The Co-Strategy Process: introducing technology through interdisciplinary collaboration, so it meets biology in society

A case study regarding the path of Robot-Assisted-Rehabilitation from laboratory to patients in Sweden

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Abstract .......................................................................................................................... 2

List of abbreviations ........................................................................................................ 2

1. Introduction .................................................................................................................. 3
   1.1. Robot-Assisted Rehabilitation (RAR) for neurorehabilitation .................................. 3
   1.2 Innovative technology in healthcare: opportunities and challenges .......................... 5
   1.3 Implementation planning ......................................................................................... 6
   1.4 Aims of the study ..................................................................................................... 7

2. Methods ....................................................................................................................... 7
   2.1 Development of the Co-Strategy Process (CSP) ...................................................... 7
      A. Development procedure ......................................................................................... 7
      B. Design Thinking .................................................................................................... 8
      C. Knowledge through pictures ................................................................................ 8
      D. User journey mapping .......................................................................................... 9
   2.2 Participant observation to evaluate the Co-Strategy Process (CSP) at ÄH .................. 9

3. Results and discussion ............................................................................................... 10
   3.1. Outcome of the Co-Strategy Process (CSP) development ...................................... 10
      A. Success factors and challenges in the development of the Co-Strategy Process (CSP) 11
      B. General description of the Co-Strategy Process (CSP) .......................................... 11
      C. The Co-Strategy Processes (CSP) at Ängelholm Hospital (ÄH) for Project Rehab-Robotic 12
         a) A symposium with focus on interdisciplinarity and empowerment of process participants 13
         b) DT as structure for the workshop ......................................................................... 13
         c) Knowledge through pictures (KTP) for the Exchange phase ............................ 14
         d) The User Journey Mapping (UJM) method for the Development Phase ............. 14
         e) Exchange and Development: the workshop ....................................................... 15
   3.2 Evaluation of the Co-Strategy Process (CSP) through application at ÄH: case study .... 16
      A. Preparatory phase .................................................................................................. 16
      B. Knowledge Empowerment phase: Symposium, 2nd Nov at ÄH ............................ 16
      C. Exchange phase: workshop day I, 20th Nov at ÄH ............................................. 16
         a) Introduction to day one of the workshop ............................................................... 18
         b) Identify contributions and hindrances to the Robot-Assisted Rehabilitation (RAR) project at Ängelholm Hospital (ÄH) 18
         c) Painting warm-up exercise .................................................................................. 18
         d) Express and share contribution and hindrance ....................................................... 19
         e) Personal vision and group vision ........................................................................ 21
         f) Presentations ....................................................................................................... 22
      D. Development phase: workshop day II, 21st Nov at Ängelholm Hospital (ÄH) ........... 22
         a) Updating group vision ......................................................................................... 23
         b) Patient journey (persona, journey, touchpoints) .................................................. 23
         c) Meeting with experts (feedback and update) ....................................................... 24
         d) Presenting the work ............................................................................................ 27
         e) Concerning the workshop as a whole ................................................................... 28
      E. Value of Robot-Assisted Rehabilitation (CSP’s) for Rehab-Robotic Ängelholm Hospital (ÄH) and broader use 28

4. Conclusion ................................................................................................................ 29

5. Acknowledgements .................................................................................................... 30

6. References ............................................................................................................... 31
Abstract

As part of the current fast growing development of digital technologies, collaborations between professions such as neurosciences, robotics, big data processing and artificial intelligence offer new possibilities for healthcare. For these new technologies to reach clinical practice, there is an increasing need for interdisciplinary organizational work to support decision-making over their introduction. In the field of neurorehabilitation, exoskeletons are an example of a robotic tool that can be used to regain locomotion abilities after a neurological injury. They are part of an umbrella term, Robot-Assisted-Rehabilitation (RAR), that stands for neurological recovery techniques assisted with robotic tools. For these tools, the introduction, evaluation and implementation in clinical practice have not been evaluated. In many cases it is also not taken into account that tools such as rehabilitation robotics are context-dependent. In other words, the needs, opportunities and challenges that come together with working efficiently with this new technology can widely vary between clinics, regions and countries. Lastly, it appears that smaller hospitals consider themselves in need of tools to support their decision-making in the RAR introduction phase. In collaboration with Hälsostaden and Region Skåne, we set out to develop a tool to support Ängelholm Hospital (ÄH) in their decision-making over a test-bed trial of RAR in their clinical setting. A tool that we coined the Co-Strategy Process (CSP), was developed based on identified needs related to this stage of the process, using a blend of interdisciplinary scientific methods. It integrates internal and external interdisciplinary expertise and includes four steps: Preparation, Knowledge Empowerment, Exchange & Development and Synthesis & Report. The current Master thesis presents the development and assessment of the CSP at ÄH. In the present context, it results in a new tool for supporting organizations implementing new technologies, optimized based on its application in a Swedish clinical setting. This tool aims at serving this introductory process, so that new technologies can be implemented meeting the needs of both the clinic and patients.

List of abbreviations

CBR: Community-Based Research
CSP: Co-Strategy Process
DT: Design Thinking
KTP: Knowledge through pictures
NS: nervous system
RAR: Robot-Assisted Rehabilitation
UJM: User Journey Mapping
UU: Uppsala University
QIT: Quality Implementation Tool
ÄH: Ängelholm Hospital
1. Introduction

1.1. Robot-Assisted Rehabilitation (RAR) for neurorehabilitation

Within the human body, the nervous system (NS) is orchestrating the functions of all the other parts. It is responsible for perception, cognition, emotions and motion, amongst others (Farley et al., 2014a). The NS is composed of a central (CNS) and peripheral (PNS) system, the first one being the brain and spinal chord, the second including the motor and sensory nerves (Farley et al., 2014a). Nerve cells are the main component of the system. They endorse the role of transmitting and processing information to each other through electrical and chemical signals. This specific cell type is typically composed of a cell body (called soma), an axon and dendrites (Farley et al., 2014a). The cell body is where the nucleus lies, and from which the dendrites and axons spread. While the numerous dendrites of the neuron receive information and spread it to the cell body, the unique axon transmits this information to other cells through synapses. The neurons are organized in highly structured networks, in which the synapses, these cellular gaps connecting the cells, constitute memory (Farley et al., 2014a).

The smooth and healthy functioning of the NS can be disturbed, amongst others, by injuries, which mostly take place at the level of the axon (De Vieira et al., 2016). These injuries disturb the flow of information, resulting in dysfunctional processes (De Vieira et al., 2016). In the case of motion, for example, the corto-spino-muscular network is affected, which impedes the ability of the individual to control and generate movement (Farley et al., 2014b). A diversity of diagnostics can give rise to these motor symptoms, such as stroke, spinal cord injury, traumatic brain injuries, multiple sclerosis, cerebral paralysis and Parkinson’s disease (Schmidt and Lee, 2005). All these pathologies display a diversity of biological mechanisms and neuronal cellular and molecular recovery processes. Despite this diversity, the general principles on which neuronal injury recovery is based are common: plasticity and learning mechanisms (Schmidt and Lee, 2005). Therefore, general trends, underlying processes and factors impacting the neuronal recovery process can be highlighted for all of these pathologies in the peripheral system. Further, the same tools and environments can be used to support this rehabilitative phase for locomotion recovery (Menorca et al., 2013).

Research in the last decade has been investigating the injury recovery process and pointing out several crucial aspects that affect it. To start with, the time factor has shown to be highly important (Alwis and Rajan, 2014). A lesion gives rise to the release of a chemical cocktail of growth factors and other molecules, which induces recovery by triggering the natural plasticity of the neurons in the first months after the injury (Zeiler and Krakauer, 2013). This specific time frame is one of the crucial factors to be taken into consideration when working with neurorehabilitation. Another factor is the environment in which the recovery takes place, and the level of stimulation (enhanced exploration, cognitive activity, social interaction and physical exercise) the individual can find in it (Alwis and Rajan, 2014; Nithianantharajah and Hannan, 2006; Hosseiny et al., 2015). Combining those two aspects, an experiment has shown that an enriched environment and early training after a brain lesion give rise to a significantly higher number of nerve cell communication sites in mice (Alwis and Rajan, 2014). This enhanced potential for connectivity has a highly positive impact on the ability of the axons and thus of the individual to recover (Alwis and Rajan, 2014).
Apart from time and environment, several other factors have been found to be key elements that impact the neurological recovery process. They can be divided into four categories: intensity-related factors (repetition (Schmit and Lee, 2005), duration (Langhorne et al., 2011), frequency (Lee and Geneveso, 1988)), psychological factors (motivation (Maclean and Pound, 2000)), manner-related factors (task segmentation (Newell, 1989), initiation (Schallert et al., 2003), variability (Hanlon, 1996)) and information factors (instruction (Schmidt and Lee, 2005) and feedback (Magill, 2007)) (Figure 1). In the case of neuronal injuries rehabilitation, these factors will affect neurotransmitters levels and make it possible for new connections to be built, therefore enabling the networks underlying motions to become functional once more (Zeiler and Krakauer, 2013).

Several technological tools that comply with the different key factors impacting neuronal injury recovery have been developed in the last decade (Huang and Krakauer, 2009; Di Loreto et al., 2011; Novak et al., 2014; Marchal-Crespo and Reinkensmeyer, 2009; Trlep et al., 2012; Timmermans et al., 2009; Emken et al., 2008; Chinthammit et al., 2014). All of them aim at providing the best possible assets for patient wellbeing, quality of life, and effectiveness of neurorehabilitation. Newly developed robots for lower extremity locomotion (Figure 2) create a recovery environment for patients taking into account all the key recovery factors presented above. For example, they can include

sensors that measure the current ability of a person to move, using this information to provide suited exercises of which the parameters evolve over time, along with the patient’s nerve cells needs (Matheve et al., 2018). They self-regulate to provide a challenging environment for the patient (Matheve et al., 2018), keeping a fine balance between stability and difficulty increase for the recovery to take place. When it comes to motivation, many patients have reported that being able to stand up thanks to the exoskeleton, and to do movements they wouldn’t be able to do by themselves, gives them drive and enjoyment (Maclean and Pound, 2000). Additionally, many of these robots include gamified assets. These provide a personalized environment to meet the needs of the patient based on feedback, motivation, as well as an personalized cyber environment where the patients enjoy to be.

1.2 Innovative technology in healthcare: opportunities and challenges

The development of new medical technology, such as RAR (Robot-Assisted-Rehabilitation) for neurorehabilitation, is currently at very high rate, giving rise to a broad range of new opportunities for improved healthcare (Swedish Medtech, 2017a). The financial investment in this sector in Sweden reaches around 22 billions SEK per year, according to data from the Dental and Pharmaceutical Benefit Office (Tandvårds- och läkemedelsförvaltningen, 2017), illustrating the current importance of this sector. However, it appears that monetary inputs into health care technology outweighs the resulting outputs in terms of patient value, similar to pharmaceutical companies developing new drugs (Swedish Medtech, 2017a). This low productivity trend highlights the difficulty for the existing new medical technology to reach healthcare in an efficient and structured manner in Sweden, as well as in other European and North-American countries (Swedish Medtech, 2017a; Canadian Institutes of Health Research, 2011).

Taking a look at the path of medical technologies from the laboratories to the patients, i.e. the ‘clinical knowledge translation journey’ (Canadian Institutes of Health Research, 2011), provides further keys to understand this low rate of outreach. In practice, it is observed that many technologies don’t reach out to the clinical practice due to two critical phases, or valleys, at which problems are currently occurring (Figure 3) (Canadian Institutes of Health Research, 2011). The first valley represents the difficulty of moving from laboratory research into clinical trials, and the challenges of commercializing research-based solutions. The second one has been identified by the Canadian Government as a trend for a low integration of research results and products into clinical practice (Canadian Institutes of Health Research, 2011). That is, the actual implementation
of the results or devices into daily use by the health staff has been shown to be a weak link of this chain (Canadian Institutes of Health Research, 2011). These trends are also observed in Sweden, as reported by several governmental organizations (Folkhälsomyndigheten, 2017; Swedish Medtech, 2017a, p.4). As a matter of fact, it appears that technology on its own is not enough for creating an added value in terms of patient care: improvement in the societal processes underlying their introduction and implementation are needed.

In order for research results related to medical technologies to have an impact in society, these studies (Canadian Institutes of Health Research, 2011; Folkhälsomyndigheten, 2017) point at a need to understand how to overcome these two valleys. They emphasize that further understanding their nature is central, so that the human, economical, material and energy investments into developing tools to improve health and quality of life reach their end-goal. These studies question the nature of the different barriers that need to be overcome, and call for the development of tools and processes that can support the introduction of new innovations into clinics. They also highlight a need for collaborations between the research community and practical activities in municipalities, county councils and regions, idea-based organizations, companies, healthcare structures and authorities (Folkhälsomyndigheten, 2017).

In addition, the Swedish Medtech (2017b) governmental agency identified another prominent reason for the low out-reach success, namely the difficulty of evaluating the impact and cost-effectiveness of these new technologies. These evaluations, appearing problematic, are used as a basis for decision-making over the introduction of these technologies, both at large (government, municipality) and small (hospitals, healthcare facilities) scale (Swedish Medtech, 2017b). On the large scale, clinical evidences and Health Technology Assessment are the most used tools for these evaluations. These pose a problem for several reasons, some related to institutional collaboration, others to the clinical assessment of technologies (Swedish Medtech, 2017b) and seem related to the so-called first valley, above mentioned. On the small scale, the fact that many of the new technological devices are context-dependent create a series of important decision-making points in the local introduction of medical technology into specific clinical practices. A lack of supportive tools in this local decision-making is reported (Swedish Medtech, 2017b), which can be connected with the second valley.

1.3 Implementation planning

The way implementations are done has been studied for several decades, giving rise to a diversity of models and theories (summarized by Nilsen, 2015), from which 25 frameworks have been identified and reviewed (Meyers et al., 2012a). Attempts to unify those gave rise to the Quality Implementation Tool (QIT), including 4 phases and 14 steps. The ten first steps concern matters to be considered before the implementation actually starts, while the four last are about the implementation per se (Meyers et al., 2012b). This tool is currently recommended for use in Swedish Healthcare for any implementation of ‘a new way of working’, which includes methods, programs, interventions, innovations, amongst which medical technologies (Folkhälsomyndigthenet, 2017).

In the context of the difficult outreach of new medical technologies, two other important tools for the implementation process in healthcare are test-beds and pilot studies (Galea et al., 2017). As a hospital stands in the first phase of the QIT, initially assessing the situation, some questions might be difficult to answer, as a reliable source of information is lacking. Then, using a test-bed is a way to investigate questions that remain unanswered by developing scientific evidences that can be
used as a source of information for those (Galea et al., 2017). Thus, test-beds can be regarded as a complementary method to use together with the QIT.

1.4 Aims of the study

In the early phase, one of the initial decision-making point for a hospital concerns the investment into a test-bed. Swedish hospitals deal with this decision in different ways. Some, as Uppsala University or Karolinska University Hospitals have a specific unit or service dedicated to running test-beds within their organization (Innovation Akademiska in the former, Center for Innovation in the later) (Innovation Akademiska, 2017; Söderman and Nydahl, 2016). Other hospitals, smaller in size and with lower levels of collaboration with a university, simply deal with opening test-beds for innovation case by case, depending on opportunities and context. In general, it appears that there is not a systematic way to deal with and create evidences for test-bed decision-making on the level of the hospital (Swedish Medtech, 2017b).

As to contribute to this, my degree project focuses on the development of a supportive tool for local hospital decision-making during the pre-test bed introductory process. One can compare this to the situation of someone, Mister A, having the project of building a new house. In this comparison, my intervention correlates with the one of a consultant, Miss B, trying to understand how to support Mister A (the hospital) with making decisions about this project. For example, Miss B tries to understand Mister A’s situation and finds ways to figure out his financial possibilities, the necessity of the project, the potential for making it happen, the practical details, ... After, and thanks to the intervention of Miss B, it is possible for Mister A to decide whether or not building this new house.

Working with Ängelholm Hospital (ÄH), in Region Skåne, I aimed at understanding how one can support a small-scale structure in this phase, and at developing a specific tool for this purpose. The specific medical technology at stake at ÄH is RAR exoskeletons for locomotion neurorehabilitation. This is part of the Rehab-robotic project in collaboration with Uppsala University, Basel University and ETH Zurich. The tool developed was coined the Co-Strategy Process (CSP). As this tool was being developed, it was used and evaluated in this case study at ÄH.

This report presents the methods that were used to develop the CSP and evaluate its application at ÄH. The result section comprises a description of the CSP and the outcome of its evaluation onsite, leading to suggestions for further improvements. Lastly, conclusions about the value of the CSP as a supportive tool for ÄH in the pre-test best decision-making phase, together with its potential value for broader use will be drawn.

2. Methods

2.1 Development of the Co-Strategy Process (CSP)

A. Development procedure

The development of the CSP took place within the Project Rehab-Robotic at ÄH. This project uses a bottom-up user-centered approach with the aim to develop an interdisciplinary, scientific and practical strategy that healthcare settings can use or modify to introduce, evaluate and implement new medical technologies.
First, needs to be addressed and success factors in the situation of test-bed decision making were identified in the literature, and through the CSP’s first phase (Preparation) onsite. Suitable scientifically-supported methods were then looked for in literature, and built upon for meeting those needs. Adapting those methods and combining them in an original way, we developed the CSP in its different four phases. These methods are Design Thinking (DT), Knowledge Through Pictures (KTP) and the User Journey Mapping (UJM), presented below in this section.

The development of the CSP was organized around iterations (Roberts et al., 2016), meaning that it was not linear, but rather a process going forward and back as it occurred. Phases of research and development were interspaced with phases of reflections and feedback from our collaborators at ÄH and UU.

B. Design Thinking

Design thinking (DT) is an innovation process developed at Stanford University by Roberts and colleagues (Roberts et al., 2016). This method is developed to create solutions from an established need, that has been identified together with the end user, by using an iterative and open-ended process (Roberts et al., 2016). Today, Design thinking is used by academia, corporations, as well as health care sectors. Examples in the latter include addressing the time and money costly issue of missed medical appointments at John Hopkins Hospital, USA, and remodeling prenatal care units, focusing on the emotional needs of expectant mothers at Mayo Clinic. (Kim et al., 2017; Kalaichandran, 2017).

Design thinking involves four phases: Discover, Define, Develop and Deliver. The first phase “Discover” uses tools to understand the needs of the enduser, e.g. students, customers and patients. This phase of learning about a specific population’s needs is followed by formulation “Define” of the identified need. The aim of the Define phase is to understand and see the identified need from a different perspective by reformulating the challenge and creating a common vision and challenge based on the identified need. With a formulated vision and challenge the method of Design thinking moves to a “Develop”, phase during which ideas to solve the challenge are produced, prototyped and quickly tested (IDEO, 2015, p.25). As DT is an interactive process feedback is continuously received from different actors affected by the formulated need and its solution, e.g. patients, medical doctors, decision makers and companies (IDEO, 2015, p.43). With a tested prototype the last phase of DT “Deliver” is initiated. This phase is when all ideas are converged and presented as a final comprehensive solution to the initial challenge.

C. Knowledge through pictures

Knowledge through picture (KTP) is used in the CSP development process to serve the Exchange Phase. It is a method, using painting and drawing as a media of expression for developing and sharing knowledge (Dahlman, 2004). It has been used in university classes, for example, as a tool for knowledge awareness and development (Dahlman and Boman, 2009). It is shown to increase the user’s ability to develop new and different ways to observe their environment (Dahlman, 2007), to build a comprehensive view on a tackled topic and to build a comprehensive view and to focus on a specific topic, leading to higher problem-solving abilities (Dahlman, 2004). For these reasons, we selected KTP as a method for creating exchange of insights, perspectives and expertise between the participants at the workshop for Exchange and Development at ÄH.
Additionally, using painting and drawing for knowledge expression is known to have the potential to turn an unconscious and unworded piece of one’s knowledge into an item that one can reflect upon (Dahlman, 2009). It stems from certain theories of knowledge considering that not all that one knows is conscious and fully worded in ones’ head (Polanyi, 1958). The pieces of knowledge that are unconscious and not put in words are referred to as ‘tacit knowing’ (Polanyi, 1958). They can be depicted through artistic creation, thus becoming an object of reflection for the painter and for anyone watching the painting (Clark, 1997; Dahlman, 2009). This potential of KTP to allow for the expression of forms of knowledge that are difficult or initially impossible to put in word is another reason that motivated its use for the Exchange phase of the CSP.

D. User journey mapping

User journey mapping (UJM) is used in the CSP development as a method for the Exchange and Develop phase. More precisely, this tool was selected as a framework for the workshop participants to practically develop a strategy to introduce RAR at ÄH. Used in several disciplines such as product development, design, and UX (user experience) design (Nasoi, 2017), it is also a well-known and recommended practice for healthcare development (The Institute of Health Design Thinking, 2015). UJM aims at highlighting and understanding the interaction of a user with an item, process or product (applied in our case on the interaction of a patient with RAR at ÄH). By using UJM, participants engage deeper into empathizing with the user and better understanding of what s/he does, feels and needs at each interaction point or touchpoint (i.e. point of contact between the user and the item/product) (Boag, 2015; Tassi, 2009). UJM is of particular interest for the Develop phase of the CSP, since it focuses on empathy for the user, i.e. the patient, in this case. Keeping the focus on the user (i.e., the patient) of the technology is recommended and supported by DT methods (Roberts et al., 2016).

The UJM takes place in three steps: outlining a persona (i.e. a composite character made of characteristics of different users) of the user, defining the user journey stages and touchpoints and finally analyzing the touchpoints (Nasoi, 2017; Boag, 2015). An additional step involving feedback from experts can sometimes give the journey an even stronger value (Boag, 2015). This is the method used for developing the exercises of the Develop phase, taking place in ÄH during the second day of workshop.

2.2 Participant observation to evaluate the Co-Strategy Process (CSP) at ÄH

For the evaluation of the CSP based on the case study of ÄH, we turned to participant observation, an inductive methodology as the ones used in anthropology and social sciences. Induction means that the investigation is guided by what is discovered during the fieldwork (Persson-Fischier, 2017). In other words, this type of investigation is open-ended and allows for the initially unknown and unforeseeable to be picked up or grasped by the investigator along the way. It allows for new comprehensions and change of premises to happen during the investigative process and to be included in the final conclusion. The aim of this type of methodology is not to prove or disprove a statement or hypothesis, but rather to “try to create understanding” (Heintze, and Thielbörger, 2017, pp. 333) through the development of new statements on the way.

Participant observation entails that the researcher is gaining knowledge about a studied phenomenon by participating in it (Guest et al., 2013, p.75). Simultaneously to taking part in the phenomenon, s/he fullfils her/his role as a researcher through observing, taking notes, audio recordings, image capturing and informal questioning (Guest et al., 2013, p.75). This method is
qualitative, interactive and gives rise to relatively unstructured data, from which the analysis is interpretative (Guest et al., 2013, p.75).

At this stage of the development of the CSP, we thus opted for such an open-ended inductive investigation method. As there is no generally developed and accepted systematic way to work in a co-strategize manner in the field of implementation of medical technology, induction would allow us to observe, document and identify the different aspects to be further modified and assessed.

The phenomenon observed through participant observation is the practical application of the CSP at ÄH. And the research purpose is to evaluate its value for the project. In other words, evaluating whether the CSP reached its goal at ÄH, i.e. providing the hospital with three pre-requisite for the test-bed decision making; actions, groups and community awareness explained in the introduction.

Participant observation was used throughout the application of the CSP at ÄH. The role of participant observer was assigned to different people at different phases, with Dr. Sors Emilsson and myself as a constant throughout the project. The Preparatory phase was researched upon by only the latter. For the Knowledge empowerment phase, we were helped by Veronica Wiktor Castalezzi Gyllenram and Anna Joos Lindberg, students from UU participating in the Project Rehab-Robotic. During the Exchange and Development phase, one member of each interdisciplinary team, the facilitator, endorsed the role. The facilitators/participant observers are referred to in this text as Helen, Jenny and Tom. None of them belongs to ÄH and all had previous knowledge about RAR, the CSP and the research purposes of the project. In this setting, we defined a research question to guide their observations: “How well did this workshop method guide, lead and empower your group to identify what is necessary to be addressed at ÄH for working with RAR?”. Lastly, the Synthesis and Reporting phase will not be reported upon in this study, since it are still currently undergoing.

All participant observers throughout the process reported their observation in a written form, complementing it with audio or video recordings and with pictures. These data were analyzed and summarized. They gave rise to a synthesis of the understandings we gained of the value the CSP brought to ÄH, presented and discussed in the result section (3.3). From this work, we can draw conclusions on the value of this supportive tool and point out specific recommendations for its future optimization.

3. Results and discussion

This section is divided into two parts. The first one presents what resulted from the development of the CSP (3.1). The second outlines and discusses the evaluation data gathered through participant observation during the application of the CSP at ÄH (3.2).

3.1. Outcome of the Co-Strategy Process (CSP) development

The development of the CSP is here presented chronologically. This section starts by presenting the key factors initially taken into account to develop the CSP and by describing the practical challenges that occurred during the development. It then presents the influence of these key factors and challenges on the final form of the CSP (i.e. its four phases). Secondly, we describe how the four phases of the CSP took place in practice at ÄH, i.e. through an interdisciplinary preparation work, a
symposium, a workshop and a report. Thirdly, what has been learnt about the CSP through participant observation as it was applied at ÄH will be discussed.

A. Success factors and challenges in the development of the Co-Strategy Process (CSP)

During the initial development of the CSP, several success factors (1-9) were identified, both from literature around implementation (Swedish Medtech, 2017b; Folkhälsovård, 2017) and from fieldwork at ÄH during the preparatory phase.

A strategy to work with RAR should be aligned both with the administrative possibilities of the clinic and with the practicalities of daily life in the Neurehabilitation unit. In practice, several actors will come in contact with the technology during its use. Each of these actors has unique requirements, related to their work. Despite this difference in needs, these actors strive for the same goal: providing the patient with the best possible rehabilitative healthcare. A strategy to simultaneously provide for these unique needs and to serve this common goal ought to be developed based on collaboration between these different actors. This highlighted a first success factor (1): the importance for the CSP to support interdisciplinary work and collaboration. We early understood that these actors were patients, physiotherapists, medical doctors and decision-makers (i.e. hospital directors, heads of the neurorehabilitation unit). We also understood that the early involvement of representatives of all these stakeholders identified as directly involved in the CSP was another key success factor (Folkhälsovård, 2017, p.34). That the CSP would take into account all of their voices was another success factor (2). In order to take into account all contingents opinions, we aimed at empowering each stakeholder in their own expertise. We also worked with communication tools that would help unveil the different unique needs and experiences in relation to the RAR project.

The Report on Implementation Methods from the Swedish Board for Public Health highlighted a series of other success factors that we worked from. Firstly, this report points out that an equal sharing of knowledge about the project amongst the different people involved (3) is necessary. It is also important to make sure that the staff is educated and motivated about this project (4) (Folkhälsovård, 2017, p. 34). Blend of expertise (5), creation of community readiness (6), and the degree to which the inner workplace social structure are considered (7) are other success factors. (Folkhälsovård, 2017, p.28, 29, 34, 37). Also, discussing the potential problems and concerns (8) the implementation entails should be done early in the project (Folkhälsovård, 2017, p. 34).

Lastly, the time possibilities (9) of our collaborators and of representatives of the involved contingents at ÄH created a practical constraint on the structure of the CSP. For example, one day was available for the knowledge empowering phase and two half-days (8 hours in total) could be assigned for the Exchange and Development phase. We thus had to optimize the use of this time, also making sure that all participants can attend.

B. General description of the Co-Strategy Process (CSP)

In line with all these aspects, the CSP was developed, unfolding in time in four phase: preparation (1), knowledge empowerment (2), exchange and development (3), synthesis and report (4) (see figure 4). Each of these phases builds on the previous one to result in the identification of action
areas and in the creation of awareness, important to the project. The preparatory phase (1) is to be done in collaboration with an interdisciplinary team from the organization at stake, dedicated to taking part in the work. This preparation with the working group involves firstly discussing the apparent needs of the organization, understanding their current level of progress and its central key points. Secondly, the collaboration should result in planning and setting up the next steps of the CSP. The knowledge empowerment phase (2) is about bringing everyone at the organization, as well as the external experts that will be invited to take part in the next phase, to the same minimum level of knowledge concerning the project. In short, this phase is about awareness, information and discussion. Thirdly, exchanging and developing (3) aims at bringing together the different contingents involved, creating a sharing of insights an co-creating a pre-strategy to introduce the technology. ‘Exchanging’ stands for exchange of knowledge, collaboration and group cohesion, while ‘Developing’ points at practical interdisciplinary development and expert’s feedback. Lastly, the observations and conclusions, gathered along the whole process ought to be synthesized and reported back to the organization (4).

C. The Co-Strategy Processes (CSP) at Ängelholm Hospital (ÄH) for Project Rehab-Robotic

The next task was to apply the CSP’s four phases to ÄH’s project. This gave rise to organizing a symposium for the Knowledge Empowerment phase, and a workshop for the Exchange and Development phase. This workshop happened during two consecutive half-days. To create the workshop, we turned to already existing scientific methods that could be used in this setting. After researching the literature, we selected DT, KTP and UJM (presented in the method section). In this section, will be described the final shape of the symposium at ÄH, and the integration of these different methods for creating the workshop. The full schedule of the symposium and workshop can be found in appendix I and II.
a) A symposium with focus on interdisciplinarity and empowerment of process participants

The symposium, on November 2nd 2017, gathered fifteen speakers and seventy participants from ÄH as well as other national and international organizations, clinics and citizens. To inform the audience of the type of profession present at this meeting, and encourage interaction, we provided each of them with a name-tag indicating their personal expertise (e.g., clinical, patient/relative, corporate, research). By inviting rehabilitation robotic companies as sponsors, we aimed at creating a hands-on interaction between the participants and the technology, and at making it more practically real to symposium participants (see Figure 5).

We scheduled a broad range of topics for the talks as to provide the audience with multiple views on RAR. One session gathered different rehabilitation units in Sweden so they could share their experiences with robot-assisted rehabilitation, gained from clinical trials and other involvement in testing phases. During another session, two patient expert speakers gave their opinion on how patients can, want to and should be actively involved in the development of the next generation of healthcare and introduction of innovations such as RAR. The roles of innovation, cooperation and bridges between expertise for a sustainable development in healthcare were also tackled. In the end, the audience was personally engaged and invited to reflect on the future of rehab robotics. Each participant let her own expertise guide her/him in identifying an opportunity and challenge to work with RAR.

b) DT as structure for the workshop

The four phases of DT were used to structure the two half-days of the workshop. The first half-day focused on the two first Ds, Discover and Define, while the second aimed at targeting the Develop and Deliver phases. We grouped the participants in three small teams of five people, creating a palette of expertise from radical collaborators, i.e. collaborators with radically different backgrounds or viewpoints (Roberts et al., 2016). Each team thus included a patient expert, a doctor, a physiotherapist, a decision maker from the hospital and a facilitator. The latter would be introduced to the workshop process in advance and would endorse a support role for the group in its work. It is noteworthy to remind the reader that the facilitator is also the person endorsing the role of participant observer in this context. The activities of the first half-day aimed at providing a platform for each participant to express her/his insights and expertise concerning the project. The Define phase takes place as the groups builds a unique group vision for the project. On the second half-day, discussions regarding the practical introduction of RAR at ÄH, with interviews and feedback from different experts would work as an iterative prototyping step in the Develop phase (Roberts et al., 2016). These experts, coming from both within and out of ÄH would shed lights on technical, human, economical, and research aspects of the project. A list of the experts present in Ängelholm during the workshop can be found in appendix III. The Deliver phase would take the shape of a final presentation of the group work resulting from both days.
c) Knowledge through pictures (KTP) for the Exchange phase

For the first day, we aimed at an exchange of insights and expertise between the different participants. The team members occupy different positions within the organization. They might meet often, or less often, might be very used to communicating with each other and to collaborate, or less used to it. Each organization has its own flow of information, daily working routines and set up, in short, a defined social structure. To sparkle exchange and collaboration in an organization, one needs to have a process that can deal with social structures, change their frames for a moment, tweak them to create different interaction types. The process we selected is KTP, described in the method part. Using drawing and painting for this purpose was aimed to take the discussion out of the usual paths and reshuffle the social structure, opening up for all stakeholders to contribute, independently of their differences in work culture. All the participants would be using paper, pens and paint. The emphasis is on creating a relaxed atmosphere and getting creative intuitive parts of the brain to be involved, taking the attention away from the usual working paths. With KTP, the thoughts of each participant would be laid down on paper for everyone to see, aiming to become the physical material for inclusive conversation dynamics. Using visuals production also aims at being a communication media representing equally well emotions, experiences, academic and medical knowledge, thus empowering the contribution of each expertise (Dahlman, 2004). The expertise of each participant has value for the project: doctors, physiotherapists, patients, and hospital directors. The other experts brought in the workshop to provide feedback had expertise that those didn’t have, and were meant to be complementary with those. For example, one is expert in health economics, another is expert in research around rehabilitative technologies. Furthermore, the engagement of the participants in a common activity, i.e. painting and creating together, has the potential to increase group bonding in a relaxed context, fostering collaboration and the creation of a common vision for the project.

Other effects of KTP, identified by Dr. Dahlman, made the use of this method attractive for the first day of workshop. For example, that KTP results in an increased ability to develop a comprehensive view on a topic, to observe the environment in new original ways, to focus and to better solve problems (Dahlman, 2004; Dahlman, 2007) would be useful effects for the teamwork. The ability of the drawing act to catalyze the formulation and reflection upon the subjects’ tacit knowledge (Dahlman, 2009) was relevant too. In the context of the Discover phase, this can be a way to unveil experiences, opinions and views, of which the individual is both aware and unaware, to him/herself and to the group. Based on the drawn or painted productions, individual reflections and group discussions can grow.

d) The User Journey Mapping (UJM) method for the Development Phase

The user journey mapping method (UJM) is the tool I used to guide our participants into the practical aspects of the daily experience of the patient, as s/he comes in contact with RAR. We decided to use it as the first exercise of the second day of workshop. I will here describe the reasoning underlying the creation of this exercise. Replacing the user by the patient aims at directly creating a focus on him/her as the subject in need, to whom the clinic can offer services and care. Laying down a path from his/her entry in the clinic to her/his recovery invites the participants to empathize with the entire rehabilitation work, having a broad picture while focusing on specific practical stages. The creation of a fictional composite character, i.e. a persona, channels their imagination and makes the journey real. And the identification of touchpoints narrows the focus on the interaction between the persona-patient and the RAR technology at the clinic. This was followed by an analysis of each
touchpoint from the perspective of what the patient feels, does and says and of what the clinic can provide to him/her. This analysis triggers both empathy, reflection and development of practical solutions (The Institute of Health Design Thinking, 2015). All of this slowly directs the groups towards the development of awareness around what is necessary for AH to work with RAR. We found the expert feedback part of the UJM particularly suited to our workshop. It is an ideal moment for bringing in experts from out-house, simultaneously creating prototyping and iteration, as suggested by a review in design thinking for health (Roberts et al., 2016). We invited six experts, providing feedback to the groups one by one, resulting in two expert sessions, interspaced with a time to implement the feedback in the work.

e) Exchange and Development: the workshop

In summary, the first day of workshop would start with an introduction, followed by a warm-up exercise aiming at empowering the participant in their ability to paint concrete and abstract items (figure 6). The use of painting would then serve the discovery phase, with each participant painting a personal contribution to the project (positive skill-based aspect), and a potential hindrance (negative aspect framed as something to overcome) they can identify (cf ‘sharing insights’ on figure 6). The day would close with the creation, in group, of a shared painted vision for the project, that they would present to the other groups (‘define vision’ on figure 6). On the second day, the groups would start by quickly reviewing their common vision (figure 6). Moving into the patient journey mapping, they would imagine a patient persona, identify touchpoints on this persona’s journey and analyse them through a canvas (workflow on figure 6.; canvas to be found in Appendix IV.). On this patient journey, experts would provide feedback and give inputs related to their expertise (figure 6). The groups would update their work according to the feedback, before presenting their patient journey in relation to their group vision to all the other groups (figure 6).
3.2 Evaluation of the Co-Strategy Process (CSP) through application at ÄH: case study

This section is a synthesis of the observations and reflections on the CSP at ÄH from the participant observers. This synthesis is combined here with elements of discussion, which in the workshop sections are indented in the text. In the latter, participant observations were gathered from the three team facilitators, referred to here as Tom, Helen and Jenny.

A. Preparatory phase

Having a reliable and defined group dedicated to work with us at ÄH was a strong success factor for this phase. Initial meetings covered discussing and understanding their intentions with the RAR project, together with their current progress and their primordial needs. The organization of the CSP took place step by step, as we would come with new inputs on how to proceed and receive feedback from them on the suggested workflows. It was important for both parties that trust and honesty prevailed in the communication, exchange of opinion and feedback provided. The discussions shared on those meetings helped adapting the CSP to suit the organization’s need. For example, the involvement of patient experts, the choice of specific experts from in-house and outhouse, the type of contingents involved and thus needed during the CSP, were decision that came out of these discussions. As for practical matters, the team supported us in setting up the symposium and workshop at the workplace (date choice, schedule, venue, practicalities, ...).

B. Knowledge Empowerment phase: Symposium, 2nd Nov at ÄH

The day of the symposium was very dynamic and full of interaction between the participants. The number of attendees was 77, and the wide majority followed the whole day. A high level of interaction between the participants during the breaks and lunch was noticed, and questions were raised after each presentation. The presence of sponsors with robots to display also sparked a high level of interaction with the tech. Some participants even tried the robots, others would ask about what they are like, give their personal opinions or testimonies... The presence of members from four clinics in Sweden who are already working, or have worked with these robots directed discussions towards very practical aspects. It seemed like their presence also made the topic more realistic and concrete for the ÄH staff. A feeling of enthusiasm, engagement and reflection could be sensed in the end of the day.

When it comes to this project, the symposium removed a prior skepticism in the organization, that was reported to be due to a low amount of information of the project and knowledge regarding RAR. This highlights the importance that information concerning a new project/intervention or process equally reaches employees at different sections and levels of the organization. This is a goal that the organized symposium managed to meet. It also reached its goals in terms of providing information and sparking discussion between the different staffs, stakeholders, and persons attending the event interested in RAR. A project participant from ÄH reported that the symposium resulted in an overall reduction of the skepticism towards the project and towards robots in general within the clinical staff.

C. Exchange phase: workshop day I, 20th Nov at ÄH

In general, the participant observers report the first half-day of workshop as particularly effective at three things. Firstly, at inviting the participants to share insights and discuss. Secondly, at fostering the teams’ bonding. And thirdly at creating a team’s dynamic or workflow (see Figure 7,
left picture). They also found that validating these three assets within the teams was especially fruitful before getting onto thinking together about action plans and practical work, on the second day.

The artistic activities got the group members to talk and open up, as reported by all participant observers. They created an atmosphere of exchange of ideas and of expression of individual contribution based on personal knowledge, skills and experience. Tom observes that the participants were also led to approach each other, and later the topic, in a creative and original way. The combination of expressing oneself visually and being asked questions openly by all set a ground for listening to each other. It is also reported to have empowered each actor to present their opinion. Having the thoughts laid down on paper with colorful forms particularly sparkled interest, transforming it further into playful curiosity, describes Helen. She argues that it guided the teams into creating a pattern and habit for discussion.

Figure 7. Photos from workshop day I, 17-11-20, ÄH. On the left: participants (doctor, patient expert, physiotherapist, decision-maker and facilitator) interacting and exchanging perspectives. On the right: focused atmosphere in the room as the participants are visually expressing their perspectives about the project.

As the group members were engaging in similar tasks and getting to know each other through visual productions and discussions, Jenny could observe group bonding growing stronger. The work to perform helped the group to develop their own ‘group culture’. Ways to interact were found, decision-making strategies appeared as the groups were forced to reach consensus or to decide on the road they would take next. The day resulted in three quite cohesive teams, well grounded for respectful and fruitful discussions, with even levels of participation from all members.

During the early stages of the day, some participants were hesitant or insecure about the tasks to come, while others welcomed them with openness and quiet excitement. One or two also found the connection between the activities and RAR vague or difficult to understand. In all cases, the participant observers found that the intervention of the process leaders was an important factor for the development of the teamwork. Especially important was the clear communication by the process leader of the method used, of the seriousness of the artistic approach and of its purpose in relation to the project. A soft but strong and clear empowering attitude from the process leader diminished any uncertainties the participants might have had about KTP. Throughout the hours, the atmosphere raised by the act of creating together, using the provided art material. The way the tasks were organized in the agenda also led to an observable increase of the participant’s self-confidence in their abilities to use painting as an expression media. Thus, it appeared that each step
prepared the participants for the following one. This was especially evident when it came to the participants’ ability to express themselves visually through drawings.

a) Introduction to day one of the workshop

At the beginning, a wavering feeling could be sensed in the room. First-hand introductions of self and mutual questioning about the day’s activities quickly took place. Soon enough, the introductions by the process leaders clarified the ambiguities and focused the attention. Overall, the aims for the day and the tasks to come were well explained, with questions well handled, reports Tom, one of the participant observers. He also found that the practice was well grounded in a scientific frame, which he found increased the trust of the group members and had a positive effect on their attitude. The idea of working with pictures was welcome by most, some being slightly or strongly reluctant to the act of painting.

b) Identify contributions and hindrances to the Robot-Assisted Rehabilitation (RAR) project at Ängelholm Hospital (ÅH)

Individually formulating and writing down own opportunities and challenges to work with RAR was particularly good to do before any drawing task was performed, reports Jenny. Then, the minds of the participants were still fresh and unaware of the upcoming tasks. The obligation to use only one word for describing, first, an opportunity, and secondly, a challenge, forced the participants to be concise and to summarize their thoughts. An example of challenge for the project could have been expressed as «I believe that the physiotherapists have a lot of preconceptions and ideas concerning RAR, which make them reluctant to engage in this project. I have heard my colleague saying this and that, and therefore I think there is a lot of pessimism about the project, .... ». With the guideline of using one word to describe this, a whole story filled with details became «negativity». A reflective and thoughtful atmosphere could be sensed as everyone was performing the task.

c) Painting warm-up exercise

As this exercise was announced, a couple expressed hesitation or skepticism, others a small discomfort with drawing. One person openly wondered about the connection of the task with the RAR project. The rest of the participants went easily into the tasks, showing dedication and curiosity. Some groups didn’t even express any uncertainty, as reported by Helen and Tom. The tasks’ seriousness and connection with the project were not questioned by their group mates, thanks to the process leader clarifying the exercise’s purpose as it happened, they suggest. Enjoyment and fun were words that came out, together with appreciation for the ‘great inspiring material to work with’.

After the previous exercise, more thinking-oriented, this creative one lightened up the atmosphere. As the participants reported enjoying themselves, their minds seemed to loosen up and think differently, in a more relaxed and intuitive way, observes Tom. Helen hears her group colleagues saying they are feeling like children, remembering childhood or mentioning their own children as they draw. Jenny reports similar observations and links this with the participants possibly getting slowly into a playful kid-like ‘beginner mindset’, more open to re-discover an already known topic. When presenting the painted fruits to group members, all have taken the task seriously. The exchange of pictorial production created a group feeling again, and a dynamic of exchange and mutual curiosity, analyses Jenny. The next exercise, in which the participants had to draw and
abstract item (i.e. the reason for which they appreciate their favorite fruit), seemed more difficult to many. Surprise is expressed at first, before quickly getting into the task. Once again, imagination and creativity were stimulated as the pencils and brushes moved along. The silence required during these individual tasks created focus and depth, reports Helen (see Figure 7, right picture). It also contributed to the dedication and seriousness shown, she thinks.

The sharing of the abstract productions led to small group discussions. Jenny’s group conversed on how individuals have different ways of processing and expressing thoughts. And on how this exercise allowed them to get insights into each others’ paths of thought. Helen’s group developed further on the topics of thinking in new ways and finding original solutions. They concluded that several things were important for this to happen. For example, they cited: overcoming fear and inhibition, setting imagination free and being open-minded to new concepts. Tom’s group’s discussion went around the topic of communication in general, its difficulties and the usefulness of using another type of language, such as painting. The participants felt guided to think outside the box and to get into a creative approach. When it comes to the group dynamic, mutual trust and interest was observed to grow as the tasks went along. Collusion and bonding also went increasing, according to all participant observers.

Reflecting on what happened at ÄH, this sequence of exercise was valuable for the Exchange phase, as it progressively built both a habit for interaction and group bonding. The fruit exercise, even if seemingly naive or simple, has indeed played a crucial role in making the participants comfortable using the painting media to express themselves and communicate with each other. The attitude of the process leader strongly affected the positive proceeding of the workshop. An ability to make the participants confident about the method used and to empower them during the work was pointed out as a key element to the success. The person leading the process should be knowledgeable about the KTP method, able to ground it in a scientific frame, fully engaged during the day and supportive without unnecessary softness (i.e. the pace and purpose of the day shouldn’t be lost).

d) Express and share contribution and hindrance

During the questioning time, where the group members discussed each painting produced within the group, Tom could sense curiosity in the questions and sincerity in the answers. This was reported to be the key moment of the discovery phase by most participants. It provided an understanding of the background, experiences and attitudes towards RAR. One participant said, reflecting on the exercise in retrospect, that the questions asked by the others on his own picture gave him new inputs and thoughts concerning his personal role in the project (Figure 8). Being asked questions allowed a patient representative to explain her feelings towards the project, as well as her reflections on possible problems, reports Jenny. This reflection was a trend in all participants, which led the participant observers to regard this work on contributions and hindrances as the key exercise of the day. Participants also felt that listening to the questions a team mate would ask was revealing of her/his personal positions and perspectives about the project, or simply revealing aspects of him/herself. Helen found that in her group, many subjects were broached during this exercise, brushing the surface rather than going in depth. In short, this was found to be both a reflective and insightful time.
The design of the exercise resulted in a very democratic and equalitarian exchange of ideas, report both Tom and Jenny. The ideas or thoughts of each participant were equally presented at the view of all, while all were reflecting on each pictorial insight. This dynamic, with everyone’s opinion equally considered and questioned by the others, is different from the ones both Tom and Jenny report to usually encounter. A time and space was created for each, which allowed participants to speak and be heard, despite the differences of roles and already existing social structures. The exercise’s structure also lead to a similar engagement of all group members, reports Helen. As the questioner was unaware of what the painting depicted, s/he could only ask questions solely about what s/he would see. This directed the focus of the upcoming discussion on intention, feeling, meaning, deeper and unexpected aspects of the concepts presented. This ‘blind questioning’ also sparked curiosity for each other’s perspective, ways of experiencing and expressing things.

One of the participant observer witnessed Dr. Dahlman’s theory on tacit knowledge and painting taking place in practice in her group. That is, how artistic creation can mediate the expression of and reflection upon tacit knowledge (Dahlman, 2009). In her group, Jenny noticed several participants being thoughtful from specific questions about their painting. A participant in particular expressed the ability to be inspired by others (see Figure 8). The questions from other group members were targeting specific visual aspects of the drawing: the variety of colors used, the small black dots that irradiate from the center, the feeling of an exploding strength that they got from looking at the painting, the core of this explosion and what it represents. The author of the painting managed to answer each of these questions very specifically. When discussing the painting, the painter commented: « I got questions about aspects of my painting I hadn’t neither reflected upon nor thought of. For example, the question about the core of my inspiration. But when trying to answer, I could actually feel what the answer was. As I was asked, I realized that I actually knew what this was about. I hadn’t thought about it, but the answer was there anyway. ». To Jenny, this definitely exemplified how this person already had this ‘tacit knowledge’ about what she meant inside her, even before painting. Doing so allowed the participant to let the unconscious knowledge be formulated together with the other participants. Having the creative productions as a communicative media resulted in deeper discussions, not only skimming over the surface, but

Figure 8. Painted contribution of a decision-maker at ÄH: the ability to be inspired. Workshop day I, 17-11-20, ÄH.
dealing into deeper representations, meanings and personal realities of the concepts. A powerful phenomenon for exchanging insights, of which some participants became aware.

These results highlight how valuable this exercise for exchange was to a Discover phase (cf DT) including several actors. The combination of identifying, expressing through painting and question-based sharing of contribution and hindrances unveiled personal expertise and perspective to the groups members. It also conveyed deeper discussions onto those in relation to the project. Working with KTP at this stage, triggered curiosity and playfulness, activating a beginner mindset to re-discover the topic at stake from new perspectives and to foster innovation. A phenomenon that has been previously demonstrated by Dr. Dahlman in her research: the development of new original ways to observe, of comprehensive views on a topic and of better problem solving abilities (Dahlman, 2004; Dahlman, 2007). Furthermore, the characteristic of KTP to offer a media for tacit knowing expression (Dahlman, 2009) provides the CSP with an increased depth of individual sharing and group discussions.

e) Personal vision and group vision

General comments on this tasks were a lack of time and of guidance around what is meant by ‘vision’, reported by all participant observers. Some participants were confused about whether the vision should be abstract or concrete, and the word ‘vision’ ended up being understood in different ways by the different groups regarding RAR at ÅH and how the work with RAR would look like in the future (see figure 9).

A lack of time to produce, gather and discuss thoughts was definitely present at this stage. It might be good sometimes to keep the pace up not to lose potential momentum. But in this case, the observations led to conclude that this rush prevented, to some degree, the growth and application of the new collaboration set up just developed by the groups. For example, Jenny’s group based the common vision on the vision of one participant that they further developed, instead of creating it from scratch. Jenny felt that this created a bias in the collaboration, due to the lack of time. Despite

![Figure 9. The common visions produced by the three groups on workshop day I, 17-11-20, ÅH.](image)

despite this aspect, most participants were positive, encouraging and enthusiastic towards the exercise. One or two only showed some reluctance and lack of understanding of the point, but still being open-minded.

21
In one group, the personal visions were very similar, while in another group they differed greatly. When shaping the common vision based on the individual ones, the different groups worked differently. In one group, they agreed what was to be painted first, and then one member painted the vision. While in another group, all members simultaneously created their vision on the same paper, each with a brush in their hand. This appeared to Tom as a result of the group bonding that had been created throughout the day. In line with this, Jenny said that despite the lack of time, the creating together resulted in a group mindset that they were working together towards a common goal. Furthermore, during this exercise, the group members realized that discussions were essential for reaching out to each other. Helen realized that the task empowered exchange of what was created, synthesis and consensus making. She noticed a real energy buzz, group feeling and momentum in her group. Finally, having participants that did not come from ÄH was fruitful in this part: they could suggest parts of the visions that were not identified by participants working at the clinic.

Taking ÄH observation as inputs on the CSP, it appears that this exercise would benefit from a bit more time. The different comprehension and interpretation of the word ‘vision’ by the three groups led to discussions whether the word should be better defined when the exercise is explained. Leaving the word to interpretation can be experienced as difficult during the exercise, but this is outweighed by the potential diversity of outcomes it created. It forced the participant to reflect and give a personal perspective on the matter. The potential diversity of produced vision can even give complementary lights on what the project can mean, as occurred in the case of ÄH. Creating space for interpretation also emphasizes the role of the participants in building this project, as implied by the concept of community-based research. Collaboration, synthesis and consensus making were also positive outcomes of this task.

f) Presentations

As the groups targeted three different standpoints in the vision, the participants found it interesting to hear about what the other teams had produced. The spirit was reflective and sparkling discussion, both concerning the produced visions and the workshop’s activities. It also became a feedback and wrap-up time. The quick introduction to the second day primed the participants brain and reminded them of the bigger picture and context around this workshop.

D. Development phase: workshop day II, 21st Nov at Ängelholm Hospital (ÄH)

The change of room and room setting (see figure 10) is reported to have played a role in the change of working mindset. More space was provided to each team, which triggered an increase in group focus, felt Tom. Helen noticed that the drawings from the previous day on the walls around her team stimulated their imagination and kept the work from the previous days alive in their mind and work. She adds that the prepared workspace, with the canvas ready for direct use, set the groups into the atmosphere of a productive work day. With the high tempo, the teams did end up producing a lot together. However, it also sometimes created a sense of urgency, which worked against an equalitarian discussion platform, observe both Jenny and Tom. During the expert sessions in particular, the discussion dynamics could seem like each wanted to ask her/his own specific question to the expert. This happened at the cost of listening properly to each other – as the participants would be too focused on one’s own point or question – and of leaving a space for each to talk. Finally, certain groups felt a lack of information concerning the desirable outcome of the day. They
felt uncertain about how deep to go into each of the topics tackled, unable to decide for themselves whether to focus on the patient perspective or the preparation of working with RAR for the clinic.

For further use of the CSP, the change of room setting in connection with the change of mindset it created between the two days of workshop was identify as important. This finding is consistent with the sole existence of the field of workspace design, and can find support in recent research on innovation spaces (Wagner and Watch, 2017, p.4-8).

Figure 10. Setting of the room on workshop half-day 2. On the left, a broad view of the room, with one corner of each organized for each team. On the right, a corner of the room set up for teamwork, with a working table, a white board displaying the touchpoint analysis canvas and their painted vision and visual productions (contribution and hindrance) from the previous day.

a) Updating group vision

This was a good way to get back into the working and group mindset, report the participants observers. One group complemented their abstract vision with concrete thoughts, for the others it became a recap of the previous day.

b) Patient journey (persona, journey, touchpoints)

In general, the persona were created by the group, with each person adding assets that related to their own expertise (Figure 11, left picture). In two groups, each person took a pen and participated to creating the fictive patient identity. In the third group, one person became the group’s secretary and took the responsibility to write the persona’s identity based on group consensus. Overall, the definition of the persona was easily understood and the work with post-its was quick, efficient and democratic, report the participant observers. One could notice that the participants enjoyed thinking about a character and building a background story, tells Jenny. The exercise allowed each to put him/herself in the shoes of a patient. Furthermore, having a specific persona in mind made it easier to complete the next task, observed Tom.

Identifying touchpoints and analyzing them (see figure 11, right picture) created a lot of discussion. In Helen’s group, these often went into expressions of personal experience, which she found relevant but also taking the focus away from the exercise, leading to shortage of time. In Tom’s group, the identification and analysis were done simultaneously, which generally went well. The group experienced slight difficulties in agreeing on some touchpoints, but Tom found that the
exercise generally went well. The structure of the canvas created a focus on the patient and the patient experts in the groups were asked for their opinions and perspectives repetitively. Identifying the touchpoints was also part of the empathetic process with the patient, together with a consideration of the human and medical context in which the technology could be introduced,

Figure 11. Group work on workshop day II, 17-11-21, ÅH. On the left: persona creation; on the right: patient journey mapping.

analyses Jenny. She adds that it gave the participant a broad picture of the patient’s life throughout the whole treatment. And that analyzing the touchpoint triggered empathy even more, as the participants were trying to figure out what the patient feels, thinks, says and does. The last category of the touchpoint analysis focused on what the clinic can offer as service for the patient care. This depicted the clinic as an active supporter and provider for the participants, inviting participants to come up with ways to support and offer services, observed Jenny. Before meeting the experts, some participants felt that they missed the opportunity to summarize what they had written on the post-its.

Tom suggested that this exercise could be changed in two ways. A finished persona could be directly handed to the groups. That would reduce the focus on creating and presenting it, which he found took time and energy. Secondly, the journey’s touchpoints could be outlined in advance, so that the group efforts could have been concentrated on filling the grid for each of them with content. In this way, he argues, more content would have been developed for each touchpoint.

c) Meeting with experts (feedback and update)

While many aspects of this part of the workshop seemed to have worked well, other aspects’ efficiency were intensely reflected upon by the participant observers in their written reports. The following paragraphs will first outline the aspects reported to be positive. Then, aspects pointed out as negative will be discussed.

Firstly, the two experts sessions presented a broad range of expertise, which gave a sense of full picture to the participants. The discussions with the groups flowed well, many questions were asked and most of the feedback was perceived as insightful (figure 12). Through these meetings, the experts clarified some aspects of RAR and of the implementation process that might not have been
talked about otherwise in the groups. Many participants found these discussions short and felt rushed through the task. They however appreciated the mix of time to meet with the experts and time to update their canvas. One expert gave the feedback that he enjoyed his intervention, and felt that it allowed him to express the standpoints and importance of his expertise to the participants (figure 12).

Figure 12. Expert feedback during workshop day II, 21st Nov 2017, ÅH.

The case of ÅH highlights the impact of the expert choice for these feedback sessions. The comments they provide will shape, to some extent, the result of this Exchange and Development Phase. Discussing the relevance of experts with the organization project team during the Preparatory phase and reflecting on what each expert will bring to the project is thus essential. Making sure that the selected experts do not come in with a specific agenda, influencing the project in their advantage is another crucial point.

Helen highlights the difficulty of pitching the persona and patient journey shortly to the experts, and the tiresomeness of repeating this pitch to each of them (six times in total). Additionally, given that the patient story was not relevant to all discussions with experts, she suggests that each group would present its persona to all experts at the beginning of the sessions. Another possibility for change here would be to pair up the experts in groups of two, dividing the number of presentation by two and potentially increasing the efficiency of these sessions.

On the second day of the workshop, the time aspect was highlighted as a problematic element. It hampered the group equalitarian exchange strategy, developed on the previous day, to bloom and reach its full effect as hands-on tasks were approached. This counterproductive sense of urgency could be addressed through several changes in the agenda, some of them suggested by the participant observers. The first suggested change is to provide a readymade persona and journey with touchpoints to the groups, instead of letting them create those. However, reducing the time allocated to creating the persona would diminish the focus on the user, which is particularly important in the context of introduction of new devices. I recommend thus to keep the task of creating the persona and outline it journey to the group work. Leaving the identification of touchpoints as a group work is also important, in connection to the potential application of the CSP in other organizations. These touchpoints might change from one organization
to another, and these cannot be predicted beforehand. It is therefore important for the workplace stakeholders to identify them themselves, which requires an open-ended process (i.e. a process of which the end-result is not defined at an early stage). The connection with the community-based research principles here clearly appear, and with the central fact that what the participants are the ones bringing into the process what the organization is keen on learning. In other words, initiative and engagement of participants are key in the CSP. Another suggested change concerns the presentation of the persona and journey to each expert. The presentation to all experts at the same time, at the beginning of the session and the combination of experts in duo are both valid propositions for changes. These settings will increase the time for discussion with experts, lower some repetitiveness and tiresomeness for the group and address the problematic time rush.

The participants of one group in particular experienced strong difficulties in grasping what scope of the project they should focus on. In a way, the participants felt that the aim for them was vague and that the different exercises were taking them onto conflicting or discordant paths, reports the group’s facilitator, Jenny. The latter suggests this might be due to a certain mismatch between the angle taken in the patient journey exercise, and the perspectives brought in the expert sessions. This point appears to be a key concept to understand what created friction on this second day of workshop. In relation to this, the first panel of expert was reported to have worked better than the second one, likely due to its closer connection to the patient’s journey. The second panel was perceived by the participants as rather connected to RAR implementation than to the treatment with RAR, which was perceived more abstract and remote.

This discrepancy between the patient journey and experts’ feedback was also reported by the participant observers, in connection with the touchpoint analysis canvas. As the attention was focused on the experts’ perspectives, the participant observers noticed that many post-its produced by the team during the previous exercise got lost on the way. Those ideas, amongst which some might be very important, ended up being simply left aside, reports Jenny. Moreover, it appeared difficult for all groups to update their canvas with the inputs from the experts. A lack of space for feedback on the canvas was obvious, but a lack of inclusivity for some types of feedback also came out. In reaction to these observations, the participant observers suggested changes to the canvas layout. Helen depicts a canvas with two time axis: one for ‘AH working at installing RAR’, the other focusing on ‘contact with the patient’. Jenny suggests providing the groups with an additional fully blank canvas, in which the they could create a new structure where the inputs from the experts would fit.

All along this second workshop day, confusion was sensed in the participants, concerning the scope of the work to aim for. Additionally, the aspects tackled in the UJM were difficult to combine with the information from the experts. In order to improve this, we suggest increasing the agility (susceptibility to changes on the way) of the exercise and the encouragement of group engagement and initiative through modifying the canvas. This change entails keeping the canvas as it is for the UJM and providing the groups with an additional blank canvas during the expert feedback, as suggested by a participant observer in AH. Thanks to this, there will be a space for adding expert feedback together with the patient journey by providing the groups a possibility to re-cluster their findings and organize them into original categories of their choice. This solution keeps the group discoveries free and open, while suggesting that changes might be necessary. It also
maintains the emphasis on group investigation and findings, as strived for. For example in ÅH, most groups discovered that a lot of work needs to be done in preparation to working with RAR, which was a valuable information concerning RAR at ÅH. This agility and openness of this new canvas use make it possible for a use of The CSP in other workplaces, where other types of findings, not identified at ÅH this time, could come out. Having to recreate a canvas themselves will also force the groups to go through the post-it they wrote before the expert feedback, and those wouldn’t be left aside, as reported in ÅH. Finally, such a canvas would also call for a freer form of handling the final presentation, amplifying and enabling group diversity.

One way to address the participant’s confusion during these exercises is to give them more guidelines and instructions. However, this will affect the outcome of the workshop, in the sense that it will limit what participants will find. For example, it will direct them towards certain needs of the institution that we already know of. Others that only they would be able to tell about, and of which the institution is not yet aware of, could then be unidentified and missed. Frictions are not bad per se, as they often occur when conflicting ideas come in contact or when people are taken out of their comfort zone, possibly leading to new ideas or innovative views. Recent theories within DT even claim that chaos and confusion in teams is highly fruitful in terms of outcome (Hall, 2017). Still, the data from ÅH highlight that the participants are in need of some kind of support in this process.

A first way to support the participants is by emphasizing the use of Community-based Research (CBR) in the CSP by the process leaders. CBR is a research approach that is community-driven, participatory and action-oriented (Center for Community-Based Research, 2016), broadly taken in this project. Secondly, the facilitators can also be a source of support to the participants. As the process leader would provide guidelines involving vagueness, create confusion and press onto the systems to push the work forward, the facilitators should smoothen this pressure, create a safe environment for the co-workers, encourage their initiative, pick up ideas from everyone and be diplomatic. Once again, the high impact of the process leaders’ and facilitators’ attitude appear here, coming in as key aspects for the smooth running and success of the CSP.

d) Presenting the work

Preparing the presentation forced the groups to include the expert feedback in their initial picture of the work to be done, and to create a new, broader one. It was an important time for each group to wrap up their ideas, put the pieces of information together and draw conclusions from their work, reports Helen. One of the groups held on to the canvas layout a lot, which made this task difficult for them. Another one spontaneously took the liberty to make an additional poster for the presentation. The last group decided to leave many post-its aside from the canvas and focused on preparing a written script, which didn’t seem to be beneficial according to Tom. Relating the patient journey and the group vision was also experienced as difficult at this stage, noticed Jenny. She suggests that a more open and free form of presentation would have benefited the groups.

Besides these points, having the different groups presenting to each other was observed to have synergistic effects, with interesting contributions from all groups. It opened up for questions and answers and for further discussions about the RAR project at ÅH, its upcoming stages and the value
of the CSP in this context. Sharing what they had produced was also the occasion for the groups to feel the final result of the work accomplished during those two days. This gave rewarding and satisfactory feelings and created a sense of engagement.

   e) Concerning the workshop as a whole

Regarding the participants, the fact that some of the group members were external and not part of the hospital structure (the facilitators and patient representatives) was perceived as beneficial. The participants from the hospital reported that it took them out of their usual ways and created a different interactive dynamic. Moreover, it brought them new ideas, ways of thinking, perspectives and feedbacks. Besides, the sharing parts between the teams at the end of each day were also regarded positively by the participants. They opened the floor for discussions about broader topics and showed the different reflections and ideas of each group. They also provided a feeling that we were, altogether, doing something meaningful. Furthermore, participants expressed that dividing the workshop into two days had beneficial effects: it provided an opportunity to take in the information, reflect on it and process it. Since the workshop itself was perceived as intense and tiring by many participants, an overnight break was particularly appreciated. Participants also reported valuing the time given for interaction without any particular task, such as during the breaks. Lastly, the support of the facilitators to the teams was perceived as helpful, particularly on the second day. As the exercises were then very different from each other, help with understanding them and not getting lost in details was definitely useful, expressed participants from all teams.

   Learnings from ÄH highlighted the value of an Exchange and Development phase in two parts, with a time to process and re-load in between the two phases, and space for off-work interaction. Mixing participants from in-house and outhouse, together with radical collaborators as supported by DT theories (Roberts et al., 2016), is another element that should remain part of the CSP. Finally, the facilitator role should also be kept.

   E. Value of Robot-Assisted Rehabilitation (CSP’s) for Rehab-Robotic Ängelholm Hospital (ÄH) and broader use

The first question when it comes to the CSP is whether this tool supported ÄH with the three pre-requisites enabling them to make a decision over test-bed introduction.

The first day of workshop materially resulted in three complementary visions for working with RAR, common to representatives of all continents that would come in contact with the technology. With respect to workshop day II, the group work led to creating a strategy to work with RAR at ÄH. This was done through identifying a list of the aspects to consider and act upon before, during, and after the technology would be introduced. These workshop outcomes can, in turn, be connected with pre-requisites (2) and (1). In addition, the CSP overall resulted in a large increase of community readiness, through its three first phases; Preparation, Information (symposium), Exchange & Development (workshop). The participants developed a heightened understanding of the process, of the diversity of actors involved and of what really needs to be addressed when working with RAR at ÄH. A feeling of engagement, insightfulness through exchange with other stakeholders are also considerable parts of what the participants took home, and can share with their co-workers in the future. This community awareness, readiness, engagement and motivation are the foundation for the project to take place, in case ÄH decided to test and evaluate RAR at their rehabilitation unit. Based on these aspects, we can conclude that by using the Co-Strategy Process provided ÄH with reliable, creative and engaged inputs.
from its community and external experts. These will enable ÅH to undergo the two first phases of the Quality Implementation Tool (QIT), answering the questions of the initial assessment and developing a structure for implementation. With those in hand, the hospital will most likely be able to make a decision over the introduction of test-beds.

In practice, a report is currently being prepared aiming at communicating the results back to the workplace. As this fourth phase of the CSP, Synthesis and Report, is still undergoing, we cannot draw a final conclusion on the value the CSP brought to ÅH in terms of enabling their decision-making. Further follow-ups are thus necessary. Additional surveys to the CSP participants, assessing specific aspects highlighted by participant observers, are also recommended to increase the value of this final conclusion. Interviews or focus group discussions could also be used for this purpose.

4. Conclusion

In conclusion, the Quality Implementation Tool (QIT) provides organizations willing to introduce a new way of working with nailed-down questions and checklists (Meyers et al., 2012b; Folkhälsomyndigheten, 2017). It however appears that ways to support this work with reliable sources of information and processes for actions to take place are felt missing by some hospitals, such as ÅH. This connects with the lack of support to small-scale decision-making, reported by the Swedish Medtech agency as an important underlying cause of the low rate of medical technology outreach to healthcare (Swedish Medtech, 2017b). The CSP, developed in this degree project, is a tool aiming at providing this missing support. It is a practical process, involving four phases, that can be set up at an organization to unveil necessary information and generate necessary actions to support the introduction. Specifically, it is here targeted at the early stage of introduction when a hospital makes a test-bed decision.

The flexibility and agile character of the CSP makes it applicable for broader use in other hospitals, and potentially in other non health-related organizations working with introducing a new technology or process. The outcomes of the workshops rely on the active and unforeseeable inputs of the contingents from the workplace community involved. The experts to be invited must be re-considered for each case, according to the field in which the introduction would take place, and to the Preparatory phase outcomes. Also, the facilitator/participant observers setting results in that every time the CSP is used, we can learn more about the contexts where it can be used, and about specific aspects in need of refinement in these contexts. Furthermore, special care should be taken when preparing candidates for the role of process leader and facilitators, as these appeared central for the process’ success. In conclusion, the original combination of artistic communication methods (KTP) with Design Thinking and User-Journey Mapping, together with the agility, adaptability and self-learning character of the CSP make it a powerful tool to use when an organization needs material to evaluate the pros and cons of introducing a new tech or process in their workplace.

As for the future of research in this field, we recommend the use of deduction methods such as survey or interviews to further evaluate the specific elements highlighted by participant observation in this study.
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6. References


