

## **Business Model co-development in collaborative innovation relationships – exemplified through public private innovation projects**

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### **Abstract**

This article investigates how firms' Business Models (BMs) are co-developed during collaborative innovation relationships. Collaborative innovation relationships are explored through Public Private Innovation (PPI) projects. These projects are particular well-suited for examining the co-development of BMs that takes place over time as PPIs involve different actors from the public and private sector with each their interests, goals and values. The public and private actors collaborate together as development partners in order to develop new products and services directed to the public sector for the benefit of both parties. However, exactly how to reach benefits that suits the different parties involved is challenging making it possible to get rich data on how co-development of BMs can take place when firms' interact with external partners over time. The article builds on a multiple in-depth case study of 4 PPI projects from the healthcare sector in Denmark. The 4 cases overall show that firms' over time either co-develop new BMs or extend existing BMs based on co-development. The firms' BM evolves over time as the firms' comprehend the public context better by getting insight into who the important multiple public stakeholders are (e.g. users and purchasers), what their different needs and values are and which levels of influence the stakeholders have. Findings thus show that in collaborative innovation relationships multiple external partners are important to interact with to obtain BM changes that support successful commercialization in the end. However, findings also show that novice firms, without any prior experience with public markets, go through a longer co-development process with more experimentation, then what serial firms, who know public sector stakeholders from previous relationships, goes through. Further, findings show that serial firms qua their prior knowledge comprehend the public context and the values of public stakeholders easier and quicker as they are capable of drawing on multiple stakeholders from different levels that are directly or indirectly influencing their PPI-solution and BM.

### **1 Introduction**

In the article we investigate the importance for single firms to develop and manage relationships with external partners in the value producing system (Wilkinson & Young, 2002) when BM development take place. We argue that in light of recent changes in BM-literature there is a need to focus on how BM change occurs through co-development of value with partners outside the single firm (Nenonen & Storbacka, 2010) and we thus contribute with new knowledge to this more recent BM literature. Our approach is in line with the call for more focus on the triggers of BM changes (Aspara et al., 2011: 17) that often are the result of the intertwining of emerging trends in the surroundings of the firm and deliberate decisions taken internally in firms (Demil and Lecocq, 2010: 235, 239).

Research into BMs (Business Models) has increased in the last decade (Magretta, 2002, Osterwalder & Pineur, 2009, Demil and Lecocq, 2010) and has to some extent given both rival and complementary explanations of what drives and limits the development of firms (Zott & Amit 2008). This has led to the situation where a number of different understandings of BMs have emerged. Several authors propose that BMs is equal to the core logic behind the firm (Magretta, 2002) and therefore a particular focus has been on core elements that BMs consist of and how these elements connects (Osterwalder & Pigneur, 2009 and 2008; Johnson et al. 2008; Morris et al. 2005). This view of a BM is often considered a more static approach or a blueprint (Demil and Lecocq, 2010). However, new streams of BM literature has arrived the last years pushing the traditional BM theory from a static position to a more dynamic approach where the belief is that BMs frequently are revised and changed as time pass (Sosna et al. 2010; McGrath 2010). As an example McGrath, (2010) find that the process of BM change is not easy to manage as it is something that evolves over time and thus is more related to discovery or experimentation than planning.

Further many authors have traditionally viewed BM theory from a primary internal perspective. In this line of research authors often consider BM as a structure of a firm that can help a firm to develop a BM and subsequently deliver value to a market (Morris et al. 2005, Osterwalder & Pineur 2010). Other researchers in the same line of research consider BM in relation to a technology push where the technology is defined and subsequently the BM specify a group of customers or a market segment to whom the value proposition will be appealing (Chesbrough and Rosenbloom, 2002). Even though a firm may initiate BM change internally, it can be discussed whether it makes sense to only understand BM development as an internal dynamic process isolated from its environment (Håkansson & Snehota 1989, 1995). Recently therefore some authors have argued to look at BM in relation to external relationship partners (Clarke & Freytag 2011) and in relation to the network firms' are parts of (Nenonen & Storbacka, 2010). The implications of this more recent approach to BM development is that value is looked upon as something which is created through co-developing when firms' interact with other business partners rather than inside the boundaries of a single firm alone (Prahalad and Ramaswamy 2000). Therefore, authors in this recent line of research recognize that customers and other external partners are increasing taking the role as innovators in the development of value propositions. New BM research therefore points at the need for looking at BM changes as something that takes place through co-development: Co-development can thus be considered a dynamic process where there is experimented with different BMs as the developing firm and the customers or other external partners get to know each other's context, needs and capabilities. Firms' BM development through interaction with external partners is thus a process where value may be perceived differently depending on which stakeholders is influencing the BM.

Although this article takes an external and less prescribed orientation, the internal social interaction among actors within the single firm which shape BM change should also be recognized: BM changes at times may be less influenced by external surroundings then internal ones and therefore we do not abandon internal sources of change since emergent choices during BM change may also be guided by autonomous (e.g. managerial) decision making within a single firm. However, in the article we particularly emphasize how BM changes occur during co-development with external partners over time. The research question we put forward is therefore: *How do firm's BMs evolve through co-develop during collaborative innovation relationships?*

In the article the research question is investigated based on a multiple in-depth case study of 4 Public Private Innovation (PPI) projects. PPI refers to a setting in which public and private players work together as development partners with an aim to develop new innovative solutions targeted the public sector through a continuous transfer of ideas and knowledge between the players involved (Weihe et al., 2010). As such PPI projects are particularly interesting for investigating change in firms' BMs, as the public sector is a complex external partner and potential customer, but characterized by having many different stakeholders with multiple values that the firms have to consider. Therefore, a firms' understanding of BMs often change during the course of the PPI project as the parties interact with each other and thus create more insight into the different stakeholders' needs and values. This process can result in changes of firms' BMs.

The rest of this article is structured as follows: First a state-of-the-art of BM theory is provided to be able to distinct between more traditional approaches to BM theory and some of the more recent theory contributions to BM in which this paper contributes. Secondly the method is presented for selecting, collecting and analyzing the 4 in-depth cases, followed by a presentation of the four PPI-projects and the parties involved. Thirdly the empirical findings are presented and discussed, and finally a conclusion is presented in which we propose theoretical and managerial implications of the findings presented.

## **2 State-of-the-art of BM theory: Past and present discussions**

Different understandings have evolved in the research on BMs resulting in BMs viewed in several ways as design, narrative and sensemaking, innovation, transactive structure, and opportunity (George and Bock, 2010: 86). This article focuses on how BMs evolve through collaborative innovation relationships in order to create value. Our understanding come close to Chesbrough's (2006) who sees a BM as connected to the value concept as he defines a BM as: *'a BM performs two important functions as far as the commercialization of an invention is concerned. These functions are: Value creation and value capture'* (Chesbrough 2006, p. 108). As such we employ the definition Chesbrough make when saying that value is not only about value for the customer, but also for the focal firm. However, we go the step further by incorporating the call for research stated by Aspara and colleagues (2011) and Demil and Lecocq (2010) that goes beyond Chesbrough's definition by emphasizing in a stronger manner dynamic BM change or evolution through co-development of value. This approach emphasizes the importance on co-development with different stakeholders outside the single firm (e.g. Coombes & Nicholson, 2013; Demil & Lecocq, 2010; Sosna et al., 2010).

The theoretical understanding of BM we employ have implications for what parts of the BM theory we contribute to. As stated in the introduction recent literature on BMs has moved from a more static approach to a more evolutionary and dynamic approach (Zott & Amit, 2013). At the same time BM theory have also developed from a predominant internal focus to considering the external surroundings in which BM development takes place. The following table shows these trends taken place in the BM research field by identifying them as different approaches based on the dimensions of external versus internal and static versus dynamic. The combination of these dimensions highlights four different approaches to BM, which different researchers contribute to through particular papers. As such the researchers may through their carrier have published papers in other quadrants, but for the purpose of exemplifying the focus in the four quadrants we list these authors and specific papers. Being aware of these approaches to BM is necessary, as each of the approaches have consequences for which BM activities researchers focus on.

Table 1: Main focus in existing BM literature

Main focus in BM development	Static approach	Dynamic approach
<b>External oriented (e.g. toward stakeholder relations)</b>	<p>(Quadrant 1) BM is viewed in a static way, however the surroundings of the firm (e.g. its central relationships) are considered to have some influence on the development of the firm's BM.</p> <p>Examples of papers are: Chesbrough, 2006 Bohnsack et al., 2014 Zott &amp; Amit, 2013 Sánchez &amp; Ricart, 2011 Sosna et al., 2010 Calia et al., 2007 Cavalcante et al., 2011 Chung et al., 2004</p>	<p>(Quadrant 2) BM is viewed in a dynamic way as the firms BM is considered to be ever changing due to its external relationships and internal dynamics.</p> <p>Examples of papers are: Coombes &amp; Nicholson, 2013 Tongur &amp; Engwall, 2014 Aspara et al., 2011 Nenonen &amp; Storbacka, 2010 Heikkilä et al., 2010 Demil &amp; Lecoq, 2010</p>
<b>Internal oriented (e.g. toward firm strategy)</b>	<p>(Quadrant 3) BM is viewed in a static way, and is considered to be an internal strategic activity, which the firm is durable of developing by themselves.</p> <p>Examples of papers are: Markides, 2013 Casadesus-Masanell &amp; Ricart, 2009 Teece, 2012 Bouwman &amp; MacInnes, 2006 Hacklin &amp; Wallnöfer, 2012 Magretta, 2002</p>	<p>(Quadrant 4) BM is viewed in a dynamic way as a firm's BM is recognized to be influenced by the emergent strategy of the firm.</p> <p>Examples of papers are : Gay, 2014 Hacklin &amp; Wallnöfer, 2012 McGrath, 2010 Doganova, 2009 Björkdahl &amp; Holmén, 2013</p>

We contribute to quadrant 2 which view BM in a dynamic way by focusing on how single firms continuously interact with external partners in their environment when (co-)developing BMs (Tongur & Engwall, 2014; Aspara et al., 2011; Coombes & Nicholson, 2013; Demil & Lecoq, 2010; Nenonen & Storbacka, 2010; Heikkilä & Heikkilä, 2010). The dynamic nature of BM is not something that is 'revealed in a flash' (Demil & Lecoq, 2010) but rather it is discovered through a (ever-changing) process reaching beyond firm boundaries. As such, value is considered to be co-developed among various partners within the networked market (Nenonen & Storbacka, 2010). In this sense firms do not evolve autonomously; they co-evolve with specific others (Håkansson et al. 2009, p157). Success for a business actor is time dependent, relationship specific and determined by the way that the actors co-evolves with others (Håkansson et al. 2009, p157). Therefore the actors influence and are influenced through the interaction process. Co-development with other partners gives access to resources and the possibility to adapt processes (Håkansson & Snehota, 1995). Resources may be useful in many ways and activity links may be created due to the common knowledge at hand (Dosi, 1988). This knowledge offers the opportunity to exploit and to create value. At the same time

combination of resources and interconnection of activities restricts firms' possibility to change and can be considered as burdens (Håkansson & Snehota, 1999).

Concerning what restricts or creates burdens for co-developing BM is often that co-development introduces experimentation that often is a time consuming process as it involves a number of actors from the firm and its collaborating partners. More, the process can be complicated by the fact that different actors may have dissimilar views on which needs and values is essential to create, which can create barriers for adaptation of a new or adjusted BM. These dissimilar views may originate in diversity of organizational backgrounds making the BM change process filled with dilemmas, communication difficulties sometimes resulting in conflicts and failures. However successfully handled the BM change process can also result in sources of knowledge sharing, learning and creativity (Ritter & Gemünde, 2002). Thus, the changing of BMs is understood as a conscious reflection and a choice made by the firms (Casadesus-Masanell & Ricard, 2010), while at the same time being experimental in regard to an open BM perspective (Coombes & Nicholson, 2013). A factor that seems to be influential on the challenges firms face when co-developing is how knowledgeable firms are in interacting with their external partners. This is a factor that we will explore as pre-knowledge may influence how BM change takes place.

### **3 Research design**

In order to take a closer look at quadrant 2, the dynamic external approach to BM change, we employ a qualitative in-depth case study approach. Such a case study approach was preferred as this gives the opportunity to interpret specifically how BM co-development takes place over time. As such, we follow Dubois & Gadde (2002) emphasizing that in-depth cases are particular useful in order to understand interaction between firms and their environmental context. This approach also makes it possible to explore and develop empirical and theoretical insight into the still rather undeveloped area of how BM change occur, emerge or evolves - an approach recommended when issues are complex (Yin 2003) or in situations where little is known about a topic (Carson et al. 2001). As such choosing an in-depth qualitative case study approach allows the team of researchers to develop new theoretical knowledge through empirical insight into the way firms' handle co-development successfully.

The data presented is based upon a multiple study of 4 cases. The cases selected represent both firms that have engaged in collaborative innovation relationships several times (so called serial firms) and firms with no prior knowledge of how to collaborate with these sorts of relationships (so-called novice firms). As such the case selection strategy have been to achieve maximum variance when comparing the firms' former experience in regard to engaging in collaborative innovation relationships of the form taking place when PPI-projects takes place. However all cases have been in different extent successful with selling their solutions, thus they have all achieved commercial success. Thus, we employ a case selection strategy proposed by Seawright and Gerring (2008, p. 300) when arguing that diverse cases are particular appropriate when exploring how a phenomenon changes over time – in our case how BM change occurs over time. To be able to identify four appropriate cases we have in line with Seawright and Gerring (2008, p. 294) been aware of how to select the four cases based on a broader population of background cases. These background cases are not integrated into the study we conduct, but they play a role for the analysis in an informal way as they secure that we choose the four cases purposively and not randomly or pragmatically (Seawright and Gerring, 2008, p. 295) securing in the end that we actually employ maximum variation. Based on an ongoing four year research project process, we have been able to identify a population of 14 cases besides the four used in this article from Denmark engaged in PPI-projects

successfully (see appendix 1), meaning that all cases have been able to commercialize their welfare solutions in some extent. The 4 cases were identified by studying Danish reports on PPI-projects, by participating in PPI networks and workshops, and by participating in two large and two smaller research projects during the last four years. As such the four cases have been selected among a wider range of informative successful cases.

Overall interviews, observations and diverse secondary data were gathered with the purpose to identify and understand how firms' change their BMs when co-developing their BMs with external partners. Concretely several semi-structured in-depth interviews have been conducted with the leading project manager or the Managing Director of the firms (Malhotra and Birks, 2006). The interviews lasted 2-3 hours and were transcribed. Also observations have played a role in the study as observations have been used for the purpose of being able to understand the context in which the collaborative innovations relationships take place. Observations have been possible when following some of the PPI-projects the firms have been involved in, or possible when meeting the firms during different PPI-workshops (Piekkari and Welch, 2004). Also various secondary data was gathered as background information for the interviews and the observations.

For the multiple in-depth case studies, a grid analysis was conducted (Gammack and Stephens, 1994; Basit, 2003). This technique allows the team of researchers to categorize interview data based upon predetermined themes (e.g. a provisional start list recommended by Miles and Huberman, 1994), as well as explore new themes grounded in the empirical data. The themes in the grid analysis were extracted by literature on BM exploring BM change in a dynamic and evolving way (e.g. Coombes & Nicholson, 2013; Tongur & Engwall, 2014; Aspara et al., 2011; Nenonen & Storbacka, 2010; Heikkilä et al., 2010; Demil & Lecoq, 2010). The predetermined theoretical themes were: 1) How BMs evolves continuously in a dynamic way and 2) How BM changes through co-development with external partners/stakeholders. As such, emphasis is on how private firms develop BMs by interacting with multiple public stakeholders as this approach gives insight into how firms' BM changes through co-development.

### **Background information of the cases and the context within which they are embedded**

PPI projects are the empirical context of our study of how firms' BMs change. This empirical context is chosen as PPI projects provides us with an empirical setting where firms' BMs are relatively highly dependent on co-development with different external partners, such as various public stakeholders. In PPI projects it is necessary to combine skills that cut across the public and private sectors to develop new innovation welfare services and products (Klijn & Teisman, 2003). As such, PPI projects contain many challenges related to differences in objectives, practices and competing logics between actors in the public and private sectors (Carranza & Longo, 2012; Thornton & Ocasio, 1999). More, firms have to sell to a broader public sector that is characterized by multiple autonomous levels (e.g. political level, management level, employee level, procurement department level) and characterized by stakeholders with different values and incentive structures operating at these different levels. To succeed in the broader public market the kind of value proposition offered by firms has to balance these different stakeholders' needs and objectives. As an example, the objective of a procurement department can be to low price whereas doctors might value improvements in quality when purchasing new solutions.

In the following the four cases will be presented. The four cases have been selected based on a maximum variance strategy comparing the firms' prior knowledge in regard to engaging in collaborative innovation relationships of the form taking place when PPI-projects occurs.

Table 2: Cases selected based on diversity concerning public market experience

<b>Pre-knowledge of the public market: Serial firms</b>	<b>Non-knowledge of the public market: Novice firms</b>
Manufacturer of hospital beds (case 1) Designs and manufactures electric linear actuator solutions (case 2)	Design and manufactures internal transport systems for blood samples in hospitals (case 3) Design and manufactures tele medical solutions (case 4)

NOTE: The four cases have been anonymised and will in the following be called case 1-4.

### Case 1

The firm was founded in 1970 and is a manufacturer of beds, side tables etc. for hospitals and nursing homes. Thus the firm has an extensive experience with delivering solutions to the health care sector in Denmark. The firm is situated in Denmark and has 35 employees. Their products are developed in close collaboration with staff groups in the nursing sector as well as hospital sector. Apart from being the supplier to the Danish market, the firm is exporting products primarily to the Scandinavian market and the Netherlands as well as other countries in Europe, Asia and Africa.

The collaborative innovation project the firm have been engaged in started in 2012 as the firm was heading a consortium who won a tender for developing an intelligent hospital bed for the future. The intelligent bed is developed in collaboration between a hospital (within the Central Denmark Region), a municipality and the consortium consisting of four firms including the firm. The development task was launched by the Central Denmark Region through the EU tender form 'competitive dialogue'. Winning the tender ensured a sale to the hospital afterwards, which consisted of a delivery of a certain amount of hospitals beds.

### Case 2

The firm was founded in 1976 and the firm designs and manufactures electric linear actuator solutions. The linear actuator especially facilitates ergonomic improvements in workplaces so diverse as offices, hospitals, comfort furniture, farms and industry. The firm has about 1.600 employees in 35 countries and therefore is supplier to multiple markets.

The firm has an extensive experience with delivering solutions for beds in the health care sector. The collaborative innovation project the firm has been a part of was called ICare and lasted over 2 ½ year. Opposed to case 1 no public tender was involved in the project. The aim of the project was to develop a series of product concepts for standard commercial products in the health care sector and in relation to the care of bed-bound patients/residents. Beside the firm, the project partners consisted of one municipality, another private firm which manufactures beds and one university.

### Case 3

The firm was founded in 2008 as a spin-off within an existing firm. The firm produces a product which is an innovative patented invention for the internal transport of blood samples in

hospitals. Using a transport pipe of 40 mm in diameter it can be installed in any hospital and can be directly connected to automation systems in the laboratory, making the product an important part of the pre-analytical process. Optimizing blood tube transportation can ensure faster analytical responses resulting in significant time and cost savings for the hospital while relieving patient anxiety. When using the blood sample tubes are transported in a safe and dedicated line quickly. The project lasted 1 ½ year.

The firm was founded when the founders started collaboration with a Danish Hospital. Their entry point to the hospital was based on informal network as they knew a board member in a Danish hospital located within the same region as the firm. The hospital board member once announced that a problem within hospitals was the great amount of time spent on transporting blood samples and that a well reputed doctor and professor working at the hospital had come up with an idea to develop transport pipes for transportation of blood samples. The firm received contact details of the well reputed doctor and professor. The firm new how to develop such transport pipes and had expertise in developing them for other industries; however they had no prior experience of how to approach the health care sector. They then met with the doctor and expressed that they were able to develop transport pipes for transportation of blood samples. He became the firms' gatekeeper to the hospital. After the project ended the firm has been successful in launching and selling their products to almost every hospital in Denmark and international.

#### *Case 4*

The firm is also a spin-off of an incumbent firm, established in 2002, operating within Global IT Systems and delivering consultancy to private firms. In 2006 the firm was created in relation to the firm's first product development project dedicated to the public sector. It happened when the founders started collaboration with a Danish Hospital. Prior experience in collaboration with the health care sector did not exist.

As in case 3, the firms entry point to the hospital was based on informal network as the firms' founder knew a doctor which had close relations to the management at the hospital. The firm developed the idea for a PPI project with this doctor. The project got the name 'The Patient Briefcase'. The Patient Briefcase allows the hospital to provide treatment and control of their 'Chronic Obstructive Pulmonary Disease-patients' (COPD), while the patients are staying in their own homes via telemedicine. The tele medical solution was developed by the firm in close collaboration with practicing doctors at the hospital within a project period of three years. After the project period the hospital purchased the product from the firm and an operating agreement about running the Patient Briefcase for patients in treatment of COPD was made. During the end of the project period the firm started to contact different hospitals in different regions with an aim to present test documentation and sell the product. However, it did not succeed in making another sale to other hospitals in Denmark. The firm experienced that the different hospitals was influenced by what the firm characterized as a 'not invented here' syndrome meaning that the hospitals prefer to invent new solutions by their own in order to benefit from the brand it gives them.

#### **4 Findings: BM co-development during PPI projects**

In this section the findings from the analyses of the case study will be presented. Overall the multiple case-study reveals two overall findings: The first finding show that firms' BM changes follows two overall distinct pathways seemingly dependent on how knowledgeable the firms are with the healthcare sector in which they operate. As such prior knowledge of the public market seem essential for how BM changes and how firms handle the intertwining of emerging

trends and deliberate decision-making. The second finding show that the successfulness of the changes in firms' BM seemingly is dependent on how firms' over time comprehend the public context better by getting insight into who the important multiple public stakeholders are (e.g. users and purchasers), what their different needs and values are and which levels of influence the stakeholders have. In the following the two findings will be presented separately.

*The intertwining of emerging market trends and deliberate decisions: Two pathways identified*

The case study shows that the four firms either change their BMs by *extending* the existing ones or *developing* new BMs. The firms extending existing BMs are already situated in the public market and are selling to the public market. Contrary, the firms developing new BMs are operating in other industries (e.g. private sector) and thus have no previous experience in doing business with the public sector. The two distinct pathways are illustrated in the below table:

Table 3: Two distinct ways of co-developing BM

<b>Extension of BM (serial firms)</b>	<b>New BM (novice firms)</b>
Case 1 and 2	Case 3 and 4

More, the case study shows that there seem to exist a clear difference between how the four firms approach BM changes. Depending on whether the firms have prior knowledge of the public market and related stakeholders or not seem to influence the speed of the co-developing process or how quickly the firms are able to react towards emergent trends in the public market they operate in. Those firms being able to react more quickly are distinct in a way that makes them notice quicker based on prior knowledge the external emerging trends that lead to internal choices and decisions for making BM changes. In some instances these firms can as such be interpreted as being more proactive in their response to the BM changes needed: They are not put in a situation where they need to change their existing BM in radical ways, rather they can build and sustain their performance while making slight changes to their existing BMs (Demil & Lecocq, 2010: 227). The situation for the novice firms, who are not experienced with operating at the public market, is somewhat different as they are not able to see or take notice of emergent trends taken place in the hospital sector market just a quickly. Their understanding of the public sector is evolving much more slowly, because they have difficulties in getting insight and knowledge of which multiple stakeholders might influence their BM. As such the novice firms are more focused on stakeholders they interact with directly initially, instead of seeking knowledge of the multiple stakeholders in the public sector that operate in the periphery of the PPI-project, but may have a vast indirect influence on their BM. These novice firms therefore co-develop their BM slower by over time comprehending what implications BM changes makes for their ability to commercialize successfully. This makes the intertwining between emerging trends and deliberate decisions seem more determined by coincidences then deliberate strategic considerations.

In the case (1+2) both firms are rather quickly during the initial start of the PPI-projects guided by prior knowledge of not to develop too expensive solutions to the public market. The prior knowledge exists from many years' experience with purchasing stakeholders in the public sector and prior experience with selling large amounts of beds for hospitals. The purchasing stakeholders is not directly involved in the PPI-project, rather they operate in the periphery, but both firms knows from prior experience that these stakeholders are bottlenecks when developing new solutions to the public sector. Concretely the firms have learned from earlier

experience that public purchasers often are focused on the cheapest products, even though a selling firm can document savings in the long run if a more innovative but also more expensive product is purchased. However even though both firms only extend existing BMs the result of this prior knowledge makes the firms decide very differently.

In case 1 the firm extends their existing BM in a way that makes it possible for the firm to develop an innovative flexible bed for, at this moment, two public markets including hospitals and municipalities. The changes the firm makes to their BM is built upon a concept that makes the basis for the bed fairly simple making it possible to add on extra equipment on the existing bed depending on different customer needs, which also makes it possible to keep the product at a low cost. In case 2 BM changes were also initiated as the firm realized that its new series of product concepts for standard products to hospital beds was too difficult to sell at all to the Danish health care market. This was the situation even though the business case of the new series of products concepts would make it possible to release patients earlier based on more comforting products. For example, one product was concerned with building comfortable light into the bed making it less uncertain for the patients to get up from bed on their own. However being already situated in other countries the firm knew that extra comfort-equipment for bedbound patients would be prioritized higher in another of the firms' other markets, namely Germany, where the health care system is based on high competition from private hospitals. The firm knew that the current situation at the German market would create an opportunity for them to sell extra comfort-equipment because German patients value this and hospitals want to offer the best solutions in order to attract patients. Therefore, the most central consideration behind the changes in their BM stems from a necessary shift in focus from the Danish health care market to international markets – at first the German market. As such the Danish health care sector was only used as a means for *developing* and *testing* new series of product concepts for standard commercial products in order to prepare new products for sale to international costumers.

In case (3+4) the firms did not have any prior experience or knowledge of the health care sector, however the firms knew they would be very dependent on having a steady access to their public partner, a Danish hospital, in order to observe the work flows. This made both firms very dependent on a gatekeeper – a doctor – and the doctors' ability to represent the needs of the various levels of actors in the public sector and guide the firm through the levels and complexity of the public sector. It was therefore central to both firms successfully to be involved with gatekeepers who did not give up, but brought the idea and product ahead despite opposition in the system. This might have been the reason why these firms have been able to and pushed into co-developing new BMS, while the other more experienced firms have only made adjustments. However even though the starting point for both firms is to co-develop new BMs around gatekeepers the result of this makes the firms co-development process evolve very differently as their gatekeepers influence and ability to articulate their case into the hospitals and to other hospitals is very different. More their products interfered differently with work practices and routines.

In case 3 the firm gained over time knowledge about the workflows in relation to transportation of blood samples and found that these were scattered across different departments. Based on the knowledge the firm came to realize that it was essential to keep a focus on all the stakeholders involved in the transportation of blood samples. As such the firm needed to address different needs of various public stakeholders such as bio analytics, nurses and doctors, among others. Being successful in securing all the different needs a first prototype of the product was developed within ½ year making the first part of the innovation process

successful. After this, the firm used their well reputed doctor (their gatekeeper) to arrange a meeting with the hospital management which led to an agreement about making a laboratory for the blood sample transport system within the hospital. As a part of the agreement they convinced the hospital management to pay for the installment for further tests and if the management did not want to buy it afterwards they would tear the laboratory down again. It seemed central for the firm to develop professional tests on a larger amount of patients over the next period of time in order to create legitimacy and to secure robust documentation of the (especially timesaving) value of the product to secure value creation for the hospital management. After the project period of 1 ½ years where the product was developed and tested at the hospital, the doctor who functioned as the firms' gatekeeper also became a central reference when the firm made contact to other hospitals to sell the product. However, the character of the product also plays a central role in the firms' BM changes. Though the product interferes with different work flow across departments, it does not interfere with complex work practices or routines. This may make it easier to implement in different hospitals and may be a central reason why the firm found it fairly simple to involve other hospitals after the initial PPI project. Thus, the firm initiated other projects with different hospitals aiming to refine and implement the transport system and to sell the product to these hospitals. The documentation developed through tests in the first PPI project became a central reference in the following PPI project at another hospital and so forth.

In case 4 the firm does not succeed in selling their product to other hospitals in Denmark as is the situation in case 3 even though a gatekeeper is identified. In the first period of the PPI-project the firm's gatekeeper, the doctor are helping the firm to gain access to the management level at the hospital which he was a part of himself supporting the firm in selling their products locally. However the gatekeeper does not have the same amount of influence outside the local hospital and is therefore not able to in the same extend as the doctor in case 3 to be a gatekeeper between hospitals in Denmark. This forces the firm to contact different hospitals in different Danish regions with an aim to present test documentation and sell the new product. However, managers at other Danish hospitals do not agree to buy the new product in spite of the documentation of the products' several benefits provided by the firm. After a few years of banging on the wall and trying through the political regional and national level in Denmark to influence the legislation on the area the firm gradually gains knowledge about health care systems in different countries and finds that Norway and England are promising markets for commercializing tele medical solutions. Concretely their experience made an impact in the development of the firms' BM as it shifted focus to international markets. England was promising because the hospitals have responsibility for patient 30 days after they are released from the hospital, making telemedicine an important value for the hospitals in order to keep track on their patients when they return to their homes. Norway was promising because its health care system is build up in a way where each hospital has less autonomy to decide whether a new solution is going to be purchased and implemented. As such, gaining knowledge about different health care systems made the firm create its BM based on development or refinement of tele medical solutions in close collaboration with practicing doctors from a local hospital with proximity to the firm in order to sell the product on international markets – specifically targeted healthcare systems containing incentives to implement telemedicine within the health care system.

*Interacting with different stakeholders changes the firms BMs over time*

Overall each of the 4 cases clearly show how the firms are maneuvering over time between different public stakeholders based at different levels within the health care system. The stakeholders the firms interact with are directly and/or indirectly involved in the various PPI projects. Thus, during the innovation process in the PPI project the firms select certain stakeholders to target an appropriate value proposition in order to make it suitable for influential stakeholders. As our focus mainly is centered on public (external) stakeholders the internal stakeholders (e.g. employees, board members, management or investors) within the single firms is beyond the scope of this paper. This being said we recognize that the firms during the BM development in the innovation process in PPI projects make deliberate decisions about how they must operate in the public sector environment.

In all cases the firms' success is dependent on the interaction with different stakeholders through the BM development as they through co-development gain an increased understanding about the context and the values and needs that are in play in the healthcare sector. For all the firms the interactions with different actors leads to knowledge of new market opportunities and a more clear value proposition for central stakeholders. Knowledge gained is for instance insight into how to make a solution easier to use for the hospital personal, how to streamline work flow processes, how to give better experiences for the patients, how to produce a solution at a rather low prize that even rationalise sparse resources. Being open to the process, the firms also acquire knowledge that can help to expand its current markets into new segments e.g. municipalities or international markets. Thus, in general the four firms during the various PPI projects they participate in reconsider what value should be created, who the value should be created for and how the product or service should be commercialized. The changes in value proposition often occur when the context is better understood (levels that influence) and who the important stakeholders are (e.g. users, doctors, purchasers, management etc.) and what their needs are. Figure 1 show how a co-development process often evolves through iterations where the firms and stakeholders interact. The co-development also contains a period where the firm further develops the solution based on new knowledge gained.

Figure 1: The co-development process



Commonly the four firms all make early attempts to align expectations between themselves and the stakeholders directly involved in the PPI-projects. However these early attempts to align expectations are not enough as new knowledge of the context is comprehended during the course of the project that makes it necessary and possible for the firms to gain a deeper

understanding of the values and needs in play. This is necessary as the public sector is a complex entity with various stakeholders operating at different levels of influence which makes it particularly important with a continuous interaction to ensure that the assumptions on which the BM is build is solid. For instance a continuous interaction secured in case 1 that the firm late in the PPI-project identifies a related public market segment which they currently are not servicing (e.g. municipality). This makes the firm prepare the solution they are developing for the hospital in a way so that small adjustments can be made that makes it possible for the firm later on to penetrate the new market segment. However as stated earlier in the first finding the speed of the co-development process is seemingly dependent on whether the firms have prior knowledge of the public market or not. For instance in case 4 the co-development process is taking place throughout several years as the firm struggles to sell their solution outside a local hospital and thus get their solution commercialised at a broader public market. One of the reasons for this is that the firm itself only is capable of understanding the stakeholders participating in the project and was not involving or analysing the need of public stakeholders on different layers and their project partners did not manage to introduce them to these actors. They focused on develop the product and lower degree focus on the value proposition to different stakeholders and first late in the process considered how to commercialise the product. At this stage they had specified the product too narrow for covering a wider market.

As such differences also exist between the four firms depending on which pathway the firms build their BM on. In case 3 and 4, which is those firms that develop a new BM, do not seem to the same degree have a focus on adaption and following market standards as the firms which extent their BMs (case 1 and 2). Instead, they seek to change the rules of the game, however the output of these attempts are very different. For instance, in case 3 the firm creates a need for a new kind of blood sample transportation in close collaboration with a health profession stakeholder by developing a totally new product for the health care system. Similar case 4 seem to create a new need in close collaboration with a health profession stakeholder and by influencing politicians in order to change hospitals' incentives to use tele medical solutions. However, case 3 and 4 differ from each other as case 4 did not succeed in selling its new product to more than one hospital in the Danish health care system, mainly because the firm experienced the existence of a 'not invented here' logic. This changed the firms' focus, as it began to focus on exporting the product.

## **5 Discussion and conclusion**

The article revolved around the research question: *How do firm's BMs evolve through co-develop during collaborative innovation relationships?* By putting forward this research question we have through a multiple case study shown how four firms change their BMs during their engagement in PPI projects by co-developing with stakeholders outside the single firm. The focus on external relations in the firms' BM change emphasizes the importance of firms' relations with actors in their environment, especially potential customers (Håkansson & Snehota, 1989). Nevertheless, firms' BMs are not only dependent on and shaped by relations with stakeholders in the single firms' environment. The single firm itself may also shape its environment and stakeholder relations. Thus, internal decision making may additionally motivate a firms' BM change. However, PPI is particularly characterized by relations between firms and public actors and therefore, in this paper we have particularly focused on external relationships when firms aim to create commercial value based on PPI projects.

Further our multiple case study show that firms extending their BMs typically are experienced in operating at the public market, and therefore is capable of broaden their window of

opportunity as they not only focus on the market the PPI-project is directed towards, but also considers the opportunity to move into new markets.

Firms co-developing new BMs have typically no pre-experience in operating at the public market making it resource demanding to get to know the public and making the firm's window of opportunity narrower as they emphasize the market the PPI-project is directed towards. In these projects the firms are more depended on the partners to provide information of the public context and different stakeholder levels. They are also dependent on their partners in the further commercialization as they can use their networks and status to sell to the hospital and other hospitals in Denmark and abroad.

The theoretical implications of the study is that BM change in the period of the PPI project as more knowledge is acquired. We find that there are important learning's when firms co-develop their BM with partners in particularly in OPI projects. We saw that the BM changed when the firms understood; the context better understood (levels that influence) and who the important stakeholders are (e.g. users and/or purchasers) and what their needs are. Further we learned from the successful firms that:

- Value has to be created for different levels and stakeholders in order to be successful
- Involving new stakeholders gradually, as this has implications for the BM, but changes in BM might be necessary to be successful in the end
- The solution and the BM development should co-evolve in order to reach the potential of the innovation

The managerial implications of the study are that it is important for the parties continuously in the project to test the assumptions that are made when working the different BMs. The assumption about what can be done and the needs of different stakeholders should be tested. Furthermore, it is necessary continuously to challenge how much the potential customer pay to solve the problem today and how much they are willing to pay based on the value proposition offered based on the PPI project. It is also important to understand the perceptions of value desired among the different levels in the public system (managers, purchasers, doctors, patients etc.) to ensure that the right value proposition is found.

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### Appendix 1: Background cases: 14 cases successfully involved in PPI-projects

Business area	Interviewees
Manufacturer of software and hardware products for the healthcare sector.	Managing director
Provides services withing 4 areas of business: Assistance, Rescue, Healthcare and Training.	Regional manager
Manufacturing of healthcare products.	Managing director
Manufacturer of products and services within two main areas: beds and lifting equipment and a product range which includes ramps, lifting platforms and small lifts.	Regional manager
Manufacturer of healthcare products with special focus on telemedical solutions.	Biomedical Engineer
Manufacturer of toilet seats and related products for installation in the homes of physically disabled people - formerly just bathrooms but now also kitchens.	Business Development Director
Manufacturer of intelligent lighting control equipment.	R&D Manager
Developer of platforms for telemedical solutions.	Managing director
Developer of software solutions to the health care sector, transport sector and agricultural sector.	Managing director
Developer of intelligent hygiene solutions with special focus on intelligent soap dispensers for bathrooms.	Managing director
Consultancy within the areas of developing madrasses and pillows for beds and related products with a focus on sense stimulation.	Managing director
Manufacturer of intelligent lighting control equipment.	Stakeholder Relations Manager