model frameworks, e.g. Kagermann, Christensen and Johnson's (2007) 'Innosight model' and Osterwalder and Pigneur's (2010) 'Business Model Canvas' focus on business model *commercialization,* which is not the purpose of this exploratory study. Especially because the healthcare system in the Nordic countries do not need perspectives of commercialization: there are already 'too many' customers, and the numbers are increasing rapidly. The purpose of utilizing the VIP method to analyze the Nordic model is to demonstrate that the shortcoming of the current invention-biased innovation system reduces the full potential of creating radical change and thus improved service with e.g. lower costs for tax payers. The goal is to develop propositions that can guide legislators to move (at least some of) the current incentives from invention-based activities towards innovation-based activities.

Figure 1: the 'Vertical Innovation Process' framework

The content that must be found and developed for each of the nine levels of inquiry in the VIP is explained in table 1 below. The relevancy of utilizing the VIP framework to analyze the Nordic healthcare system is that the framework goes beyond product, process and financial perspectives, where areas of inquiry such as politics, business, social, cultural and system are developed to seek potential of the invention in a larger

perspective and to strengthen the acceptance of the new invention amongst the users (social), the patients (business) and society/community (culture).

Table 1: the content of the VIP framework

Area of Inquiry	Explanation of content
Product	How technologies, techniques and design approaches are to be used in the construction of the product
Process	How to produce the product and/or to provide the service including the buying or selling rights
Business	How to meet/interact with the customers and/or users; including branding, creation of needs and relationship building
System	How 'the subject' interacts with other products, services and systems, both internally and externally to the organization
Social	How to get acceptance of 'the subject' by users and partners and their motivation to use the product, service and/or system
Financial	How to finance the system, how the cash/flow will be conducted and how the cash/flow is financed
Cultural	How to adapt to the habits in the target group(s), the communities, the branch and society, including written and unwritten rules/customs
Political – Legislative	How decisions are reached and made including addressing barriers (opportunities) such as laws, legislation and competitive tendering in the context of the new idea
'Other'	What might also be affected beside the eight areas of inquiry above

Source: Jakobsen and Brix (2012)

The purpose of analyzing the Nordic model in the VIP framework is to demonstrate that the inventions that create disruptions are the ones that affect more than one level of analysis in the healthcare system. By doing this we can determine that the myopic product, process or financial focus must be broadened when new inventions or measurement points are developed and introduced in healthcare systems to deliver value beyond single variables. To see how the VIP is used to describe an innovation instead of a single invention by systematic search and creations of disruptions, see our example in appendix 1.

4. The Nordic healthcare system: presenting the case

The current state-of-the-art in healthcare innovation projects is systematically presented as an overview in the Vertical Innovation Process framework (Jakobsen and Brix, 2012) below. The content has been found and integrated based on close collaboration with medical experts, regional and national healthcare professionals, GPs, and healthcare consultants who have guided our literature search. The mapping in table 3 below shows, as seen from the Nordic Countries, a majority of single area activities, where activity related products (inventions), process (new logistically optimized hospitals) and mainly financial activities (contracting performance) represent the majority of the innovation activities.

Table 2: Extract of state-of-the-art in healthcare innovation

Level	Content	References
Product	*ICT for healthcare* (Electronic Health Records, prescriptions, Telehealth, etc.) *Innovative Materials and Devises* (smart fabrics and interactive textiles; in vitro fertilization (IVF); artificial pacemaker) *Technologies to improve procedures* (Novel surgical tools, rehabilitation robotics, new diagnostic systems; self-diagnostic systems; blood pressure monitor; insulin pump; pregnancy tests; fMRI scanner; endoscopy; DNA tests; IBM Watson for oncology;) *Technologies to improve operational procedures* (Infection control and cleaning solutions) *Technologies to reduce environmental impact* (low carbon energy solutions, water and waste management)	EcoQUIP (2013); MedTech Europe (2012); The Economist (2011);
Process	Proactive communication and collaborative approach between suppliers, customer and value chain, and between customer stakeholders; early engagement in supply-chain, outcome-based specifications on contracts; whole-life costing; support wider market development; be creative and flexible; integrated care improves patient outcomes and reduces costs; multi-chronic diseases are more expensive to cure than single diseases (multiple systems are engaged); 'cancer package' (Denmark); Design and establish new hospitals based on ideal processes	OECD (2011) WHO (2009) Danish Regions (2012); Norden (2010); Bertelsen et al. (2013); Eggers et al (2012)
System	'Touch points'; doctor to patient (D2P) communication; doctor to doctor communication (D2D); Patient Recorded Outcomes Measures (PROMs) – patient evaluation of doctor's intervention; Electronic patient records; interactive healthcare websites; health clubs (fitness, etc.);	Bechmann (2012); The Economist (2011); EcoQUIP (2013) Bertelsen et al. (2013); Kjellberg et al. (2009)
Business	Prevention campaigns | programs; higher demands from informed patients and larger demand for technology that cure one problem is expensive; user-driven dialogues; health promotion	WHO (2009); Danish Regions (2012); Norden (2010); Gillison et al. 2010
Social	Satisfaction with current routines in the hospitals; job-functions are clearly marked; Skills gap; reduce costs of daily operations; good work environment leads to less re-admissions;	EcoQUIP (2013); Hildebrandt (2000); McHugh and Chenjuan (2013);
Financial	Healthcare systems that rely on government funding will not see significant cash infusion to meet growing cost pressure; Block budgets; fee-for-service payment; diagnosis-related groups (DRGs); Pay-for-performance (P4P); using case-mix payments; capitation funding; bundling payments to doctors and hospitals; prospectively or reimbursed treatments; Accountable Care Organization (ACO), Performance Contracting; government funded or private insurance?; Activity-based funding; Integrated care model | managed care model; articulate value for payers, patients, policy makers, hospitals, health professionals, and society; private health insurance in Denmark (even though everyone is publically secured!);	Wagner (1998); Coleman et al. (2009); Kodner and Spreeuwenberg (2002); Glickman and Peterson (2009); Charlesworth, Davies and Nixon (2012); O'Reilly et al. (2012)
Cultural	highly coordinated healthcare system (environmental issues, prevention, monitoring public health, and warnings in case of emergencies) workforce shortage; reduce burden on hospitals; prevention rather than treatment; work loss due to illness; Lifestyle choice and chronic diseases;	EcoQUIP (2013); DICE (2002) The Economist (2011)
Political – legislative	Union jurisdiction demark job functions between doctors and nurses; different demands to regional vs. municipal hospitals; super hospitals; new healthcare centers; healthcare reforms; new super-hospitals disrupt old routines	Danish Regions (2012) Norden (2010)

Source: authors' elaboration

5. Results and propositions

Our review in table 3 above demonstrates strong tendencies which support our introductory claims: that current innovation activities in the Nordic healthcare system are based upon single-variable initiatives with a strong biased focus on strengthening/maintaining the 'old and traditional' expensive Nordic model. For example the strong focus on products and technology to support surgical procedures adds costs to the healthcare system and not necessary a financial return on investment. Innovation projects as the ones described in the product and process areas of inquiry have not been rethought into the system; they have served with improvements to the treatment of illnesses. And this is good, naturally. However, when relating to the increase in expenditure and the costs to the tax payers, this approach has led politicians to focus on the financial aspect of the healthcare system, since they are responsible for the significant cost overrun and budget increases (that has occurred in most of the Nordic countries, especially in Norway). As a response the national states, in order to fully or only partly to pay the expensive bill, have attempted with financial control systems based upon performance contracting (see 'financial' area of inquiry for examples).

Based on these insights it is therefore possible to develop the first three propositions all based on the premise that 'you get what you measure' (Jakobsen et al. 2008):

1. *Innovation projects in the Nordic healthcare sector are biased towards new products!* The large number of PhD students and researchers are assessed on the basis of the numbers and quality of published articles and not in terms of innovation results in healthcare

2. *Innovation projects in the Nordic healthcare sector are biased towards new processes as logistic optimization systems!* A large number of newly built super hospitals are listed with clearly defined benchmarks on logistics and streamlined processes

3. *Innovation projects in the Nordic healthcare sector are biased towards financial solutions managed through performance contracting!* Performance targets are typically based on e.g. number of beds, duration of hospitalization, etc. to measure and ensure improved performances.

The first propositions provide continuously increased costs at a rate, which the optimized process systems and related measures (defined by proposition 2 and 3) cannot meet. The introduction of new therapies will only continue to rise to spiralling costs unless they are understood as a fundamental vertical function for healthcare; as a system not limited to a treatment system, that is. This is argued, because the integration of e.g. the business (interaction with the patient), social (new way of processing, internal change) and/or cultural part (changing habits amongst patients) of the vertical process is not considered in the current innovation practices. As an example: the self-diagnosis of patients with high blood pressure, which is controlled and monitored at home will have to be repeated (again) when consulting the GP, even though the technology, culture and system have provided new possibilities to eliminate this unnecessary double checking.

The fourth and fifth and sixth propositions therefore suggest:

4. *There are no or limited coherence between the different vertical steps, as new innovation activities are based on pushing for single breakthroughs with sub-optimized measurement points!*

5. *Disruptive and radical innovation activities are almost completely within the domain of the construction of new modern hospitals with a biased focus on process innovation; e.g. optimized routines, procedures and logistics!*

6. *Disruptive innovation occurs when all levels in the vertical innovation approach are integrated!*

It is seldom that technology transfer and licensed inventions lead to innovation that revolutionizes the healthcare sector, although it may contribute to improved earnings for the innovating enterprise. As stated before, this mainly contributes with new additional costs reasoned in new diagnostic methods or new treatments. This is evident, even though the projecting and construction of new super-hospitals have provided a 12 percent improvement. However, we stress that the myopic focus on new therapies, new robots and the improvement of productivity in the Nordic healthcare model cannot keep up with the increased cost that healthcare is facing due to an aging population. It is not the new buildings *per se* that makes the difference. What then makes the difference? It is the social acceptance of the critical questioning of the existing skilled incompetence's and myopic routines that removes assumptions and taken-for-granted attitudes towards what a reasonable and functional system is (e.g. cf. Brix, in press; Brix and Jakobsen, 2013).

7. Implications

Researchers, policymakers and legislators in the Nordic Countries must revise and challenge the assumptions that are made on existing performance measures in the healthcare system. The practice of clearly defined and very narrow metrics promote inventions and more incremental innovations, but the Nordic health sector challenge requires a much more radical approach as well as broader defined and vertically anchored measurement points. The key message of our study is clear: *the existing model to measure the healthcare system is defined by measurement points that are inadequate, because they do not provide sufficient disturbance in the system.* For example, it contributes to increased or decreased waiting times; instead of cheaper treatments.

Disruptions in the health sector are therefore not only based on inventions, but in the way new inventions, new treatments and new cures are implemented in hospitals and subsequent rehabilitation centers. New inventions have to be vertically integrated to ensure the healthcare system can cope with the increased cost new possibilities provide, even though they provide perfect treatment or diagnosis.

Policy-level

More focus should be directed towards meso and macro level projects from a legislative point of view to improve the effect of the resources that are invested in innovation activities in the Nordic model. Tendencies are starting to emerge within the new EU Horizon 2020 program, and therefore national and regional support and incentives should also be given for projects of this type, rather than the current linear model for product/service innovation. The performance contracting model used today is based on specific measurement points that pose major challenges to what is seen as measurement

points. The strong focus on large university hospitals with affiliated research contributes to highly academic environments, and highly specialised research activities. But very little, if any, academic meriting is given in the medical society to study system innovation.

Organizational level

A huge effort is done worldwide to cure diseases and in most countries the average age of populations increases rapidly. Therefore, there is an increasing pressure on the healthcare system as well as new options for cure will increase the economic pressures on healthcare budgets. At the moment organizational changes in the Nordic healthcare system is mainly seen in connection with the construction of new hospitals. The large changes that many industries have experienced in recent years with new and different ways to meeting its customers, different ways of organizing the work, new ways of financing activities etc. have not yet had a significant impact on the Nordic healthcare system. The healthcare sector's sharp focus on highly specialised diagnostics, medicine and surgery distract attention from vertical innovation of the system and mega factors and innovations become too incremental (focus on procurement, number of beds, etc.) despite new options as self-diagnosis, communication methods, etc. creating new disruptive opportunities.

Research

Innovation activities in the Nordic health sector are based on measurement points primary related to three activities: 1) cure of diseases (usually measured in percent), 2) price (usually measured in number or time duration), or 3) routines (lean systems and logistics, etc.). A research agenda with a holistic approach understanding healthcare systems as innovation systems does not exist at the moment and with this explorative paper we seek to set out a new research agenda. The first direction we can point at is the further research on the propositions we have developed: here the clear 'one product, one solution' approach to generating and implementing new innovations must be overcome to create a turning point to the increasing healthcare costs for taxpayers. As a first step, we recommend that researchers and legislators start to work, experiment with and demonstrate new measurement points that relate more to all points in the VIP framework as an innovative healthcare system, and not as a way to cure diseases only. To put it simply: stop asking 'are we doing things right?', and start asking 'are we doing the right things?' (Argyris, 1999), when it comes to healthcare innovation.

8. Discussion

Innovation activities have the last couple of decades led to increased costs in the healthcare system, where the income through the tax system does not correspond to the expenses of delivering healthcare services. To curb this, the focus of contracts between the state and healthcare delivery and payment for services are defined via the described metrics, e.g. time (duration of hospitalization), and number (e.g. number of beds, number of admissions and re-admissions).

Within this expanded public-private innovation activities are established that actually deals with optimized procurement procedures. Finally, partially completed and ongoing

activities with the establishment of new mega hospitals have had tremendous impact on optimization and rationalization of business processes and logistics. New innovation activities in the Nordic Health sectors have been dominated by single step activities such as the Public-Private innovations activities in the Nordic Healthcare sector, which in the same way as any other single activity does not contribute to the necessary disruptions in the healthcare system to cope with increased costs in the future.

In this article we indicate that the normally practiced single solution innovation model based on simple measurement methods is not sufficient to achieve the required reductions in the healthcare budgets of tomorrow. Completely different vertically disruptive solutions must be explored and implemented to ensure both efficient hospital system and effective treatments - but not necessarily at the same time and not necessarily integrated.

Basically, to quote the great Danish physicist, Niels Bohr and his colleague Albert Einstein discussions in the 1930s about measurability of real objects, we conclude: *you get what you measure* (Jakobsen et al, 2008). Therefore we must be much more focused on both *what* we measure, and *how* we measure healthcare innovation in the Nordic model to achieve both improved treatments for the benefit of the citizens and at the same time a better economy for the overall society.

Appendix 1: *From invention to innovation, the case of Edison's light bulb*

Thomas Edison is undoubtedly best known as the inventor of the light bulb. But the bulb was actually not invented by Edison and it was not the invention of the bulb, which was the primary part of Edison's work and success. None of the principles in Edison's works were especially new, but Edison managed to put each element of his work into a larger context, where he created new innovations by rethinking the entire system: as new business model. Here Edison's work is demonstrated by using the VIP model as method for analysis:

Area of Inquiry	Example based on Edison
Product	Edison made a bulb in 1878, but the bulb was already invented in Britain by Humphry Davy in 1810, and the first tests were done by the German Heinrich Göbel in 1854. Several others have also patents before Edison, but Edison created a bamboo based filament able to burn in 1200 h.
Process	The bulb was difficult to produce, and Edison found with his good friend Henry Ford a process by which he could produce 10.000 and more on one machine. Also he made a cable solution by decreasing the consumption of cobber with 1/8
Business	Salesmen went from door to door – offering to do all the installation, with electricity and promised that it was cheaper and better than the normal kerosene solutions. Each person who joined were provided with 12 bulbs for free
System	The bulb was the small part: Edison made also the power plants with generators to produce DC, he dug up the streets of all Manhattan and he put the new invented cobber wires in the ground. He even made the installations in each house from gas supply to DC electricity
Social	Edison was facing a lot of criticism, and his idea was called castles in the air. Edison published his new cotton bulb and invited people to come and see a demonstration in his lab at Menlo Park. First time 3.000 arrived and became impressed
Financial	Many of the millionaires from New York pre-paid a lot of money to be the first with private electric light as it was a status symbol. The richest person in USA, William H. Vanderbilt, was the first in 1882 to turn on the electrical light
Cultural	Edison got a journalist from the newspaper "The Sun" to write about how he would be lightning up all of Manhattan, and how his inventions would provide power, heat and cooking facilities. Even satire drawings became an important tool in the process of changing culture from gas and kerosene to DC
Political – Legislative	Edison invited the corrupted politicians to his facilities in Menlo Park for demonstration followed by a dinner with lots of wine, champagne, food from an exclusive restaurant and presents, which made the responsible politicians to argue: "Gas is dangerous" and Edison was allowed to dig up all Manhattan and implement his system
'Other'	Edison denied stubbornly AC, and this stubbornness was his driving force

Edison started his project as 31 years old in 1878. The bamboo bulb was created in a few days, but he did the final test of the complete installed system in 1882, and in these four years the color of his hair changed from dark to grey.

References

Bechmann, S. (2012), *Service is marketing: a strong brand is not created by what the organization says, but by its actions* (in Danish), Gyldendal Business, Copenhagen

Bertelsen, S.R., Hyllegaard, M. Christensen, M. and Bennike, C. (2013), *Radikal velfærdsinnovation: hvordan får vi mere effekt af innovationen?*, Mandag Morgen Innovation

Brix, J. (in press) Improving individual knowledge construction and reconstruction in the context of radical innovation, *International Journal of Innovation and Learning*, Vol.xx No.yy

Brix, J. and Jakobsen, H.S. (2013), Corporate Creativity: introducing the Creative Idea Solution © framework, *International Journal of Innovation and Learning*, Vol.13 No.4 pp.388-405

Charlesworth, A., Davies, A. and Dixon, J. (2012) *Reforming payments for health care in Europe to achieve better value*, Nuffield Trust, UK (ISBN: 978-1-905030-54-5)

Christensen, C. M. and Bohmer, R.K.J. (2000), Will disruptive innovations cure health care?, *Harvard Business Review* September–October

Christensen, C.M., Anthony, S.D. and Roth, E.A. (2004), *Seeing what's next: Using the theories of innovation to predict industry change*, Harvard Business School Press, Boston

Christiansen, N.F. et al. (2006), *The Nordic Model of Welfare*, Copenhagen University Press

Coleman, K., Austin, B.T., Brach, C. and Wagner, E.H. (2009), Evidence on the chronic care model in the new millennium, *Health Affairs*, Vol.28 No.1 pp. 75-85

Danish Regions (2012) The whole health system: the Regions' vision for a coherent health system (ISBN: 978-87-7723-769-0)

DICE (2002), *Work lost due to illness – an international comparison*, CESifo Forum Vol.4

EcoQUIP (2013), *Delevering efficiency, quality, and sustainability in healthcare*, Lead Market Iniviative for Europe

Eggers, W., Baker, L., Golzales, R. and Vaughn, A. (2012), *Public sector, disrupted: how disruptive innovation can help government achieve more for less*, Deloitte Development LLC, A GovLab Study

Gillison,S., Horne, M. and Baeck, P. (2010), *Radical efficiency: different, better, lover cost public services*, Nesta (June)

Glickman, S.W. and Peterson, E.D. (2009), Innovative health reform models: pay for performance initiatives, *American Journal of Managed Care*, December

Hildebrandt, S.M. (2000), *Physicians, Nurses and Housestaff: the continuing struggle for collective bargaining rights*, Suffolk University Library Review

Jakobsen, H.S. and Brix, J. (2012), The 'Vertical Innovation Process': constructing sustainable business models in practice, *Proceedings: ISPIM symposium Seoul South Korea*, December

Jakobsen, H.S., Gertsen, F., Goudscheit, R.C., Rebsdorf, A.O. (2008), *Impact of measurement and evaluation on innovation level*, Valencia Spain

Johnson, M.W., Christensen, C.M. and Kagermann, H. (2008), Reinventing your business model, *Harvard Business Review*, December pp.57-68

Kjellberg, J., Soegaard, J. and Andreasen, M.N. (2009), *Private/public collaboration in healthcare*, Danish Healt Institute, March (in Danish)

Kodner, D.L. and Spreeuwenberg, C. (2002), Integrated care: meaning, logic, applications and implications - a discussion paper, *International Journal of Integrated Care*, Vol.2 pp.1-6

Länsisalmi, H. et al. (2006), Innovation in healthcare: a systematic review of recent research, *Nursing Science Quarterly*, Vol.19 No.1

LCB-Healthcare (2012), *Innovation procurement: delivering efficiency, quality and sustainability in healthcare*. European Lead Marked Initiative

McHugh, M. and Chenjuan, M.A. (2013), Hospital nursing and 30-day readmissions among medicare patients with heart failure, acute myocardial infarction, and pneumonia, *Medical Care*, Vol.51 No.1

MedTech Europe (2012), *Creating value in European Healthcare: How Europe's medical technology industry is delivering on the promise of the Contract for a Healthy Future*, MedTechEurope.org

Norden (2010), *Health Innovation in the Nordic Countries*, Nordic Council of Ministers, Denmark (ISBN: 978-92-893-2139-6)

OECD (2011), *Average length of stays in hospitals, in*. Health at glance OECD Publishing

O'Reilly, J. et al. (2012), Paying for hospital care: the experience with implementing activity-based funding in five European countries, *Health Economics, Policy and Law*, Vol.7 pp.73-101

Osterwalder, A. and Pigneur, Y. (2010), *Business model generation*, John Wiley & Sons, Inc., New Jersey.

Rasmussen, M.B. and Obel, B. (2012*),* Koordineret organisering af sundheds- og velfærdsydelser, *Ledelse & Erhvervsøkonomi*, Vol.77 No.3 pp. 38-53

Ratten, V. (2012), A theoretical framework of entrepreneurship and innovation in healthcare organisations, *International Journal of Social Entrepreneurship and Innovation*, Vol.1, No.3 pp.223-238

The Economist (2011), *Future-proofing Western Europe's healthcare: a study of five countries*, The Economist Intelligence Unit (September)

The Economist (2013), *The secret of their success: the Nordic countries are the best governed in the world*, Special report on The Nordic Countries (February)

Wagner, E.H. (1998), Chronic disease management: what will it take to improve care for chronic illness?, *Effective Clinical Practice*, Vol.1 No.1 pp.2-4

WHO (2009), *Milestones in Health Promotion: statements from Global conferences*, World Health Organisation, Switzerland

Yin, R.K. (2009), *Case study research*, Sage Publications, New York

Zott, C., Amit, R. and Massa, L. (2011), The Business Model: Recent Developments and Future Research, *Journal of Management*, Vol.37 No.4 pp. 1019-1042