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Navigating Across Complex Barriers between Universities and the Public Healthcare Sector:

Experiences from Collaboration in Education

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Indhold

Summary

There are many benefits associated with university/industry collaboration including the transfer of novel and useful knowledge and building innovation competences for the future workforce. In this rapport, we present the experiences from a 3-year innovation project between four university partners and two partners from the public healthcare sector. The project centered on creating innovation in the public healthcare sector and preparing students to enter the future workforce by taking real-world challenges from healthcare and transferring them to university courses. Based on this innovation project, we outline the complex relationship between university education and the healthcare sector and provide a set of useful recommendations for facilitating student collaboration with healthcare professionals. Our experience-based recommendations give useful insights about university/industry collaboration and exemplify how partners in these innovation projects can strengthen their innovation capabilities by organizing collaborations, communicating findings, and building new agendas.

1. Introduction

University/industry collaboration has a long tradition in the open innovation literature (e.g., Brunneel et al. 2010; Perkmann et al. 2011, 2013). One option of such collaborations is to allow students to work with public and private industry partners as a part of their education (Bekkers and Bodas Freitas 2008). Such collaborations provide industry with the latest knowledge from the universities by using the students as ambassadors for innovation. As students do not require salaries and can work as a crowd within a course setting, they are also an affordable resource to provide alternative proposals for solutions that solve industrial and societal challenges. In contrast, students gain a lot from collaborating with industry professionals as they gain work experience and a clear insight into how industry works in practice. When working with real-world challenges, students also gain additional innovative competences by building up their problem-solving abilities and push them to acquire new practical skills and knowledge.

Conflict in collaborations between universities and industry is fairly well-known in the innovation literature (e.g., Brunneel et al. 2010). However, there are lacking experience-based frameworks that innovation practitioners can use to navigate the complexity in university/industry collaborations with students. To our knowledge, this problem is especially evident within those collaborations between universities and the public healthcare sector where there is high complexity. However, such collaborations lack frameworks that can help innovation practitioners to navigate this complexity. In this rapport, we aim to provide knowledge to this research gap by explaining how to universities and the public healthcare sector can collaborate within an educational setting despite high organizational complexity. To this extent, we focus on collaborations that have an educational purpose, for example, when students and healthcare professionals use real-world challenges to collaborate within a university course setting.

To understand the complexity between universities and the public healthcare sector, we take outset in the organizational complexity literature (e.g., Anderson 1999; Byrne and Callaghan 2014; Dougherty and Dunne 2011; Stacey 1996). Hence, to guide the framing of the rapport, we define complexity within the context of university/industry collaboration as a set of conflicting structures such as culture, work practices, expectations, and policy-making, which despite the intention to collaborate, create barriers between the collaborating partners.

Finally, our approach is experience-based rather than theoretical. We consequently draw on our experiences from our own collaboration during a three-year project between three universities and two industry partners from the public healthcare sector. With this rapport, we thus attempt to provide a glimpse into the complex relationship in these collaborations and how to navigate them.

The remaining rapport is organized as follows: We start out with the case study of Copenhagen Health Innovation and elaborate how the project was designed to create collaboration between universities and the public healthcare sector in the Copenhagen area of Denmark. We then continue to explain the complexity of the Danish healthcare and university sectors and outline the barriers between them when they try to collaborate on education in an innovative setting. We then use this outset to list a set of recommendations for organizing and communicating collaborations between educators and healthcare professionals and show the value of using these recommendations.

2. Case Study: Copenhagen Health Innovation

This rapport presents a collection of experiences made during the Copenhagen Health Innovation - Knowledge-Based Entrepreneurship for Healthier Growth (CHI-VEST) project between 2016 and 2019. CHI-VEST is an innovation consortium in healthcare involving The Technical University of Denmark (DTU), Copenhagen University (KU), Copenhagen Business School (CBS), Copenhagen Profession School (KP) as the educational institutions and The Region of Copenhagen and Copenhagen Municipality as the public healthcare institutions.

Overall, CHI-Vest had five overall objectives:

1. Creating collaboration capabilities between Danish Universities in the Region of Copenhagen and the public healthcare sector.
2. Using students to transfer novel and useful knowledge between universities and the public healthcare sector.
3. Providing novel ideas for products and service innovation in healthcare.
4. Preparing the future workforce for innovation in the healthcare sector.
5. Encouraging more students to create entrepreneurial startups in healthcare.

CHI-VEST had by summer 2019 registered over 1500 students that went through courses involving challenges from the healthcare sector. Around 250 different challenges were developed in collaboration with healthcare professionals and students. Finally, 60 students across 22 startup companies participated in a specialized incubation program for startups within healthcare.

3. Typical barriers when facilitating collaborations between educators and healthcare professionals

Danish universities and public healthcare sector sectors are huge organizations that individually are highly complex and contain large difference in structure, culture, and policies. Thus, facilitating education-based innovation between university educators and healthcare becomes particularly difficult when the inherent differences in complexity between the two sectors creates a range of barriers for innovation. As we have outlined in the following and summarized in Table 1, we observed a range of complex variations and differences during the CHI-VEST project. This includes differences in culture, estimation of required involvement, conflicting views, and rules and regulations that created barriers between the university educators and the healthcare professionals.

Table 1: *Summary of barriers that increase the complexity of collaborations between the public healthcare sector and the university sector in Denmark*

Barrier	Public healthcare sector	University sector	Barriers
Culture	A no-failure culture based on safety standards and formalized practices	A fail-forward culture based on experimental learning and trial-and-error	When the collaborating partners have conflicts in culture - it can stifle innovation and learning between the two sectors
Motivation, estimated involvement, and expectation of outcome	Focused on low involvement, time savings, novel solutions, better treatment, and educating here-and-now over postgraduate training	Focused on high involvement, quality teaching, and research collaborations	When the collaborating partners have conflicts in focus - it can create problems with communication and collaboration
Rules and regulations	Rules and policies for public administration, treatment of patient information, ethical behavior	Rules and policies for educations and expected learning requirements for individual courses	When different rules and policies conflict - it can limit the potential collaboration outcome between the partners

3.1 The barrier of different cultures

The healthcare and university sectors contain two opposing cultures that can prove difficult when they want to collaborate on innovation through education. The culture in the Danish healthcare sector can best be described as a no-failure-culture. The sector is driven as a care provider that delivers safe healthcare products with high quality and high security to the citizens. As they have a low tolerance against failure there are standards and formalized practices for all aspects of work. This inherent focus on safety and security creates a massive barrier for larger innovation schemes. Not only can the innovation of organizational practices compromise safety standards.

Organizational changes accompanied by innovation can also create ripple-effects throughout the rest of the organization that can create catastrophic consequences of safety and security. One such example is the implementation of the Epic Health Platform in The Region of Copenhagen and the Region of Zealand. Epic was an information system implemented to innovate work processes, however, during its implementation in 2018, a serious safety and security violation was created when an internal error caused 0.6 percent of the patients in the region to receive labels with wrong medicine dosages.

In contrast and with exceptions from some of the traditional healthcare educations, the Danish university sector is mostly a fail-forward culture. A lot of university education and research is based on trial-and-error where students experiment within problem-based learning to create novel and useful solutions for society. Within this educational context, students are encouraged to break down problems by experimenting with prototypes and new forms of organizing that most of the times fail or are useless in practical setting. However, it provides the students with valuable learning about what to do and what not to do.

In most other sectors, this educational culture is valuable because it inspires companies and organizations to think outside the box and creates a range of possible solutions that can be implemented at a later and more mature stage. However, within the Danish healthcare sector, this educational approach can create problems for patient safety and security. Instead, educators and healthcare professionals must create a safe environment for experimenting when trying to innovate. Hence, such collaborations require clear communication between the two partners to address what is possible within the safety standards of the healthcare sector and where students and educators from the universities can help healthcare professionals to experiment and sometimes fail.

3.2 The barrier of conflicting motivations for collaborating, estimated involvement, and expectation of outcome between healthcare professionals and university educators

Because Danish universities and the healthcare sector are so different in culture, they also have conflicting motivations for collaboration, which makes them estimate their involvement differently and create different criterions for the collaboration outcome. In the following, we outline these differences between healthcare professionals and university educators and summarize them in Table 2.

As outlined in the prior section, the culture of the Danish healthcare sector is based on effectiveness and quality of treatment. In many ways that work culture is all about treating as many patients as fast and as efficient as possible and with the best quality. Hence, when health professionals collaborate with universities, they are motivated by improving their work practices or solving problems that cause quality/safety issues. Moreover, the public healthcare sector in Denmark also sees the value in educating students to work in practice. This motivation is primarily based on resource savings that are expressed through a willingness to educate students while they are in school over providing them with postgraduate training when they enter their first job in the sector. In summary, the motivations from the public healthcare sector are primarily based on anything that will make their work-life easier or free up resources that they can transform into quality for patients.

Table 2. *How healthcare professionals and university educators differ in their motivation for collaborating, estimated involvement, and expectation of outcome*

	Healthcare Professionals	University Educators
Motivation for collaborating	a) To make work easier by solving problems that take time or have quality/safety issues. b) To educate students to work in practice to remove costs associated with postgraduate training.	a) To provide quality teaching with a clear outset in practice and imitate research collaboration. b) To create long-term collaboration that they can transform into research projects.
Estimated involvement	Low estimation. Resources are limited for collaboration.	High estimation. The more access – the better teaching quality.
Expectation of outcome	a) To solve problems by providing a solution that they can deploy into practice. b) To create organizational capabilities within practice that can help to solve problems or make work processes more effective.	To provide students with learning of central theoretical themes or topics combined with their use in practice.

In contrast, universities are teaching and research institutions. Working with professionals from practice is highly attractive for educators because such collaborations provide an insight into problems and issues that can become relevant for students once they enter practice. As such, university educators are not necessarily motivated to provide healthcare professionals with novel solutions. Instead, their motivations for collaborating is based on providing students with quality teaching and initiate collaborations that can boost their research portfolio and funding opportunities.

These differences between healthcare professionals and educators also affect their estimation of involvement and expectations of outcome. Because healthcare professionals are pressured on time and resources, they tend to underestimate the resources they have to put into a collaboration with students to get something in return. For example, getting students to work in hospital clinics can be challenging simply because the healthcare professionals do not have the time to host them. Moreover, healthcare professionals tend to overestimate the outcome of collaborations with students. They often expect that students will provide solutions for those problems they are presenting, or design ready-to-use organizational capabilities. The reality is, however, that solutions and organizational capabilities can take years to develop, which is not feasible within the setting of a single university course. Instead, students can provide valuable knowledge that individual healthcare organizations can use to create solutions or gain capabilities over time.

In contrast, university educators tend to overestimate the available resources available in healthcare organizations by asking for student access to clinics or critical data. The reason for this lies in the educational outset in university teaching. Modern education at Danish universities

are, to large extent, based on problem-based-learning with outset in existing research and its application to practice. This approach to learning requires a lot of interaction with practice to identify problems and design solutions. Hence, in many course settings, especially within the technical, business, and design educations, students are simply required to interact with professionals from practice. This interaction helps them to understand work-practices and develop prototypes for useful solutions. However, the reality in most clinics is that time and resources are scarce - even when allocating them to patients. For this reason, hosting student collaborations are in many cases not an option - because there are no available resources to assign for such projects. Moreover, students often need access to critical data, for example, to help them develop machine learning algorithms. However, these requests are often problematic because they can infringe data-security laws and patient rights.

3.3 The barrier of rules and regulations

The healthcare sector is likely one of the most regulated sectors in Denmark. Beside a range of laws and policies for product safety and quality of medical devises and procedures, Danish healthcare providers are required to follow laws and public policy practices that includes how good behavior in the public administration, how they treat personal information of patients, what ethical behavior is, and even how to create good work environments. All these laws and public policies are created to protect the patients as citizens and thus create a safe and reliant environment for both the patients and the healthcare professionals. However, these laws and public policies can also become barriers for innovation. For example, a barrier when creating digital solutions have for long been regulations that requires consent from the patients before public entities can transfer their information.

Moreover, when the Danish healthcare sector collaborates with the Danish universities their rules can conflict with the rules applied at the universities. For example, Danish universities operate under specific laws and regulations that outline the scope of an education and expected learning requirements for individual courses. These learning requirements are especially difficult when collaborating with healthcare professionals because the educator is placed in a position where the options for collaboration becomes limited. For example, the learning requirements may dictate that the students need to visit healthcare practice and talk to patients, but due to local regulations and resource allocation, the healthcare professionals can only offer a set of lectures at the university. In addition, when university students collaborate with the Danish health care sector, they often want access to all information they can get their hands on, for example, when they need registry data to build capabilities in machine learning. Thus, it can be frustrating for students when they need access to information that is vital to create a solution and the request are denied due to privacy laws or internal regulations at the healthcare provider. As a result, it not only important for educators and healthcare professionals to find a common ground where collaboration can happen; it is also important to educate students in these laws and regulations to avoid conflict and frustration.

4. Recommendations for navigating and planning student collaboration within healthcare

In the following, we present a set of selected recommendations that provide a good foundation for navigating the complexity between the needs in both university education and the public healthcare sector. We divided these recommendations between those of *organizing* that helps to structure programs and build networks and those of *collaboration* that helps to find common ground and reduce conflict by communicating value across sectors. These recommendations are based on our experiences from CHI-VEST program. An overview is provided in Table 3.

Table 3: *Overview of the outlined recommendations*

Activity	Description	Represented Model
Organizing	Demonstrates the experience-based recommendations around organizing the CHI-VEST program and how that organization provided value to the collaborating partners.	Figure 1
Collaboration	Illustrates how the collaboration process between university educators and healthcare professionals were organized on four different levels and what value could be obtained from each level.	Figure 2

4.1 Organizing

Organizing is essential to run these collaborations between industry and universities. As shown in Figure 1, we found that organizing involves four organizing pillars to make industry/university collaboration work within healthcare.

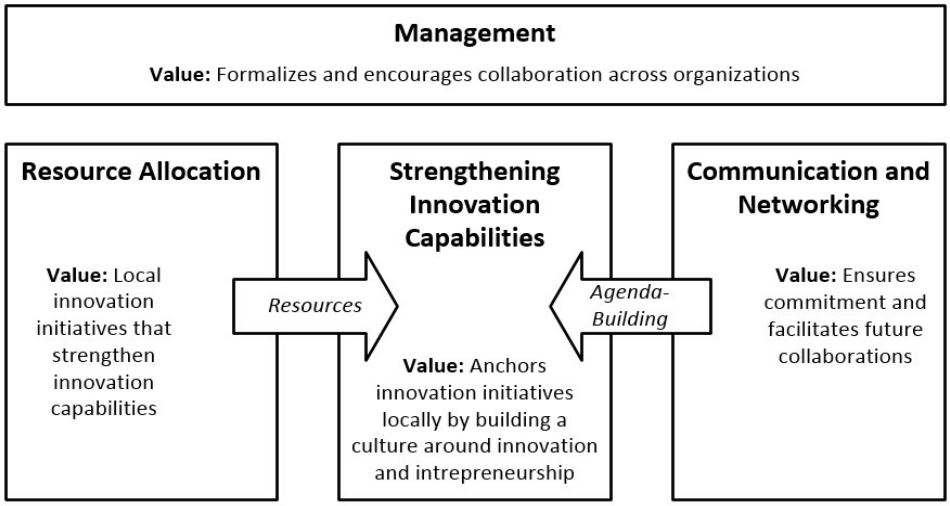

Figure 1: *The four organizing pillars of industry/university collaboration within healthcare*

The first pillar is about management. We found that backing from management is important for university/industry collaboration in healthcare because different units and actors have to work together across organizations. For example, a university course at DTU on service innovation required over 100 students collaborating with a hospital in the Region of Copenhagen, thereby, involving almost 20 different units in the hospital. Such collaborations require a high level of management commitment and preparation from the Hospital. In contrast, we also experienced that several units from another hospital backed out of a collaboration with students when the local innovation manager that spearheaded the collaboration was transferred to another position. Hence, backing from management provides value to these university/industry collaborations because it can formalize the collaboration across different organizational units and encourage people to participate - despite the need to solve production tasks.

The second pillar is about resource allocation. We found that the allocation of the necessary funding beforehand is essential to run activities and facilitate collaboration. The CHI-VEST program had at its conclusion eight full and part-time innovation consultants employed. These consultants were an essential resource because they helped facilitate collaborations between educators, students, and healthcare professionals that would otherwise have difficulties collaborating. The value of these consultants was their ability to act as a resource that did the hard leg work to strengthening the innovation capabilities in the partner organizations, for example, by developing novel ways of collaborating and continuously communicating results across the involved partners.

The third pillar is about communication and networking. Communicating results from student collaboration are of special importance for healthcare professionals because it transfers the knowledge generated during the collaborations to practice. As such, students were encouraged to share their findings with the healthcare professionals they collaborated with. Moreover, we used seminars and online communication to facilitate the findings obtained during the CHI-VEST project. Once every six months, we invited educators, students, and healthcare professionals to a seminar where they could share their experiences from the project and network with each other. On top of the seminars, we arranged a series of morning meetings around specific topics and new trends within healthcare such as self-monitoring, blockchain technologies, or the future competencies in the healthcare sector. We also developed an online communication platform named Co-Box (https://cobox.dk/en/). We used Co-Box as an innovation tool by sharing the experiences made when developing the collaborations between the educators and healthcare professionals. These experiences included models and different classifications that are useful when starting a collaboration between educators and healthcare professionals. We also provided a range of useful information on healthcare related topics such as CE certification and health economics. This information was especially useful for educators and students who wanted to collaborate with healthcare professionals within a course, research project, or startup setting, but had limited insight into the healthcare sector. Finally, we used the Co-Box website to communicate new challenges identified in the healthcare sector to educators at the universities. Educators also had the option to put their courses on the platform and find healthcare professionals for future collaborations. The value of this communication is materialized in two different ways:

a) When we used seminars, networking, and online communication to facilitate ongoing results and findings, new knowledge and inspiration were provided for both educators, students, and healthcare professionals. This access to new knowledge increased their interest in the projects and improved their chances for future collaborations.

b) When we shared identified challenges publicly to educators and university courses to healthcare professionals, it helped us to fit those challenges into specifics courses that could provide a set of solutions. It thereby facilitated the collaboration between the educators and the healthcare professionals.

The fourth pillar is about strengthening innovation capabilities. From the outset, the CHI-VEST project was a time-limited project aimed at creating innovation and strengthening student entrepreneurship as well as intrapreneurship in the healthcare sector. Hence, it was important that the activities started during the first three years would increase the innovation capabilities of the partnering organization to the extent that they could continue to collaborate on their own. By providing the necessary resources to facilitate innovation (second pillar), the CHI-VEST project could start local innovation initiatives within the public healthcare sector with the help of students from university courses. For example, one of the challenges addressed the long waiting times at the emergency wards in Copenhagen. Several student groups from a computer science course worked on this challenge in collaboration with doctors and nurses from the emergency wards. A few of those student groups continued the collaboration by writing their master thesis around the same challenge. Finally, one of those master student groups expressed their interest in starting a company to provide a solution at the end of their thesis writing. As such, the influx of resources helped to start ongoing collaborations between students and educators on one side and healthcare professionals on the other to the point where they could continue the collaboration on their own. Moreover, by using communication to facilitate results and novel approaches for collaborating (third pillar), the CHI-project also helped to standardize how collaboration could be done between educators and healthcare professionals. This communication helped to ensure commitment and facilitate future collaborations by breaking down barriers around collaboration and culture. More importantly, the communication and networking part of the CHI-VEST project helped to gain experiences and create an agenda for the future by demonstrating what worked in practice and what did not. Hence, by applying resources and building an future agenda through communication, a range of innovation initiatives could be initiated that created a culture around innovation and intrapreneurship between the involved universities and the public healthcare organizations in the Region of Copenhagen. This culture helped to break down some of the complex barriers between these partners by giving them joined innovation processes and new ways of communicating.

4.2 Collaboration

In the previous section, we recommended the use of models, frameworks, and classifications to facilitate collaboration. In this section, we demonstrate our stepwise process for initiating a collaboration between healthcare professionals and university educators.

Without calming exhaustiveness, we used a collaboration process that involved four steps. As outlined in Figure 2, these steps include a) to identify challenges, b) identify dedicated people to work with the challenges, c) deploy collaboration models to identify resource use, and d) facilitate a collaboration agreement between the partners. In the following, we outline these steps in detail:

Figure 2: *The collaboration process*

We initially identified global challenges from the public healthcare sector that would work across multiple different course settings. For example, “hygiene” is a major challenge in the public healthcare sector that cost millions in additional expenses each year. Such a challenge is also perfect to use across different educational settings. To mention a few examples, engineering students can find technical solutions to improve hygiene whereas sociology and communication students can use the challenge to work with the cultural mindset of nurses or create solutions that use simple communication such as nudging to improve hygiene in hospitals. The value of using open challenges is their value in the educational setting. Open challenges can be easily adapted to multiple courses and thereby generate knowledge from the challenge across multiple perspectives. This approach provides a solid knowledge platform for innovators in the public healthcare sector to create workable solutions that can be put into practice.

When we identified a challenge, we then started to find dedicated people that would anchor it locally. It was not hard to find educators that would work with these challenges, as they easily can be adapted to different course settings and provide educational value for the students and potential research opportunities for the educators. Hence, we mainly had to find healthcare professionals that saw the value of solving the challenge and would collaborate with students. It is important to find dedicated people that want to collaborate because it prevents collaboration failure where one of the partners withdraw from the collaboration.

To facilitate collaboration between educators and healthcare professionals in the CHI-VEST project, we had good experiences with using different collaboration models dependent on the needs of the partners. These models provided us with the necessary flexibility and timing when agreeing on resource allocation from the healthcare professionals and resource expectations from the educators. We varied these collaboration models dependent on the situation we experienced. In summary, we used two overall models as described below:

a) Collaboration with single or multiple university courses with low involvement from healthcare professionals. A challenge is collected from practice and presented by health professionals within the course setting. This form can also include data collected in practice such as interviews, industry rapports, and statistics. Students work with the challenge and present to health professionals that provide feedback. Value includes crowdsourcing of ideas for the public healthcare sector and feedback on student projects from industry people.

b) Collaboration in single or multiple university courses with high involvement from healthcare professionals. This type of collaboration is similar to the above approach. However, the level of involvement from healthcare professionals is higher. Hence, the students will work closely with healthcare professionals to develop and test hypotheses

or prototypes. This requires that the students visit clinics where they can collect data and present preliminary results. This type of collaboration can also include master or bachelor thesis writing that is extended over a long period of time and with high involvement from healthcare professionals. The value of such extended collaborations gives a detailed insight into a selected problem and helps students the students to build up critical skills they can use in their professional career.

Table 4: *The two collaboration models*

	Collaboration model 1	Collaboration model 2
Examples of involvement from healthcare professionals	Smaller presentations, providing access to data, and giving feedback to students	Close collaboration with students by participating in interviews and prototype testing or providing access to clinics and healthcare data
Data collection	Provided in advance from collaborating partners	Collected by students working with healthcare professionals
Involvement from health professionals	Low	High
Best suited for	University courses that require little interaction with practice	University courses that require deep interaction with practice and students writing on their master or bachelor thesis
Value for healthcare	Crowdsourcing of ideas	Detailed insight into selected problems
Value for students	Feedback from healthcare professionals	Critical skills for professional career

The next step in the process is to facilitate a collaboration agreement based on the selected collaboration model. The collaboration agreement does not have to be a formal and signed document. It can also be an informal agreement that outlines the level of engagement and services provided by healthcare professionals and what they can expect to get in return. For example, a collaboration agreement can describe how much the students need to work in a clinic, what data or facilities they have access to, how many times the health professionals need to visit university classes and to what extent and purpose, and whether the returned product is rapports, ideas, prototypes, student presentations, or a combination of these. Such collaboration agreements provide value by outlining the mutual expectations between the collaborating partners and thereby break down some of their complexity and barriers using simple communication that everyone can understand. This simply prevents collaboration failure due to misunderstandings and ambiguity between their expectations.

5. Conclusion

In conclusion, this rapport provided some valuable insight into the complexity of university/industry collaboration in public healthcare. We demonstrated how barriers can arise when there are complex differences between the two sectors in culture, motivation, estimated involvement, expectation of outcome, and rules and regulations. To overcome such barriers, we created an experience-based framework of organizing and collaborating. The framework provides a set of useful experiences from the 3-year CHI-Vest project that practitioners in healthcare innovation can use to set up collaborations between university educators and healthcare professionals.

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