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Exploitation of University-Based Healthcare Innovations

*The Behaviors of Three Key Actors and Influencing
Factors*

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Abstract

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Large resources are invested in healthcare research, but despite this there is a wide gap between research knowledge and healthcare practice. Implementation researchers have addressed this gap, focusing mostly on the role of healthcare practitioners. However, a narrow focus on implementation does not take into consideration the preceding stages and the roles of different actors during the whole innovation process, which starts from research and ends with implementation. The aim of this thesis is to examine the behaviors of three key actors during an innovation process and to explore the influence of selected contextual factors on their behavior.

Study I (n=10 funders) identifies several facilitative roles for funders and suggests that implementation risks becoming no one's responsibility as the funders identify six different actors responsible for implementation, the majority of whom embody a collective or an organization. Study II finds that the implementation knowledge of Swedish funding managers (n=18) is mostly based on experience-based knowledge. The majority of the funding managers define implementation as a process and express limited knowledge of implementation. The findings of Study III (n=4 innovation cases) show that the roles and involvement of academic inventors and ISAs (innovation-supporting actors) are more connected to intellectual property (IP) nature than to intellectual property rights (IPR) ownership. Study IV (n=4 innovation cases) identifies three different logics that influence the behavior of academic inventors: market, academic and care logics. A pattern emerges where the behavior of academic inventors is guided by a unique logic and there is no interaction between logics, despite the existence of multiple logics. The individual strategies to handle multiple logics coincide with the influence of logics. In addition, IP nature, distinguishing between high-tech and low-tech innovations, is connected to the influence of institutional logics: low-tech connected to the care logic and high-tech connected to the market logic.

This thesis has three main theoretical and practical implications relevant for practitioners, policymakers and researchers. First, implementation responsibility is an important issue to study and discuss, because without clearly defined responsibilities and management of responsibilities, responsibility might become no one's responsibility. Second, the finding that experience-based implementation knowledge contributes heavily to policymakers' knowledge encourages further studies and discussions regarding this relatively neglected issue. Third, the importance of IP nature in shaping innovation processes should be considered and further examined, not only as a factor influencing inventors and ISAs' roles and involvement, but also as influencing the prevalence of different institutional logics. Further, the relevance of a distinction between low-tech and high-tech IP should be reflected on.

Keywords: implementation responsibility, research funder, implementation knowledge, commercialization of science, university ownership, inventor ownership, institutional logics, medical technology

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*To my wife and children –
You are my sun*

List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

- I Brantnell, A., Baraldi, E., van Achterberg, T., Winblad, U. (2015) Research funders' roles and perceived responsibilities in relation to the implementation of clinical research results: a multiple case study of Swedish research funders. *Implementation Science*, 10(100).
- II Brantnell, A., Baraldi, E., van Achterberg, T. A Qualitative Exploration of Research Funding Managers' Implementation Knowledge. *Manuscript*.
- III Brantnell, A., Baraldi, E. The roles and involvement of academic inventors and innovation supporting actors in university-based innovation processes: The influence of IPR ownership and IP nature. *Manuscript*.
- IV Brantnell, A., Baraldi, E. Unique Logics despite Institutional Complexity: An Inductive Study of Academic Inventors and Institutional Logics. *Manuscript*.

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Introduction

“One thing that is certain is that if the thing is good enough nothing in the world will stop it. I mean all good applications or products or thingies are going to be used. There is no wastage [in the system], but on the other hand a lot of new things are produced, for instance, boxes that blink and honk and sensors and stuff that no one has asked for.” (*Swedish research funder1*)

“[W]e have our representatives of the healthcare system [in the Board], and they will hopefully absorb some of the discussion and the results we have and take them forward. But it [utilize and implement the results] is not a task for them [the Board or the funding organization].” (*Swedish research funder2*)

“[R]esponsibility to implement clinical research, it should actually be the county councils? But I don’t think that they feel like that. I mean, I have never heard these kinds of questions [who is responsible for implementation] and I have been a director in healthcare for a very long time, and I have never heard that this question [responsibility for implementation] would have been raised in any of the director groups at the county council.” (*Swedish research funder3*)

Healthcare and healthcare research

The three citations above,¹ all from Swedish healthcare research funders, highlight two central issues in patient care and healthcare research, namely: 1) some perceive that implementation² is not a problem, if there is a good treatment available it will be implemented, and 2) it is unclear who actually is responsible for implementation of new treatments. The first issue becomes problematic in a context where there is a gap between the provided care and the recommended care. The existence of this kind of “knowledge-practice gap” is well documented in several studies and countries. For instance, Grol (1) reported that roughly one out of three patients in the Netherlands did not receive recommended care. Likewise, McGlynn et al. (2) stated that in the US only 55% of patients received the recommended care. Gustafsson et al.

¹ The citations are from one of the studies included in this thesis and illustrate also two foundational aspects that guided this thesis work.

² Implementation as a concept will be presented in the Background section: Implementation of healthcare research results. For now it will be enough to state that implementation is the planned introduction of new evidence in healthcare practice.

(3) found that only 64% of Danish patients with acute coronary syndromes, diagnosed with diabetes, received the recommended care. Open comparisons of care conducted between county councils in Sweden show that women with osteoporotic fracture do not receive medication in accordance with the latest recommendations (4). Further, in a systematic review, Hulscher et al. (5) reported that there was a 50% overuse of antibiotics. Hand hygiene is still inadequate in several countries and at healthcare organizations, although the risks, of not washing hands, are known (6–10). So, given these examples and many others, implementation does not seem to take place automatically when a recommended treatment or procedure is available. In contrast, I noticed when I was involved in planning implementation of results from an applied research program that several involved actors seemed to think that implementation takes place automatically. This observation increased my scientific curiosity.

What about the other issue that was raised above, namely the lack of responsibility? My background in political science sensitized me towards thinking in terms of responsibility, when evaluating roles and tasks different actors are assumed to undertake. I noticed several interesting phenomena before becoming a PhD student: 1) many researchers, who in Sweden own the intellectual property rights (IPR) for their research, i.e., the research results, seemed to distance themselves from responsibility to implement, thinking that their role is to conduct research only, 2) the Swedish Board of Health and Welfare (Socialstyrelsen), who produce clinical guidelines, lacked implementation strategies, claiming that implementation of guidelines is the responsibility of each healthcare provider, 3) the innovation supporting actors, such as Uppsala University Innovation at my own university, claimed that the initiative is with researchers who should be the key drivers, and 4) healthcare practitioners I encountered often perceived that they implement everything that is needed. Consequently, the involved actors identified, at least partly, different actors as responsible for implementation, and perceived responsibility in different ways, for instance, researchers perceived that their role was to conduct research only. This issue deserves further attention as the IPR ownership statute in Sweden gives a lot responsibility to researchers, by granting them the ownership of research results (11).

Besides political science, the management literature also emphasizes responsibility; in implementation, as in any other project, a reasonable assumption is that there is someone who is responsible for the execution of the project, i.e., responsible for implementation (12–15). Without an actor defined as responsible for implementation, one could assume that the project would not be carried out in a proper way (16–18). Could uncertainty regarding responsibility be one aspect that contributes to the knowledge-practice gap?

Previous research on implementation provides little guidance concerning this. The focus has mainly been on the clinical context and the role of the

healthcare professionals, such as the general practitioners (GP) (19–22) and nurses (10,23–25). For instance, Cabana et al. (19) identified seven categories of barriers to GPs' use of clinical guidelines, such as lack of awareness, lack of self-efficacy, and lack of outcome expectancy. However, the barriers did not include the responsibility for implementation (19). In addition to GPs' and nurses' roles, the different elements that constitute the innovation³ /guideline/evidence that is to be implemented have been thoroughly scrutinized and well summarized in a review by Greenhalgh et al. (26) on the implementation of innovations in service organizations. For instance, elements, such as relative advantage, trialability, complexity, and reinvention were identified among factors to influence implementation outcomes (26). Greenhalgh et al. (26) also reviewed the impact of factors external to the innovation. For instance, they found that organizations with decentralized decision making structures and organizational leadership's support and involvement in implementation contributed to successful implementation (26). These factors do not explicitly address responsibility but raise factors (i.e., decision making and leadership), which can be assumed to require allocation of responsibility (15,27).

Summarizing barriers and facilitators to implementation in general, Flottorp et al. (28) provide a state of the art review, and identify seven levels of barriers and facilitators to implementation: 1) guideline, 2) health professional, 3) patient, 4) professional interaction, 5) incentives and resources, 6) capacity for organizational change, and 7) social, political and legal issues. In general the seven factors give centrality to the healthcare context,⁴ assuming that the factors that either hinder or facilitate implementation are to be found in that context (28). Responsibility for implementation is not explicitly addressed among the seven factors, but related issues such as leadership's involvement are included under the factor capacity for organizational change (28). To summarize, existing research on barriers and facilitators have not explicitly acknowledged responsibility issues and the main focus has been on the healthcare context and the healthcare personnel.

³ A distinction between innovation and invention is made in this thesis, where invention is depicted as the output from academic research whereas innovation is the further development of the invention into an exploitable product/method/treatment actually adopted by users. In this thesis innovation is also depicted as a process but in those instances the phrasing "innovation process" is used (See Background: the innovation process).

⁴ The factor identifying social, political and legal level barriers is the only factor focusing on aspects outside the healthcare context. This factor raises issues related to the economic and political context, but studies acknowledging this level of barriers are few, and the actors behind the issues are not recognized

Identifying issues that can impact implementation outside the healthcare context

A direct consequence of the “healthcare centrality” and the focus on healthcare personnel in understanding barriers and facilitators to implementation of innovations in healthcare is that a complete picture cannot be obtained, as all steps leading to implementation and all actors influencing implementation before implementation are not included. Thus, a larger process, called an innovation process, is needed where implementation is only one aspect and often the final period in the process (12). In terms of actors, there are several actors that could influence implementation during the innovation process, such as governments, non-governmental organizations, philanthropic organizations, regulatory agencies, such as the Medical Products Agency in Sweden or the Food and Drug Administration in the US, clinical guideline producing agencies, such as the Swedish Board of Health and Welfare or the NICE in the UK, companies manufacturing parts that are needed in the healthcare innovations, and companies interested to refine and implement innovations.

Despite the importance of all these actors for innovation and implementation, this thesis will focus on three influential actors whose roles are not well understood: research funders, researchers/academic inventors,⁵ and innovation supporting actors. Through their strategic position, these actors can play important roles in innovation processes. Common to these three actors is that they are interconnected: research funders make decisions that impact researchers (e.g., provide or decline grant applications and decide the type of research funded) and also implementation possibilities (e.g., facilitate or hinder implementation), whereas researchers need to follow the guidelines prescribed by the funders, for instance, concerning grant applications and reporting. In sum, research funders provide the preconditions for research and can influence implementation. Also, researchers and innovation supporting actors are connected to each other: innovation supporting actors provide support to researchers who try to commercialize research findings. In certain cases, the innovation supporting actors could also be the key drivers in innovation processes as is the case in the US where they, in general, own the IPR to university-based innovations.

Regardless of the role of the innovation supporting actors, they are dependent on the tacit knowledge that the researchers possess, and cannot drive innovation processes without the input from researchers. Consequently, these three actors are interwoven and constitute a set of actors that can have

⁵ The focus is on academic inventors, which however are also researchers during specific periods, such as during the research period and during early steps in exploitation of intellectual property. Against this background two terms, academic inventor and researcher, are used interchangeably until they are specified in the Background section.

key roles in innovation processes. All these actors come in contact with different factors, such as implementation responsibility, ownership of IPR and institutional logics that can influence the actors' behavior. Studies I and II deal with research funders and explore their roles, views on responsibility and knowledge of implementation. Studies III and IV, deal with academic inventors and innovation supporting actors focusing on their roles and practices. Further in Studies III and IV, the influence of three factors on academic inventors and innovation supporting actors' behavior is examined: IPR ownership, intellectual property (IP) nature and institutional logics. The thesis is multidisciplinary and includes theories, frameworks, concepts, and methods from several scientific fields, such as implementation science, management science, organizational science, economics, and political science. The thesis seeks to make both theoretical and empirical contributions to two main fields: implementation science and innovation management, and through this bring these two closer to each other.

Overall aim and research questions

The overall aim of this thesis is two-folded:

(A) to examine the behaviors of the three actors, i.e., research funders, academic inventors and innovation supporting actors during an innovation process, and

(B) to explore the influence of certain contextual factors (i.e., responsibility for implementation, implementation knowledge, IPR ownership, IP nature and institutional logics) on actors' behavior.

To address the aims, the following research questions were posed: Which behaviors, instantiated through their roles and their practices, do the actors display during the innovation process? and in which way do the specific contextual factors (i.e., responsibility for implementation, implementation knowledge, IPR ownership, IP nature and institutional logics) influence the behaviors of the three actors?

Disposition

The thesis is organized as follows: The background section describes in detail the concepts, theories, and issues that this thesis builds on. *First*, the innovation process is described and discussed. *Second*, implementation of healthcare research results and the role of facilitation is elucidated and problematized. *Third*, research funders' roles in implementation are described

and the existing research is outlined, together with the identification of gaps in existing knowledge. *Fourth*, academic inventors' roles in implementation are described and the institutional logics perspective in explaining behavior is introduced. *Fifth*, innovation supporting actors' roles in innovation are described and the existing research is discussed. Moreover, two aspects (i.e., IP nature and IPR ownership) that influence academic inventors and innovation supporting actors' behavior are introduced and discussed. After this, the methods applied in each study are presented, followed by results. The thesis will end by discussing the main findings, theoretical and practical implications, methodological issues and identifying avenues for further research.

Background

The innovation process

Innovation can be a service, a product or a policy that the users perceive as new. To this end, an innovation can be something old but when presented in a new context it becomes new (12,29,30). Innovation can also be the process that leads to the outcome (12,29), which is, for instance, a new product. A distinction between innovation as a *process* and innovation as an *outcome* has been made in previous literature (31). There is however, little agreement among scholars about the terms that are used to define innovation outcomes and many scholars fail to define innovation, although focusing explicitly on it (31,32). In one review it was noted that of 21 studies on product innovation, 15 different constructs were used to describe similar innovation outcomes, including product uniqueness, product superiority, and product complexity (32). In general, innovation studies have deployed different typologies of innovations as different innovations have different characteristics: product vs. process innovations (33–35), administrative/organizational vs. technical innovations (36,37), and radical vs. incremental innovations (38–40). Studies examining one type of innovation have often focused on radical innovations (41–43), which revolutionizes the practice on the user side.

However, whether or not an innovation is radical is usually only revealed through comparison. For instance, coblation technology for tonsillectomy, which can mold tissue at low temperatures (around 60°C) causing little damage, could be seen as an incremental innovation (i.e., providing some new aspects) when compared to electrosurgery, which heats up the tissue to high temperatures (around 400°C) causing more tissue damage (44). On the other hand, when the coblation technology for tonsillectomy (44) is compared to cold-knife surgery, where the tonsils are removed with a scalpel without heating up the tissue (45) the coblation technology could be seen as a radical innovation. Indeed, web-based mental healthcare programs (46), could be characterized as radical innovations when compared to the existing practice where the therapist meets the patient to provide care, but as an incremental innovation when compared to other web-based self-management programs (47). Further, a distinction between administrative and technical innovations has been made, where technical innovations are connected to a certain technology such as a product, whereas administrative innovations are connected to non-technological innovations, such as organizational policies (36). De-

spite this distinction, many recognize that the definitions are not mutually exclusive as technological and administrative innovations are often dependent on each other (12,48,49).

Scholars who have examined innovation as a process have focused on two different aspects: *understanding conditions for innovation processes* (50–54) and *identifying characteristics in innovation processes* (12,29,55). Trying to understand conditions for successful innovation processes, Axtell et al. (53) studied how certain personal and organizational characteristics influence innovation processes, whereas Obstfeld (52) examined how social networks and brokers in automotive industry predict involvement in innovation processes. Edquist & Johnson (54) focus on national innovation systems and how institutions in general, both formal and informal, influence innovation processes. The second line of research focuses on the innovation process itself and tries to understand the process and its implications. Characteristic for innovation processes in such studies is that there are different steps or phases in the process (12,29,56). Although understanding of innovation as a linear process, where either technology push or market pull is driving the process, has evolved to a more complex understanding of innovation as an interactive and non-linear process (57), few models exist which focus entirely on the innovation process.

One exception is van de Ven et al. (12), who try to disentangle what an innovation process is and how it evolves. According to van de Ven et al. (12) an innovation process is a messy, non-linear process where different aspects might be repeated, and the process is difficult to predict. Despite this, there are three general periods that most of the innovation processes go through: 1) initiation period, 2) development period and 3) implementation period. Moreover, these periods include several aspects that are often present in all innovation processes (12). (Figure 1). However, van de Ven et al. (12) did not specifically study innovations originating from university research, and thus the innovation process model depicted in Figure 1, might not provide complete guidance for the periods and the relevant aspects regarding university research.

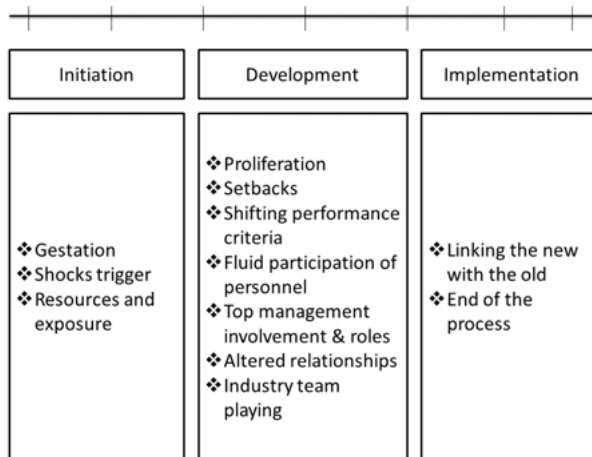


Figure 1. The innovation process (Freely adapted from van de Ven et al., 1999)

For instance, researchers probably spend less time on development than companies when trying to refine the innovation, whereas they probably spend more time on research than companies do. Clarysse & Moray (56) focus on team formation surrounding a research-based spinout, tracing the innovation process from idea generation to post startup phase. This process model includes four stages: 1) idea, 2) pre-startup, 3) startup, and 4) post-startup stage, where the stages follow each other. Consequently, the model is quite linear in contrast to the model of van de Ven et al. (12), which is a non-linear model. Moreover, the Clarysse & Moray (56) model does not cover the whole innovation process, from idea generation to introduction of new products. Clarysse et al. (58) building on Clarysse & Moray (56) developed a model, depicting the activities undertaken during a research-based innovation process, and identified six foundational activities: 1) opportunity search, 2) IP assessment and protection, 3) strategic choice of how to commercialize the innovation, 4) business plan development, 5) funding process, and 6) control of the spinout company (Figure 2). According to Clarysse et al. (58) their model is depicted as a linear model, but in reality the process might be less linear.

The Clarysse et al. (58) model labeled as the “spin out funnel” starts from the viewpoint of university administrators and Technology Transfer Offices (TTOs), where the first activity is to identify opportunities (i.e., inventions) that could be commercialized. As the model starts from the viewpoint of administrators and TTOs it does not cover, for instance, the activities of researchers and their role in the innovation process, and thus at the moment the existing models can only depict certain aspects in research-based innovation processes. Moreover, there are no innovation models that have focused only on healthcare innovations depicting the phases for university-based healthcare innovations, which is nonetheless less troubling as many innova-

tion processes can be assumed to contain the same elements, regardless of the field (12).

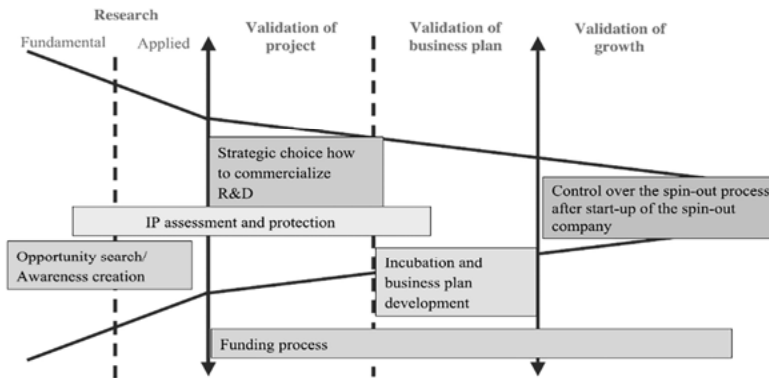


Figure 2. The spin-out funnel (adopted from Clarysse et al., 2005, p.187)

Implementation of healthcare research results

Implementation is the last phase in the innovation process, which ends the process either through acceptance or rejection of the innovation (12). According to van de Ven et al. (12), implementation is a process where activities are undertaken to introduce the innovation in the market and diffuse it to end-users. During this process, the innovation is adapted to the existing organizational context, and in some ways the “new” replaces the “old.” Grol and Wensing (59) in turn, define implementation as a structured and planned process where systematic introduction of innovations, proven better than the existing treatments, is undertaken with an aim to make the innovation an integrated part of the healthcare practice. For Rogers (29) implementation takes place when someone introduces the innovation in a using context and for this to happen behavior change is required. Rogers (29), being a pioneer in studying the diffusion of innovations and publishing the first edition of his *Diffusion of Innovations* already in 1962 (60), was early to acknowledge the need for behavior change when introducing innovations. This aspect has become a cornerstone in implementation research and nowadays, it is well established among implementation researchers that for the new to replace the old, behavior change is required, which is often cumbersome (61–64).

In detail, existing behavior is determined, for instance, by certain routines, beliefs, attitudes, knowledge, and self-efficacy, and introducing new ways of doing things often demands change in existing behavior (65). For instance, self-efficacy concerns the perceived capability to carry out a specific human behavior, being an influential determinant for the intention to act (66). If a healthcare practitioner is to change his/her behavior by applying a

new guideline in patient care, he or she needs to have confidence in his/her ability to apply the guideline (66). In order to increase self-efficacy a specific strategy such as social modelling that can be used to increase self-efficacy is required (67). A practical application of social modelling could be a video film modelling the desired behavior (66). Likewise, if the factor influencing existing practice is lack of knowledge, a similar procedure as with self-efficacy is required to develop an intervention that aims to change knowledge (66). Therefore, changing existing behavior can be depicted as complex and cumbersome (64,66).

The role of facilitation in implementation

Rogers (29) was also early to identify the need for facilitation in implementation, and defined change agents as one type of facilitator. Change agents play different roles during the innovation process, such as providing information and arguments supporting the need for change, and especially during implementation, providing assistance to the implementer. For Rogers (29), the change agents were central during the innovation process. This concept of a change agent is close to what Fixsen et al. (68) defined as a purveyor, which is a type of facilitator that tries to contribute to the introduction of the innovation. This concept (i.e., purveyor) was identified in a broad review of research concerning implementation, including areas such as medicine, manufacturing and mental health, in order to provide an overview of the existing research and identify factors influencing successful implementation (68). In their review, Fixsen et al. (68) defined implementation as a process containing several activities where the goal is to introduce an evidence-based, well defined program/guideline or innovation in practice. During this process the purveyor has an important role to play in helping the organizations to implement new practices (68).

The PARIHS framework (69) depicts facilitation and facilitators as one of the foundational pillars in the framework. In the PARIHS framework, facilitators – either internal or external to the organization – work with organizations to provide advice and guidance concerning implementation. The required capabilities and skills of the facilitator depend on the organizational capabilities and skills already in place (69). In an updated version of the PARIHS framework (i-PARIHS) facilitation is given a central role and perceived as the active component in the framework that determines the success or failure of implementation (70). Building on the facilitation definition from the PARIHS framework Baskerville et al. (71) reviewed studies on practice facilitation in primary care and found that primary care organizations using practice facilitation were 2.76 times more likely to implement guidelines than primary care organizations without practice facilitation. Altogether 44 studies met the inclusion criteria which imply that practice facilitation is well covered in previous research. On the other hand, in nursing no systematic

reviews about facilitation as described by the PARiHS framework exist, but Dogherty et al. (72) conducted a focused literature review and noticed that several definitions are used, portraying facilitation both as a process and an individual role. According to Dogherty et al. (72), these different ways to treat facilitation make it difficult to appreciate whether or not facilitation is an effective way to support implementation. Facilitation is also one of the basic methods defined in the Taxonomy of Behavior Change Methods (TBCM). Here facilitation is not a key concept, but rather one of the methods that can be used to change certain behaviors. Furthermore, in the TBCM facilitation aims to create an environment that makes a certain behavior easier and the facilitator is someone who undertakes facilitation and applies methods from the TBCM (65).

In addition to facilitation, practice facilitation, and facilitation as a behavior change method, there are at least three other concepts that focus on facilitation: educational outreach visitors (73), local opinion leaders (74), and lead users (75). Educational outreach visitors (also called university-based educational detailing, academic detailing or educational visiting) are external to the healthcare context and are trained persons/consultants who visit a practitioner's office to provide guidance on specific aspects, such as implementation of new treatments (73). O'Brien et al. (73) conducted a review concerning the research on educational outreach visitors including 69 studies, and found that this strategy is somewhat effective in influencing prescribing of medication with small, but consistent effects (around 5% improvement in performance) whereas the strategy's effect on practitioners' overall performance varied between 4% and 16%.

Local opinion leaders in turn, act within the healthcare context and can influence colleagues' behavior, because they are likable and respected by others (74). Flodgren et al. (76) conducted a systematic review including 18 studies, and found that local opinion leaders can influence the implementation of new treatments in general (12% improvement in the intervention group). However, in general the activities of local opinion leaders were not stringently defined and thus it is difficult to provide recommendations regarding how this strategy could be optimized (76).

To summarize, previous research has employed several concepts of facilitation where some of them have received more interest than others, and some have been more rigorously defined than others. In general facilitation, i.e., providing guidance and support to implementation of innovations could be a viable strategy to improve implementation outcomes. However, less is known about which role facilitation, taking place during the whole innovation process, could play, especially during the early phases of an innovation process.

Lead users are one type of actors that can influence the innovation process before implementation, and thus differ from education outreach visitors and local opinion leaders in two crucial ways: lead users are users of innovations

that are going to be implemented, and they focus their activities on innovation development (77). Lead users are users that embody the needs of the many, but express these needs several years before others and are eager to get access to new technology (78). To this end, identifying lead users and engaging them in product development, can increase the likelihood of successful innovation outcomes (79). According to my knowledge, no systematic reviews exist concerning the effects of lead users, but several studies have acknowledged the benefits of engaging lead users, mostly in high-tech but also in low-tech product development (79–82). However, although facilitative towards companies, the lead user activities are focused only on one period in innovation processes, namely the product development period.

In order to address the possible facilitation during the whole innovation process, I define innovation as: 1) as a process that comprises several periods during which a research-based innovation is created and introduced in healthcare, 2) as a process where the activities (either facilitating or hindering) of the key actors, undertaken during each period accumulate, influencing the innovation outcomes, and 3) as an outcome where the end goal is implementation but where rejection could take place providing opportunities to re-design and refine the innovation. This broad definition of innovation, comprising three integral parts, embodies both the process aspect and the outcome aspect, which both are integral parts of innovations as claimed already by Schumpeter (83). Furthermore, this broad definition of innovation does not focus on implementation, but rather includes all actions taken during the innovation process to appreciate the various actors' influence on the innovation process outcomes, but at the same time acknowledges that implementation, although desirable, does not need to be the end of the innovation process. Moreover, the innovation process is not depicted as a stepwise process, but rather as a process comprising several periods as suggested by van de Ven et al. (12).

Next, the three actors that this thesis focuses on, and the factors that can influence their behavior are introduced. Each of these actors can function as potential facilitators but can also hinder the innovation process in a number of ways.

Research funders

Research funders provide the preconditions for research, by allocating grants and stipulating requirements to obtain grants (84). The role of funders has traditionally been the management of grants, but recently their roles have evolved, and they have been perceived as one type of actor that can facilitate, i.e., support the process whereby research results are translated into clinical practice and implemented (85). Interest in research funders is still

emerging, but previous studies have recognized several facilitative roles of funders: 1) demanding consideration of implementation as a requirement for funding (86), 2) stimulating cooperation between users and researchers (87,88), 3) promoting use of research results (89,90), and 4) being involved in implementation (86,91). Implementation scholars' interest in research funders' possible facilitation in relation to implementation emerged when funders and governments noticed that resources invested in research did not match improvements in public health (89,91). However, previous studies often limit themselves to cases of single funders (87,89–91), or consist of broad international comparisons with focus on providing overviews (92,93). There is a lack of studies that systematically and in-depth investigate the research funders' roles during the innovation process.

If research funders are able to shoulder the facilitative roles, it is reasonable to assume that they should have some kind of understanding of implementation, such as who is responsible for implementation. As stated earlier, responsibility issues have not received explicit attention in implementation research, in spite of the theoretical relevance of this issue and empirical support from different fields, such as political science and management (15,18). Also implementation knowledge is relatively unexplored as implementation research is focused on generating knowledge that can be used to plan, conduct and evaluate implementation efforts (94). However, little is known about whether or not policymakers who work with implementation are aware of the implementation research output. Research funders are one type of policymakers that could benefit from knowledge of implementation research output, when undertaking facilitative roles in relation to implementation, but at the same time findings from policy research indicate that there is a "knowledge-policy gap," meaning that application of research output in policymaking is inadequate (95,96). On the other hand, actors might acquire knowledge through practical experience (97–99) making the formal knowledge from research less important. Studies I and II focus on Swedish research funders' roles, perceptions of responsibility for implementation and knowledge of implementation. Study II also aims to develop the theoretical understanding concerning policymakers' implementation knowledge.

Researchers and academic inventors

Academic inventors are university researchers, who have invented something through their research, and wish to contribute to the exploitation of their findings. Researchers are active in the early moments, regarding research idea, applying for funds, and conducting research, but they can also be involved during later stages, and become academic inventors, taking on distinct roles, such as brokers and technical consultants (100–102). Despite this initial interest in academic inventors, the knowledge about their roles

during innovation processes, and their motivations to be involved have received little attention. Researchers can, at least theoretically, have important roles after the research period, and perhaps during implementation as they have knowledge regarding the invention that presumably no one else has (103). This type of tacit knowledge is crucial for IP exploitation, as the university-based inventions often are embryonic requiring development (102). On the other hand, there is a growing literature concerning academic entrepreneurship, where academic inventors start a spinoff company and become involved in commercialization (104–108). However, the roles played by academic inventors in innovation processes have not been explicitly studied, and the reasons to their involvement are not theoretically founded. One recurrent theory to explain actors' behavior, in general, is the institutional logics approach, which builds on neo-institutional theory, where all behavior is constrained and understood in the light of surrounding institutions (109,110). In addition to institutional logics, two types of formal institutions that the academic inventors are exposed to are regulations concerning IPR ownership, i.e., who owns the research results (111) and IP nature, i.e., the patentability and the type of the invention (112). These two issues will be explored later in this thesis.

Behavior analyzed through institutional logics

From an institutional logics perspective, academic inventors are conditioned by different logics when they are involved in commercialization of IP based on university research (113). Institutional logics comprise the socially formed patterns of material practices, routines and rules, used to comprehend and form the material reality (114). As such, institutional logics can provide boundaries, for instance, for decision making and rationality (115), often reflected in the actors' practices (116). In settings with multiple institutional logics, such as academic inventing, several logics are assumed to influence behavior (113), and thus behavior becomes complex (110,117). Previous studies, focusing on commercialization of IP, based on university research have revolved around two logics: the academic logic and the market logic, often considered to be in conflict (113,118–122). However, the focus has been on the early steps in the innovation process (i.e., licensing and patenting) concerning high-tech IP (118,123–125), which implies that a complete picture of academic inventing has not been obtained. For instance, the role of the academic logic might be overstated, as the focus has been on the early steps. In detail, during the early steps the academic logic could be prevalent, as the academic inventor is connected to the university, whereas during later steps the academic inventor, trying to commercialize the IP, is not tightly connected to the university, and hence other logics might become prevalent.

Academic inventing includes multiple logics, where several logics influence the behavior of organizations and individual actors (126). Some find-

ings indicate that the existence of two or several logics leads to conflict, where one of the logics prevails (114,127–130), others argue that several logics can coexist and shift in relevance (131–135), whereas some perceive that multiple logics are either detrimental for organizations (136) or provide the basis for their existence (137). Besharov and Smith (138) developed a framework that can be used to understand the heterogeneous outcomes in settings with multiple logics.

Two central concepts in Besharov and Smith's (138) framework, are logic compatibility and logic centrality. Here, compatibility refers to the degree the logics are compatible and reinforcing, and centrality examines whether or not there is a core logic that influences behavior. Besharov and Smith's (138) framework was developed to assess the influence of logics on *organizational outcomes*, which is not surprising, as organizations and organizational outcomes for long have been central in the institutional logics literature (114,127,128,137,139,140). However, the original aim with the institutional logics perspective was to focus both on organizations and individuals (109). Focus on individuals is warranted as they are in the frontline of organizations, making decisions under institutional complexity (115,141,142). Recent research has addressed individuals' strategies to deal with multiple logics, but scholars have not made the connection between influence of logics and strategies. Further the investigated strategies have concerned highly professionalized fields where actors are organization-bound, i.e., anchored to an existing organization (131,134,135).

Research focusing on individual strategies to deal with multiple logics has identified three main strategies: segmenting or compartmentalizing (115,117,134,143,144), bridging (134,136,143), and demarcating (134). These strategies assume that there is a conflict between two or more logics, which however does not mean that the logics could not cooperate. Segmenting is one strategy, where the conflicting logics are separated, for instance, by space: in the trade floor underwriters wear suits and ties to echo the community logic, whereas in their office they are more informally dressed, echoing the market logic (134). Bridging is another strategy, which stipulates that conflicting logics can complement each other, for instance, in building a new organizational form the market logic was combined with a non-profit logic (136). Indeed, all organizations and individuals that combine two or more logics in their activities, for instance, the market logic and the welfare logic, face trending towards one of the logics, which in turn endangers organizational existence (145). Demarcating is one strategy to deal with the dangers of combining several logics, through a process that sets soft boundaries and guarantees that none of the logics is over emphasized (134).

In addition to the explicit strategies of segmenting, bridging and demarcating, Pache and Santos (143) have drafted a framework, to explain individual responses to multiple logics, and have identified three additional strategies: ignorance, compliance and defiance. These have been implicitly

exemplified in previous research (146–149). However, Pache and Santos' (143) framework focuses on individuals anchored to existing organizations, which is not optimal if the goal is to elucidate the behavior of actors' who are not tightly connected to existing organizations, such as academic inventors. Consequently, Pache and Santos' (143) framework is in line with existing research on individual strategies that predominantly focus on organization-bound actors, such as pharmacist, lawyers, underwriters, and healthcare managers (131,132,134,135). The individual strategies employed by organization-bound actors might not apply to actors that are less organization-bound, such as academic inventors. Study IV explores how academic inventors deal with the institutional complexity they face during the entire innovation process.

Innovation supporting actors

The third type of actor that this thesis focuses on, is the innovation supporting actor (ISA), a university-based actor that tries to stimulate, support, manage, and organize technology transfer in innovation processes emanating from universities (150). Examples of typical ISAs are TTOs and Incubators. Today, there is a growing literature concerning the TTOs (101,151–153), and they have been reported to be facilitators, acting as brokers (154), but also as barriers, for instance, when they do not have the capacity or skills to handle disclosures (155,156), or in case they aim to maximize income from licensing (157). To this end, previous research has found that TTOs can be either barriers or facilitators to implementation. Yet, more complex understanding of the TTOs roles is needed, for instance, to clarify under which conditions the TTOs undertake their various roles. There is also a growing literature concerning incubators (158–161), but this literature has not focused on the explicit roles of incubators, functioning under different conditions, and thus a more specific understanding of their roles would be important. Both the TTOs and incubators are generally active during the technology transfer process where the research-based IP is transferred to a third party. If the third party is a university spinoff company, the incubators might have facilitative roles, such as supporting the inventor to create a business (162,163), but if the third party is an established company this kind of specific support might not be required.

IP nature and IPR ownership as economic institutions influencing behavior

As mentioned above, institutional logics build on neo-institutional theory, which studies the impact of both formal and informal institutions on behav-

ior (115). New institutional economics, in turn, takes an economic view on institutions, and uses economic theory to explain the behavior of actors in a context where economic institutions – both formal, such as rules and regulations, and informal, such as customs and codes of conduct – constitute “the rules of the game”(164,165), and entail transaction costs (166). In spite of these aspects, the focus is often on the formal institutions, such as the IPR ownership (111). The rules of the game include institutions that facilitate economic behavior and institutions that constrain it (54). For instance, if the cost of following a constraining institution, such as the obligation to disclose research results to the TTOs, is higher than the costs of avoiding it, such as a penalty for neglecting the obligation, the actor is assumed to try to avoid that institution, that is, not to disclose (164). When actors, such as academic inventors decide on their behavior such as engaging or not in a certain activity, they are assumed to consider risks, opportunity costs and future gains (112,167).

One risk in licensing academic inventions is the fact that the licensee will not pay the inventor, if dissatisfied with the actual content of the invention when this is revealed. This risk can be addressed with patent protection, a formal institution which makes clear to the licensee the exact content of the invention and shows that the invention is protected by law. Patent protection coupled with licensing contracts provide an incentive for the licensee to pay for access to the invention, and increases potential profits for the involved parties: inventor, licensee and TTO (167,168). Consequently, an institution such as protection of high-tech IPs via patents is likely to stimulate technology transfer through licensing, with some level of involvement of the inventor, motivated by possible future profits (167,169). In contrast, with non-patentable IP of low-tech, such as copyrights, the IP protection is not equally strong. Therefore, licensing non-patentable IP becomes more difficult as the risks for the involved parties are higher than with patentable IP (170,171). Technology transfer is accordingly more likely to occur through involving academic inventors as consultants (167), although licensing of non-patentable IP can occur in theoretical situations (170).

In general, every innovation has a certain component of tacit knowledge (103), but this component is expected to be larger for non-patentable IP. To this end, inventor involvement in licensing non-patentable IP is particularly useful, but the inventors are not motivated to be involved because of the risks with non-patentable IP (170). In contrast, a patentable IP protects in-licensing firms from imitation (172–174), and provides, at least, academic inventors with a substantial incentive for commercializing the IP (175–181), but little is known about the influence of non-patentable IP on actors, such as academic inventors and ISAs’ behavior.

Another institution influencing the behavior of academic inventors is IPR ownership (111,167,182–184), which can be divided in two major regimes: university ownership and inventor ownership. In university ownership, the

gains are often shared between the university, the faculty, and the inventor, whereas in inventor ownership, the gains associated with the IP belong solely to the inventor (167). In policy circles, university ownership is often assumed to lead to economic growth (185,186), since it decreases the opportunity costs of academic inventors to involve in commercialization (185). The impact of IP ownership on the involvement of academic inventors in innovation processes is debatable with studies supporting either university ownership or inventor ownership as being the most conducive to academic inventors' involvement (111,167,187,188).

Goldfarb and Henrekson (167) compared two countries, one favoring inventor-ownership (Sweden) and one favoring university-ownership (the US). They suggest that academic inventors in Sweden, although they own the IP, do not have high incentives to be involved in commercialization. Namely in inventor ownership contexts where the profits come to the inventors, the TTOs lack incentives to be involved and thus the inventors will not receive support to commercialize and cover the patenting costs (167). Instead, the university ownership in US, which guarantees the involvement of TTOs, incentivizes academic inventors, by reducing their opportunity costs to engage in commercialization (167). Similarly, Henrekson and Rosenberg (189) argue that in an institutional context less supportive of commercialization of academic outputs, like Sweden, inventor ownership is not an incentive for inventor involvement, sufficient to overcome the opportunity costs to involvement.

In contrast, Farnstrand Damsgaard and Thursby (111) argue that even if the odds for successful commercialization are higher in the US, inventor ownership, like in Sweden, is more aligned with inventors' preferences to maximize economic utility, and will function as a strong incentive. Similarly, in their multiple case study with data from six North American universities, Kenney and Patton (187) found that inventor ownership provides more economic incentives for inventors' involvement in innovation process than university ownership. In line with this, Åstebro et al. (190) argue that inventor ownership should give incentives to academic inventors to be involved in commercialization of academic output, even if such incentive hardly turns all academics into inventors. Only 0.9% of Swedish academics become entrepreneurs annually, and of these only 1% earn more than before. Faced with these results, Åstebro et al. (190) wonder why academics choose to leave their academic positions, and risk their future income. Further, recent research on reforms transferring IPR ownership from inventors to universities, supports the idea that university ownership decreases the incentives for academic inventors to involve in commercialization (191–193). Consequently, the function of IPR ownership in innovation processes in influencing academic inventors, and other stakeholders' behavior is ambiguous. Departing from this ambiguity, Study III examines the influence of IPR ownership, but

also the influence of IP nature on the behavior of academic inventors and ISAs.

Next, the aims for the four studies that constitute this thesis are described, followed by an outline of the methods applied in each study.

Study aims

Study I: 1) identify and describe the roles of Swedish research funders, who fund clinical research and 2) analyze funders' views about implementation responsibilities and perceptions of how such responsibilities are fulfilled.

Study II: Develop a model that can explain research funding managers' implementation knowledge, and the origins of this knowledge.

Study III: Understand and explain how the roles and involvement of inventors and ISAs are connected to IPR ownership and to IP nature.

Study IV: Study how the academic inventors handle the institutional complexity they face during the entire innovation process.

Methods

As mentioned in the Introduction, I made two foundational observations, concerning implementation of healthcare research results before conducting the studies reported in this thesis: 1) some actors claim that implementation is not a problem, if there is a good treatment available, and 2) it is unclear who actually is responsible for implementation of new treatments in healthcare. These observations guided my interest to identify issues relevant to explore in the Swedish context with regard to the knowledge-practice gap, and were also brought up by the respondents in one of the studies, as the citations that introduce this thesis illustrate.

Starting with the assumption that implementation is non-problematic – a sort of automation – and acknowledging that research funders have an important position in the intersection of healthcare and research, I decided to explore whether or not research funders felt that they have roles to play during an innovation process. Finding out that the research funders identified certain facilitative roles in relation to implementation, I decided to explore which implementation knowledge these roles are based on and whether or not implementation is perceived to take place automatically. I assumed that research funders' roles and implementation knowledge might be unresolved issues as research funders roles revolve traditionally around evaluating grant proposals and funding research. To this end, I decided to conduct semi-structured interviews, instead of collecting data through a quantitative questionnaire. Further, I considered that it would be feasible to focus on research funders' perceptions, rather than following them in action because of the nature of the issues.

In order to further explore the assumption of implementation taking place automatically, I decided to study innovations emanating from university research, to appreciate the complexity of research results' journey to use in healthcare practice. When selecting innovations, I acknowledged that there is an ongoing debate about the function of the teachers' exemption in Sweden (11), which gives the IP rights to the researchers meaning that further exploitation of IP does not take place without the researchers. However, being a researcher is not the same as being an entrepreneur, which makes Sweden an interesting country to study exploitation of university-based IP. On the other hand, in the US the Bayh Dole Act (194) transferred the IPR ownership from the state to the universities in order to stimulate the exploitation of IP. This reform has been copied in several countries with a wish to stimulate the use

of university-based IP. Reflecting these changes, I originally decided to select innovations, from different IPR ownership contexts, settling on Sweden (IP owned by researchers), the US (IP owned by university) and Finland (IP owned by researchers, but taken over by the university if not exploited by the researcher). However, as the process of identifying and studying innovations was very tedious, I decided to focus on two very different contexts, namely Sweden and the US. In addition to IPR ownership, I acknowledged that it is motivated to include patentable and non-patentable innovations in studying innovation processes, as the IP nature could influence actors' behavior, especially the behavior of TTOs when dealing with non-patentable innovations. Further, I was part of a context (i.e., my research group), where researchers develop non-patentable inventions. In conclusion, I selected innovations from two contexts (i.e., Uppsala and Stanford) that provided variation in IP nature.

Initially, the aim was to include several actors (such as academic inventors, ISAs, licensing companies, NGOs, and end users), and analyze their behavior and impact during the innovation process. However, after a preliminary data analysis, I noticed that the academic inventors and ISAs were highly influential actors, and decided to focus on them. Addressing the academic inventors and ISAs, who both could own the IPR, depending on the context, I was able to further explore who should exploit and implement IP. While studying academic inventors and ISAs, functioning in different IPR ownership and IP nature contexts, I noticed that there was something other than these formal institutions that heavily influenced the behavior of academic inventors. Namely, less formal institutions connected to academic inventing, manifested through specific institutional logics. Consequently, a study about the influence on academic inventors' behavior of different institutional logics was designed. This study could contribute to theory development, concerning institutional complexity and how individuals that are not organization-bound deal with the complexity.

The initial aim was to cover also decision makers, who decide on implementation of specific non-patentable innovations, namely web-based cognitive behavioral therapy (CBT) programs. Little is known about which factors (such as patient, therapist, program, organization and society) influence implementation and non-implementation of web-based CBT programs. Some of the non-patentable inventions developed in my research group are web-based CBT programs, and exploring the factors influencing implementation seemed to be highly relevant for my groups' research. However, I considered that the thesis can make a stronger contribution, if the thesis is based on certain actors, and first after selection of actors the factors that influence their behavior are identified. Instead of focusing on a multitude of actors and factors the focus is on three actors: research funders, academic inventors, and ISAs, and on five issues that can be important in influencing these actors'

behavior: responsibility for implementation, implementation knowledge, IPR ownership, IP nature and institutional logics.

Design

An overview of study characteristics is outlined in Table 1.

Table 1. Overview of study characteristics

Study	Design	Respondents	Units of analysis	Data Collection	Data analysis
I	Comparative multiple case study	10 Swedish research funders represented by 18 respondents	Research funding organizations	Semi-structured interviews, data from funders websites, funders annual reports and goal statements	Abductive explorative approach
II	Comparative multiple case study	18 Swedish research funding managers	Research funding managers	Semi-structured interviews, data from funding managers' websites	Inductive grounded approach with six phases
III	Comparative multiple case study	38 innovation stakeholders	Academic inventors, ISAs and innovations	Semi-structured interviews, data from organization websites and financial databases	Inductive proposition generating approach with seven phases
IV	Comparative multiple case study	38 innovation stakeholders	Academic inventors and innovations	Semi-structured interviews, data from organization websites and financial databases	Inductive grounded approach with six phases

Studies I-IV were comparative multiple case studies (195). In Study I the cases were selected based on funding resources, geographical scope and type of funder adhering to a maximum variation sampling strategy (196). The goal was to capture differences and similarities across different funding levels but also within same funding levels. The units of analysis were the research funding organizations.

In Study II the cases were selected based on closeness to implementation contexts and type of research funded (i.e., basic research, clinical research, or a combination of both) adhering to a maximum variation sampling strategy (196). The aim was to develop a model, based on case study observations by comparing similarities and differences among the funding managers (195,197), concerning implementation definitions, self-assessed implementation knowledge, and the factors influencing self-assessed implementation knowledge. The units of analysis were the funding managers.

In Study III the cases were selected based on theoretical sampling (197,198): *IPR ownership* reflecting both university and inventor ownership and *IP nature* reflecting patentable and non-patentable IP. In addition to these sampling aspects the goal was to capture the innovation process and thus cases needed to have proceeded from research inventions to usable innovations in healthcare practice. The aim was to develop propositions that are testable in quantitative research (197). The units of analysis were the academic inventors, the ISAs and the innovations.

In Study IV the cases were selected based on theoretical sampling (197,198): *IP nature* reflecting high-tech and low-tech innovations and *IPR ownership* reflecting university and inventor ownership. High-tech innovations are connected to clear views of how to exploit IP and thus the market logic is prevalent (123,125), whereas less is known concerning low-tech innovations. But following the same logic as with high-tech innovations, the low-tech innovations can be assumed to entail an unclear view of how to exploit IP, and thus alternative logics might become prevalent. *IPR ownership* in turn might influence the prevalence of institutional logics as the university ownership necessitates the involvement of TTOs and thus TTOs might bring certain logics, whereas such requirement is not present in inventor ownership where the inventor is freer to act. The aim was to develop a model concerning the behavior of academic inventors facing multiple institutional logics. The units of analysis were the academic inventors and the innovations.

Respondents

Study I consist of 10 research funding organizations that represent three levels in the research funding system: 1) national public funding, 2) national, private non-profit funding, and 3) local public funding. Respondents (n=18)

from the highest decision-making bodies in different funding organizations were included. All contacted funding organizations and their representatives agreed to participate. The inclusion criteria were: seniority and experience, and knowledge of clinical research.

Study II includes 18 research funding managers who represent three types of funding organizations: 1) “far from implementation,” as these organizations belong to the central governmental apparatus in Sweden, and fund primarily basic research, 2) “closer to implementation,” as these funders, typically private foundations, operate in closer contact with specific clinical fields, and fund both basic and clinical research, and 3) “closest to implementation,” as these funders belong to the organizations that provide healthcare in Sweden, and fund primarily clinical research. The funding managers were selected to represent the key decision makers at each funder in terms of allocation of funds, holding positions such as chairman, vice chairman and general director.

Study III and IV include four university-based healthcare innovations from US (Stanford University) and Sweden (Uppsala University) constituting two pairs of innovations: two innovations from Stanford reflecting the same IPR ownership but different IP nature, and two from Uppsala reflecting the same IPR ownership but different IP nature. The four cases were identified through field studies in both contexts. From these four cases the respondents selected were 38 innovation process stakeholders, consisting of all involved academic inventors, startup founders, ISAs, selected users, and other relevant actors’ such as NGOs.

Data collection

Study I

Study I builds on 18 semi-structured, face-to-face, interviews that were conducted with two respondents per funder, except in two cases where only one relevant respondent existed. The respondents were identified by the involved researchers. Each respondent was asked to mention important respondents within their organization to validate the relevance of the included respondents and identify alternative respondents. The same interview guide was used with all respondents with small changes based on the respondents’ organization (for an example of an interview guide see (199)). The data collection aimed to capture two aspects: 1) the research funders’ roles, and 2) the research funders’ views on responsibility for implementation. No specific definition of the primary concepts, concerning roles and responsibilities were provided as exploring the respondents’ opinions, instead of making them think of specific concepts, was preferred. Data triangulation (200) was used to explore the investigated phenomenon as broadly as possible. Data was

collected from funders' websites, funders' annual reports, and goal statements (see Table 2 in (199)), and reviewed to find out how the funders presented their official roles, and whether responsibility issues for implementation were mentioned or not.

Study II

Study II is based on 18 semi-structured, face to face, interviews that were conducted with the funding managers. The same interview guide was used with all respondents with small changes based on the respondents' organization (Table 2). The data collection aimed to capture three aspects: 1) how funding managers define implementation, 2) funding managers' evaluations of their knowledge, i.e., self-assessed knowledge, and 3) factors (e.g., experience of clinical research) that influence their self-assessed implementation knowledge. No specific definition of the primary concepts, concerning implementation and implementation knowledge were provided to respondents as exploring their understanding, instead of making them think of specific concepts, was preferred. In addition to interviews, data was collected from the funding managers' websites with the purpose to triangulate data (198).

Table 2. Key interview questions in Study II

What is your knowledge about implementation?
How would you define implementation?
Can your organization, as a research funding organization, do something that improves the use of research results in practice? If so, what?
Do you think that one can compare your organization, as a research funding organization, with another similar research funding organization? If not, what makes your organization special?
What happens with results from clinical research funded by your organization?

Studies III and IV

In Studies III and IV 38 respondents were included. Here, data was collected through different means based on the availability and preferences of respondents. However, the majority of the data was collected through semi-structured interviews (Table 3). Interview guides were used, but adapted to different organizations and the availability of the respondents (Table 4). The data collection aimed to capture several aspects, such as the innovation process, the actors involved and their roles, the barriers and facilitators, and the outcomes of the innovation process. In addition to the interviews with innovation stakeholders, data was collected from organizations websites (i.e., university and company websites), and financial databases (i.e., US Securities and Exchange Commission and Allabolag) to triangulate data (198).

Table 3. Respondents and type of data collected in Study III and IV

Respondents position	Type of data
Innovation A	
1. Inventor	Interview (transcribed) ^a
2. Co-inventor	Interview (transcribed)
3. Co-founder startup	Interview (transcribed)
4. TTO rep	Questionnaire
5. CEO startup	Interview (transcribed)
6. Startup rep2	Interview (transcribed)
7. Startup rep3	Interview (transcribed)
8. Startup rep4	Interview (transcribed)
9. End user1	Interview (transcribed)
10. End user2	Telephone interview (notes)
Innovation B	
11. Inventor	Interview (transcribed)
12. TTO rep	Interview (transcribed)
13. NGO1 rep1	Interview (transcribed)
14. NGO1 rep2	Interview (transcribed)
15. NGO2 rep	Interview (transcribed)
16. End user Director	Interview (transcribed)
17. End user1	Interview (transcribed)
18. Consultant	Interview (transcribed)
19. End user2	Interview (transcribed)
20. End user clinical champion	Interview (transcribed)
21. CEO Self-help book publisher	E-mail communication (written document)
Innovation C	
22. Inventor1	Interview (transcribed)
23. Inventor2	Interview (transcribed)
24. Co-inventor1	Interview (transcribed)
25. Co-inventor2	Interview (transcribed)
26. TTO rep1	Interview (transcribed)
27. TTO rep2	E-mail communication (written document)
28. Incubator rep	Interview (transcribed)
29. CEO startup	Interview (transcribed)
Innovation D	
30. Inventor	Interview (transcribed)
31. Co-inventor	Questionnaire
32. Co-founder1 startup	Interview (transcribed)
33. Board member startup	Interview (transcribed)
34. TTO rep	Telephone interview (notes)
35. CEO first startup	Telephone interview (notes)
36. End user1	Questionnaire
37. End user2	Questionnaire
38. End user1 Director	Questionnaire

^a The interviews were conducted face-to face if nothing else is given.

Table 4. Examples of interview questions in Study III and IV

1. Could you describe shortly the innovation in question?	13. Who became the user of the innovation in healthcare practice and who took responsibility for the implementing process?
2. How and when was the innovation process initiated?	14. What was your role in implementing the innovation?
3. Was there any initial goal/s with starting up the innovation process? In that case, which goal/s?	15. Are you still involved in the innovation process?
4. What were the initial results of this process? Was the innovation useful and could it be used in healthcare practice?	16. Do you think that the results would have been implemented in healthcare practice, without the help and contribution of the TTO? If so, why or why not?
5. Were the results published in scientific journals? If so, in which journals? Why not? Was it important for you?	17. Who funded the innovation process from research to implementation?
6. Who owns the rights to the innovation in terms of intellectual property rights?	18. Was the expected impact on healthcare practice confirmed after implementation of this innovation?
7. Has the innovation been patented? If so, by whom?	19. Were there any barriers encountered during the innovation process? If so, which were the most important barriers?
8. Was the TTO consulted or were other actors consulted?	20. Is someone using this innovation today in healthcare practice? If so, who?
9. Was the innovation licensed to an organization?	21. Do you consider that implementation of this innovation was successful? If so, why or why not?
10. Was the innovation developed further after the initial findings? If so, by whom?	22. Are the existing regulations regarding intellectual property rights helpful or a hinder in innovation and implementation considering this case? In which way?
11. Was there any further research conducted, concerning the innovation, after the initial findings? If so, by whom?	23. Has this innovation and its use in healthcare practice been economically beneficial for you?
12. Who decided to implement the research findings in healthcare practice?	24. Is there someone else who I should interview?

Data analysis

Study I

In Study I the interview data was analyzed with an abductive approach (201,202), a suitable approach when one aims to study phenomena in their context, starting from existing theory (203). Combining induction and deduction, the approach allowed the initiation of the study with meaningful pre-determined concepts (about roles and responsibilities). Both a within-cases and an across-cases analysis (198) was conducted, to compare the perceptions, within the same level of funders and between different levels of funders, searching for similarities and differences.

Study II

In Study II, adhering to an inductive approach, where theory development is the goal, a systematic coding procedure was applied followed by a structured presentation of the data, resulting in a grounded theory (195). The analysis was conducted in six phases. *First*, the transcripts were analyzed to identify the first-order categories. *Second*, the first-order categories were grouped into second-order themes. *Third*, the second-order themes were grouped into higher-order aggregate dimensions (195,204). *Fourth*, the implementation definitions, self-assessed implementation knowledge and the factors influencing implementation knowledge, within and between the three different types of funders, were compared. *Fifth*, explanations for differences and similarities were explored, based on the interview data and secondary data (i.e., data from the funding managers' websites). *Sixth*, a grounded model was drafted (195). In developing the grounded model a comparison between the empirical findings (i.e., interview and secondary data) and the existing literature (e.g., policy research and implementation research) was conducted to tie the grounded model with existing research.

Study III

Study III builds on an inductive approach and the analysis was conducted in seven phases. *First*, case histories were created based on the interviews. *Second*, case histories were scanned for clues of how IPR ownership and IP nature influenced the innovation processes, in terms of the emerging roles of inventors and ISAs. *Third*, a content analysis and open coding of the empirical material was conducted to create schemes that capture the inventor and ISA roles as described by the respondents (195). *Fourth*, the schemes were developed towards a more theoretical understanding of the roles, by cycling between the empirical findings and the existing theoretical concepts to form role categories. *Fifth*, the case histories were matched with the role categories.

ries, and shorter case histories centered on the roles of inventors and ISAs were created. *Sixth*, the shorter case histories were examined to move from the multiple roles played by the inventors and ISAs, to an overall understanding of their involvement in the innovation processes. *Seventh*, a cross-case comparison (197) of the roles and levels of involvement in the four innovations was conducted, to trace patterns in roles and involvement of inventors and ISAs, in relation to IPR ownership and IP nature. The goal with this process was to generate propositions, represented in a grounded model that are sufficiently robust to be tested in future research (205).

Study IV

Study IV builds on an inductive approach where a detailed procedure for coding, representation of the data and crafting of the grounded model (195,204) was used. The analysis was conducted in six phases. *First*, to identify the institutional logics at play, short case histories of each innovation process based on the descriptions of the stakeholders were drafted. *Second*, to explore how different institutional logics influence behavior, the practices of the academic inventors were mapped starting by tracking all practices as described by the respondents and continuing by grouping these into first-order categories (195,204). Then, the first-order categories were organized into second-order themes, and thereafter the second-order themes were grouped into higher-abstraction aggregated practices. *Third*, the influence of the institutional logics on inventors' behavior was mapped by connecting each academic inventor practice with the corresponding institutional logic. *Fourth*, the individual practices were summarized to appreciate the influence of logics, assessed through logic compatibility, focusing on logic interaction, and through logic centrality, focusing on the existence of one or several logics. *Fifth*, the individual strategies to deal with multiple logics were identified, and compared with the influence of logics, in order to evaluate the overall influence of logics and the strategies in each of the four innovation processes. *Sixth*, the four innovation cases were compared in order to detect similarities and differences, which in turn allowed the crafting of the grounded model on academic inventors facing institutional complexity.

Results

The guiding assumption in this thesis is that the reigning understanding of the knowledge-practice gap is incomplete based on two deficits: 1) previous research examining the knowledge-practice gap has focused mainly on implementation in the healthcare context, and 2) the healthcare centrality has contributed to a predominant focus on actors that function in the healthcare context. The four studies included in this thesis aim to address these two deficits focusing on three different actors (i.e., research funders, academic inventors, and ISAs) and five factors (i.e., implementation knowledge, responsibility for implementation, IPR ownership, IP nature and institutional logics) that in turn influence the actors' behavior. Below the most important results in each study will be presented.

Study I: Research funders' roles and perceived responsibilities in relation to the implementation of clinical research results: A multiple case study of Swedish research funders

The 10 research funders identified eight roles for funders (Table 5). Among funders, at least at two different funding levels, two common roles were identified: "advocacy work" and "monitoring implementation outcomes." "Dissemination of knowledge" was a common role within national private funders, but not identified by the other two funding levels. In terms of funding levels, the prevalence of the roles and the number of funders enacting the roles differed between funding levels, as the national private funders enacted relatively many roles compared to the two other funding levels.

The funders identified six actors responsible for implementation (Table 6). The "county councils" were the most frequently mentioned actors followed by the "head of hospital units." The relevance of the county councils was further enforced by the fact that one funder viewed them responsible together with medical practitioners. All in all, funders believed that the responsibility for implementation is located in the healthcare setting as five out

Table 5. Research funder roles

Roles	National public funders (N=3)	National private funders (N=3)	Local public funders (N=4)	Total funders^b
Advocacy work ^a	1 funder ^c	3 funders		4 funders
Monitoring implementation outcomes		2 funders	1 funder	3 funders
Dissemination of knowledge		3 funders		3 funders
Work actively towards implementation		1 funder		1 funder
Create conditions for implementation through legislation in implementation related issues	1 funder			1 funder
Stimulate collaboration between researchers and industry	1 funder			1 funder
Educate healthcare personnel		1 funder		1 funder
Create structures for organized introduction			1 funder	1 funder
Total roles ^d	3 roles	5 roles	2 roles	

^a Multiple roles allowed.

^b Number of funders supporting each role horizontally across funding levels. NB: the sum of these totals is higher than 10, due to multiple answers allowed per funder.

^c Number of funders supporting each role.

^d Number of roles vertically for funders within each funding level.

Table 6. Responsibility for implementation

	National public funders (N=3)	National private funders (N=3)	Local public funders (N=4)	All funders^b
1. County councils ^a	1 funder ^c	1 funder	1 funder	3 funders
2. Head of hospital units		1 funder	2 funders	3 funders
3. Healthcare system	1 funder			1 funder
4. Medical practitioners together with County councils	1 funder			1 funder
5. Research funders together with the researcher		1 funder		1 funder
6. Hospital leadership			1 funder	1 funder
Total actors^d	3 actors	3 actors	3 actors	10 funders

^a One answer allowed.

^b Total number of funders suggesting each responsible actor across funding levels (N=10).

^c Number of funders within funding levels suggesting each responsible actor.

^d Number of identified actors within each funding level.

of six actors were healthcare-related. Further, all these actors were either collective (i.e., combination of several actors) or organizational (e.g., the healthcare system) actors (actors 1, 3, 4, and 6 in Table 6). The majority of the funders who pinpointed county councils as responsible for implementation considered that the county councils take responsibility for implementation “to a certain degree.” This somewhat hesitant evaluation of the county councils’ responsibility taking was based on two aspects: the system of transforming research results to practice is not optimal and implementation, which requires resources and long-term thinking does not comply well with the short-term goals of the healthcare system of saving lives. In contrast, the majority of the funders, who stated that it is the head of hospital units, who are responsible for implementation, considered that the head of hospital units take responsibility. Taken altogether, the 10 funders considered that the identified actors take responsibility “to a certain degree” (5 funders), take responsibility (4 funders) and do not take responsibility (1 funder).

Study II: A qualitative exploration of research funding managers' implementation knowledge

Implementation knowledge was assessed through funding managers' definitions of implementation and their self-assessed levels of implementation knowledge. The research funding managers defined implementation either as an outcome or a process, the majority perceiving it as a process. Further, their self-assessed implementation knowledge was either limited or substantial with the majority expressing limited self-assessed knowledge.

These four (i.e., outcome, process, limited and substantial self-assessed knowledge) aggregate dimensions emerged from the data through a rigorous step-by-step analysis. The research funding managers mentioned six different factors that could influence their self-assessed implementation knowledge: 1) clinical research experience, 2) general research experience, 3) knowledge of implementation research, 4) clinical experience, 5) industry experience, and 6) task relevance (i.e., whether or not implementation was perceived as a relevant part of the funding managers job). From these, clinical research experience, clinical experience, and task relevance were connected to both substantial self-assessed implementation knowledge (i.e., possession of the three factors) and limited self-assessed implementation knowledge (i.e., lack of the three factors), and thus constituted the most relevant factors influencing self-assessed implementation knowledge within and across the funding levels.

No clear connection between implementation definitions and self-assessed implementation knowledge was identified as the funding managers could have limited self-assessed knowledge, but still define implementation as a process and vice versa. The interview data was compared with secondary data from the funding managers' websites, concerning factors related to the professional experience (i.e., general research experience, clinical research experience, clinical experience and industry experience), which could be traced from the websites. This triangulation of data confirmed the findings from the interviews, meaning that if a research funding manager did not mention a specific factor (e.g., clinical experience) influencing his/her self-assessed implementation knowledge the same research funding manager did not "possess" this factor.

Study III: The roles and involvement of academic inventors and innovation supporting actors in university-based innovation processes: The influence of IPR ownership and IP nature

Altogether there were 27 academic inventor roles spanning over technology, legal, business and using contexts, and 31 ISA roles limited to legal and business contexts. Among the inventor roles, 19 roles were not previously identified and discussed in the literature, whereas among ISA roles, six were not previously identified in the literature. After tracing the number and types of roles of inventors and ISAs, the connections concerning IPR ownership and IP nature were identified. Finally, based on the enacted roles, the involvement of inventors and ISAs were assessed in the four cases: 1) in the first case, both inventor and ISA involvement was weak to medium (university ownership and patentable IP), 2) in the second case, both inventor and ISA involvement was medium to strong (university ownership and non-patentable IP), 3) in the third case, both inventor and ISA involvement was weak to medium (inventor ownership and patentable IP), and 4) in the fourth case, inventor involvement was medium to strong and ISA involvement was low (inventor ownership and non-patentable IP). The main results concerning roles and involvement were integrated into six propositions, which are outlined in Table 7.

Table 7. Key characteristics of the propositions

Proposition	Actor	Dependent variable	Independent variable	Content
1a	Inventors	Number of roles	IPR ownership	Inventor ownership entails more inventor roles than university ownership
1b	Inventors	Number of roles	IP nature	Patentable IP entails more inventor roles than non-patentable IP
2	Inventors	Type of roles	IP nature and IPR ownership	The types of inventor roles are more connected to IP nature than to IPR ownership
3a	ISAs	Number of roles	IP nature and IPR ownership	The number of ISA roles is more connected to IP nature than to IPR ownership
3b	ISAs	Number of roles	IP nature	Patentable IP entails more ISA roles than non-patentable IP
4	ISAs	Types of roles	IPR ownership and IP nature	The types of ISA roles are more connected to IPR ownership than to IP nature
5	Inventors	Involvement	IP nature	Non-patentable IP entails higher inventor involvement
6	ISAs	Involvement	IP nature and IPR ownership	ISA involvement in an innovation process is more connected to IP nature than to IPR ownership

Study IV: Unique logics despite institutional complexity: An inductive study of academic inventors and institutional logics

Altogether 10 second-order practices and the influence of three different institutional logics on the practices of academic inventors were identified: the academic, the market and the care logic. All three logics have certain general characteristics that distinguish them from each other (Table 8).

Table 8. Academic inventors and examples of characteristics of the institutional logics

Characteristics	Academic logic		Market logic		Care logic	
	Publish	Sell	Increase profits	Personal reputation as a care giver	Personal reputation as an academic	Personal reputation as a care giver
Goal	<p>“The first application, it was published in Y [certain year] when I already arrived to Stanford but it was written in X [certain location]. After that, we published in probably 99, 2000, and continued in 2000 until we sold the company.” (Inventor Innovation A)</p>	<p>“We had three sales reps...me and my colleague, and then we had one CEO and one fundraiser who worked to attract funding.” (Inventor Innovation D)</p>	<p>“We focus on building a solid company and then the other things will be solved. And if we start to consider too early things like acquisition and similar things then it is just a disturbance. Now we will launch this in different countries and show that it is possible to sell this and make money and we consider that it is more important than to try to sell it [the company].” (Inventor1 Innovation C)</p>	<p>“I’m the one who has contact with other physicians and I’m the one who uses the product and implements it in the clinic. And this is perhaps a quite unique role that I have. There aren’t so many previous companies that involve a physician who can give this immediate feedback because you can’t see certain things before you apply it to a patient.” (Inventor2 Innovation C)</p>	<p>“[W]e decided we wanted to do X [a program focusing on a specific clinical area], and we wanted to do X [the program] for a couple of reasons. One, because of the growing number of people [suffering from this disease], and also because X [the disease in question] is probably behaviorally the most complex of all [other similar diseases]. And thirdly because most [existing] programs don’t do anything.” (Inventor Innovation B)</p>	<p>“[W]e decided we wanted to do X [a program focusing on a specific clinical area], and we wanted to do X [the program] for a couple of reasons. One, because of the growing number of people [suffering from this disease], and also because X [the disease in question] is probably behaviorally the most complex of all [other similar diseases]. And thirdly because most [existing] programs don’t do anything.” (Inventor Innovation B)</p>
Identity	<p>Personal reputation as an academic</p>	<p>Increase profits</p>	<p>Personal reputation as a care giver</p>	<p>Personal reputation as a care giver</p>	<p>Personal reputation as a care giver</p>	<p>Personal reputation as a care giver</p>

All these three logics exerted influence on the practices of academic inventors, but both the care and the market logic were highly prevalent. The academic logic influenced behavior in five instances (i.e., a situation where a specific practice was influenced by a certain logic), whereas the market and the care logic influenced behavior in 24 respectively 18 instances.

Concerning technology types, which was one of the aspects that provided variation between the cases, the high-tech cases were mostly influenced by the market logic, whereas the care logic was prevalent in low-tech cases, with one of the low-tech cases blending the care and the market logics. In terms of logic compatibility four different types of interaction patterns were identified: “complementary,” “reinforcing,” “conflicting” and “no interaction.” All four cases displayed high logic compatibility as the general pattern was “no interaction” in three of the cases, and in the fourth case “complementary” interaction was prevalent. Regarding logic centrality four different levels of logic centrality were identified: 1) lowest, 2) low, 3) medium, and 4) high logic centrality. In Besharov and Smith’s (138) framework low logic centrality is preserved for situations which display the existence of core logics together with peripheral logics. Going beyond low logic centrality the instances when there were, in general, no peripheral logics were labeled “lowest” logic centrality. Further, the institutional logics present in the instances with lowest logic centrality were labeled as “unique” logics. Summarizing, three of the cases displayed “lowest” logic centrality as there was one unique logic guiding behavior. The fourth case displayed a blending of the care and the market logics leading to high logic centrality.

Summarizing logic compatibility and logic centrality for each of the four cases, in relation to Besharov and Smith’s (138) framework, indicated that the influence of logics was “dominant” in three of the cases with high logic compatibility (i.e., the existence of reinforcing and complementing logics) and low logic centrality (i.e., the existence of one core logic). The influence of logics was “aligned,” in one of the cases with high logic compatibility and high logic centrality (i.e., the existence of several logics which were core to individual behavior). To this end, dominant influence of logics was connected to a behavior that was guided by one core logic with generally “no interaction” between logics. Aligned influence was connected to a behavior that was guided by several core logics, with in general complementary interaction between logics.

Concerning the individual strategies for dealing with the multiple logics, three different strategies were identified: “bridging,” “segmenting” and “entrenching.” Further, each of the strategies was a response to the influence of the logics, namely “entrenching” was a response to “dominant” influence and “bridging” and “segmenting” were responses to “aligned” influence. The second ground to select cases was the IPR ownership. Innovations originating from Stanford were assumed to entail also logics connected to the TTOs, whereas innovations originating from Uppsala were assumed to entail fewer

logics as the innovators are more independent. However, these assumptions were not supported as both contexts displayed all three logics.

Discussion

Summary of findings

This thesis is based on four studies that deal with three key actors that can influence an innovation process in different ways, and in turn are influenced by different factors. Study I identifies eight facilitative funder roles in relation to implementation, where three are prevalent: “advocacy work,” “monitoring implementation outcomes,” and “dissemination of knowledge.” The funders identified six different actors responsible for implementation, but still thought that the responsibility for implementation lies within the healthcare setting. The majority of the identified actors were either collective or organizational actors. Further, the majority of the funders were not convinced that the identified actors fully take responsibility for implementation. Study II shows that the majority of the funding managers defined implementation as a process and felt that they had limited self-assessed implementation knowledge. While six factors were identified as influencing the self-assessed implementation knowledge of funding managers, three of these emerged as explicitly contributing to self-assessed implementation knowledge: clinical research experience, clinical experience and task relevance. No connection between self-assessed implementation knowledge and implementation definitions was detected.

Study III illuminates the connection of both IPR ownership and IP nature with inventor roles (the number of roles). IP nature, in turn is more connected than IPR ownership with inventor roles (the types of roles), ISA roles (number of roles) and the involvement of both inventors and ISAs. IPR ownership is more connected than IP nature with ISA roles (types of roles). Study IV identifies 10 second-order practices of academic inventors, which are influenced by three institutional logics: academic, market and care logics. The market and care logics are highly prevalent, connected to high and low-tech innovations respectively. All four cases display high logic compatibility and no interaction is the prevalent pattern of interaction. Three cases display low logic centrality and one case shows high logic centrality. Summarizing logic compatibility and logic centrality indicates that the influence of logics is dominant in three cases, and aligned in one of the cases. Dominant influence is connected to entrenching as an individual strategy to deal with the influence of logics, whereas aligned influence is connected to strategies of bridging and segmenting.

Research funders' roles in implementation and responsibility for implementation

There is a growing interest to identify and understand the roles of research funders in activities related to implementation of research results (89,91,93). Previous research has identified several roles for funders, such as dissemination of knowledge and advocating for use (89,90), connecting researchers and research users (87,88), involvement in implementation (86,91), and requiring that implementation is addressed already in the grant application (86). However, in depth multiple case studies have been lacking, as the previous studies have mainly been either accounts of single cases from one funder's perspective (87,89–91) or broad international comparisons (92,93). Study I addressed this gap, through a comparative approach focusing on 10 research funders from Sweden. Altogether eight facilitative roles of research funders were identified. Among the eight roles, three were prevalent, either within or across different funding levels, where two of these, namely, dissemination of knowledge and advocacy work, are acknowledged roles of research funders (89,90). The third role, monitoring implementation outcomes, has not been identified previously in the research funding setting, but is an acknowledged role in program and policy implementation (206–208). Monitoring implementation outcomes is a post-implementation role and is an important role for funders who are interested in following what their investments actually lead to in terms of implementation and improvement of patient care.

In terms of funding levels, the roles seemed to fit the types of funders as national public funders acknowledged relatively few facilitative roles that were not very prevalent at the funding level, which might depend on the fact that their main goal is to fund research. The national private funders, in contrast, focused on improving health and identified relatively many facilitative roles that were prevalent at the funding level. The local public funders, in turn, are part of the county councils, who provide healthcare, but still they identify few facilitative roles that were not prevalent at the funding level, which could depend on the fact that although part of the same organization, and with a task to fund patient-related research, they are not involved in implementation.

In terms of responsibility for implementation, the majority of the funders identified responsibility for implementation as lying within the healthcare context, which is in agreement with Swedish law which states that county councils are responsible for good quality care that is continually being developed (209). However, in general, the “problem of many hands” remains relevant as the funders identify six different actors responsible for implementation, which suggests that responsibility issues have become so blurred that responsibility becomes no one's responsibility (210). Yet, this risk is balanced out by the fact that the local public funders, who are closest to

healthcare and implementation contexts, identify only three different actors responsible for implementation. In cases where a collective or an organizational actor, such as the healthcare system, is identified as responsible for implementation the “problem of many hands” might become relevant. Consequently, as the majority of the funders acknowledge a collective or an organizational actor as responsible for implementation, and a total of six different actors have been identified as responsible for implementation, the risk of implementation becoming no one’s responsibility is present. In cases where implementation responsibilities are blurred, possible facilitation provided by research funders is obstructed and the implementation of research results becomes less likely.

Research funding managers’ implementation knowledge

There is wide gap between what practitioners do when treating patients and the recommended treatments (20,62,211). In order to diminish this gap implementation of new findings is required. Implementation in turn demands the change of existing behavior and thus strategies to change existing behavior are needed (64). To this end, one needs to identify the determinants of the existing behavior (e.g., lack of self-efficacy), and design an implementation strategy (e.g., role modelling) that targets the determinant. Following this, an implementation plan needs to be developed, executed and evaluated. Consequently, implementation can be depicted as a complex, stage-wise process (59). The findings in Study II support the notion that implementation can be described as a process, but funding managers generally do not acknowledge the importance of identifying determinants for behavior and only some perceive implementation as a complex process. Also, some of the funding managers felt that implementation is an outcome, which at least partly contradicts the findings from implementation research that state that implementation is not only an outcome but also requires a process (211). The funding managers that acknowledged implementation as an outcome did not imply that a process is required.

Previous studies have not focused on research funding managers’ implementation knowledge, and thus Study II is the first attempt to examine this important topic. One aspect that was assumed to influence the funding managers’ self-assessed implementation knowledge was knowledge of implementation research. Implementation research has produced a large output that can be used to plan, execute and evaluate implementation (94), but little effort has been made to assess whether or not implementation research output is used in decision making. Consequently, not much is known about the degree to which healthcare decision makers have knowledge of and use findings from implementation research. Findings from policy literature state that there is a wide gap between existing policy knowledge and practice (95,212–

214), and thus one could assume that this gap also applies to the field of healthcare implementation. The findings in Study II support this hypothesis, as in general research funding managers do not have knowledge of implementation research.

However, knowledge of implementation research might be redundant for research funders who work at the intersection of healthcare and healthcare research as they might have acquired implementation knowledge from other sources, such as through clinical experience or clinical research experience. The findings in Study II support the notion that experience-based knowledge is an important source of implementation knowledge. Clinical experience was one of the factors connected to both limited self-assessed knowledge (i.e., lack of clinical experience) and to substantial self-assessed knowledge (i.e., possession of clinical experience). Previous research has not acknowledged this impact of clinical experience on policymakers' knowledge and use of research results. Also clinical research experience was connected to self-assessed implementation knowledge in a similar way as the clinical experience.

Previous research has not distinguished between general research experience and clinical experience (91,92,216), and thus Study II is a first attempt to make this important distinction. Clinical research deals with patient-related issues, whereas general research could deal with mouse models or similar issues that could eventually be applied to humans. To this end, clinical research, which takes place in the healthcare context, should be more relevant from an implementation point of view than general research, giving rise to a specific understanding of implementation. These aspects are visible in Study II.

Further, industry experience was a factor brought up by a few funding managers who felt that this factor contributed to their self-assessed knowledge. According to my knowledge, industry experience is not mentioned in previous research relating to policymakers. Finally, a strong impact of task relevance on funding managers' self-assessed knowledge was identified. Task relevance means that a certain task, assignment, role or practice is perceived as relevant for one's activities. The connection between perceived task relevance and actors self-assessed knowledge is supported in previous research concerning planned behavior, where the intention to act depends on the attitude towards the task and whether the task is relevant (216,217). Consequently, the funding managers who perceived implementation as one of their tasks either had substantial knowledge or aimed to increase their limited knowledge. In contrast, funding managers who did not consider that implementation is relevant for their work had either limited knowledge or did not consider their limited knowledge as an issue. Further, no connection was identified between self-assessed implementation knowledge and implementation definitions, for instance, a process view was not based on substantial self-assessed knowledge. This lack of connection could depend on the

fact that the research funding managers are modest concerning their knowledge and actually know more (i.e., a majority expressed a process view) than they perceive (i.e., a majority expressed limited self-assessed knowledge). Alternatively, the low accounts of self-assessed knowledge could depend on the fact that although many perceive implementation as a process they still consider that they do not have the complete picture as they only possess experience-based knowledge.

The six factors (knowledge of implementation research, clinical experience, clinical research experience, general research experience, industry experience, and task relevance) described above together constitute a grounded model on research funding managers' implementation knowledge. The model will be discussed under the heading *Theoretical and Practical Implications*.

Influence of IPR ownership and IP nature on roles and involvement of academic inventors and ISAs

University ownership has been claimed, by both researchers and policymakers, to contribute to economic welfare and increased exploitation of IP (185,186,218,219). Based on these assumptions university ownership has been introduced in many countries (150,194). However, many researchers claim that the increased patenting and licensing of university IP in the US, where the idea of university ownership originates, is not connected to university ownership (150,194). One alternative to university ownership is inventor ownership (111). In inventor ownership the economic gains come to the inventor only, and thus this kind of ownership is assumed to provide incentives for the inventors (111,187). Others have in turn argued that university ownership is superior to inventor ownership when it comes to incentives for inventors, because the initial costs of patenting and marketing are covered by the TTOs (167).

The findings in Study III indicate that in both IPR ownership regimes the initial costs were covered by the TTOs, which were involved also in the cases with inventor ownership. Further, the findings do not indicate which type of IPR ownership is more beneficial for innovation and economic welfare. Rather, they imply that IPR ownership does not explain the roles and involvement of inventors and ISA. However, two exceptions apply: 1. the number of inventor roles seem to increase with inventor ownership and 2. the types of ISA roles are specified based on IPR ownership, namely in university ownership the ISA roles revolve around IP protection and IP management, whereas with inventor ownership the roles relate to business support. Instead, the explaining factor concerning roles and involvement seem

to be the IP nature. Consequently, the focus on IPR ownership and discussion revolving around the most beneficial IPR ownership type (220) could be expanded to include IP nature. The findings imply that although patentable IP entails more inventor and ISA roles, this does not mean that the roles are heavy and thus necessitate high involvement. Indeed, the involvement of inventors is higher in non-patentable IP. This could be due to the fact that it is more difficult to exploit non-patentable medical IP, as non-patentable IP is not very easy to define, as expressed by the stakeholders concerning both cases of non-patentable innovations.

Previous research on IP nature is mostly focused on patentable IP and the incentives it brings to different stakeholders (112,171,221). The findings in Study III not only confirm the previous understanding that patentable IP is more interesting for stakeholders, attracting more funding, but also reveal that non-patentable IP attracts funding and engages inventors and ISAs in exploitation of IP. Further, the findings provide examples of non-patentable IP which are licensed to users. In earlier studies, non-patentable IP was assumed to be of little interest for inventors and ISAs (171,222), the avenue to exploit the IP being consulting with little involvement of the TTOs (167,170). Moreover, the findings in Study III show that patentable IP does not seem to render inventor involvement unnecessary as assumed by previous research (167). This supports the argument that inventor involvement is necessary despite the innovation type (103). Consequently, the findings illuminate the importance of IP nature in explaining inventor and ISA roles and involvement. They also suggest that not only patentable but also non-patentable IP can be attractive for inventors and ISAs. To this end, the findings in Study III question the general assumption that patenting is a requirement for exploitation of medical IP (124,223–225).

Academic inventors and their practices analyzed through institutional logics

In Study IV, a new logic, in the setting of academic inventing in the domain of medicine, was identified, namely the care logic. A limited presence of the academic logic was identified, though it is often assumed to be prevalent and in conflict with the market logic (113,118–121). Previous research has mainly focused on the early stages in commercialization of high-tech IP (118,124,125), which has led to overemphasizing the academic logic. During the early stages (e.g., patenting and licensing), the academic inventors are closely connected to their universities and thus the academic logic becomes relevant. But when the focus shifts from the early stages, an alternative logic becomes more salient (i.e., care logic), which together with the market logic is prevalent during the whole innovation process. Moreover, previous re-

search focusing on academic inventing has predominantly focused on high-tech IP (118,119,123–125), ignoring for instance low-tech IP, such as different self-management programs (47,226–228). When the different types of technologies were included in Study IV, the care logic emerged as an important logic connected to low-tech innovations. Conversely, the findings show that the market logic was connected to high-tech innovations.

The findings in Study IV also indicate several patterns that picture the practices of academic inventors in settings with multiple institutional logics:

- 1) regardless of the availability of multiple logics, a strong pattern of practices, based either on the market or the care logic, was identified, where the logics prevalence was based on technology types,

- 2) minimal interaction between logics was present and the main pattern of interaction was actually “no interaction,”

- 3) instead of several logics that are core to individual behavior the behavior is guided by “unique” logics,

- 4) the combined influence of logics, assessed through logic compatibility and logic centrality, leads to a “dominant” influence on behavior, which corresponds to a strategy of entrenching with a unique logic.

These four patterns contradict the assumptions concerning settings with multiple logics regarding the influence of logics (110,114,131–133), and the individual strategies employed by organization-bound actors (131,132,134,135). Against this background, the findings support Besharov and Smith’s (138) postulation that settings with multiple logics can produce heterogeneous outcomes (e.g., multiple logics produce behavior guided by one core logic), and thus further research in this important topic is called for.

Besharov and Smith’s (138) framework was employed and adjusted to study the influence of logics on individual behavior. This application of Besharov and Smith’s (138) framework provides evidence that the concepts of logic compatibility and logic centrality can be used to study individual behavior as well. However, Study IV goes beyond the usual approach of studying individual strategies to cope with multiple logics (134–136), by mapping the influence of logics on each practice and connecting these practices with the individual strategies. Although some have connected logics with individual strategies on a practical level (134,143), this is not based on a systematic assessment of the influence of logics through logic compatibility and logic centrality. To this end, Study IV contributes to improved understanding of the connection between the influence of logics and corresponding individual strategies.

Theoretical and Practical Implications

This thesis set out to study the behavior of three key actors and the factors influencing their behavior during an innovation process. Several new empirical findings resulted from this relating to the roles of research funders and ISAs, as well as the practices of academic inventors. Altogether three main theoretical and practical implications can be derived regarding responsibility for implementation, implementation knowledge and IP nature as an explanatory factor. All these three implications will be elucidated below.

Responsibility for implementation

Research funders' perceptions of responsibility for implementation pointed at six different actors, thus introducing the problem of many hands (210) and risking making implementation no one's responsibility. If research funders do not have a unified understanding of responsibility for implementation, or if they perceive implementation to be a collective responsibility, they may face difficulties in providing optimal implementation support. This issue of responsibility raises a broader concern, namely who is responsible for implementation in complex healthcare organizations?

As clarified through the problem of many hands, responsibility may become crucial in organizations where several individuals and levels are involved. Moreover, areas of responsibilities become blurred when responsibility is allocated to collective or organizational actors (210). The role of the healthcare system or county councils as responsible actors portrays the problem of many hands. If individual healthcare professionals were responsible for implementation it would be easier, and also more legitimate to hold individuals responsible (210). On the other hand Bovens (16) points out that individual responsibility still entails a risk as it may be difficult to know if someone else contributed to the outcomes in cases where something went wrong. According to Bovens (16), an alternative to individual responsibility is the allocation of responsibility, for instance, to department heads which represent a form of hierarchical accountability.

Thompson (210), who identified the problem of many hands, in turn argues that hierarchical responsibility is a ceremonial responsibility, which does not acknowledge organizational complexity and thus leaves out the individuals who contributed to the outcomes. Likewise, Dixon-Woods and

Pronovost (229) acknowledge the problem of many hands, especially in regards to patient safety, and argue for an increased collective responsibility where, for instance, peer-sanctions function as checks and balances to responsibility, identifying *peer control* as an important ingredient contributing to responsibility. Sanctions are in turn based on the perceptions of the collective right and wrong, and thus this form of control is close to what Kärreman and Alvesson label as socio-ideological control (230). Socio-ideological control is a form of control that focuses on the management of ideas, beliefs and identity formation in complex organizations that are highly decentralized, where management of outcomes is difficult. Other alternatives of socio-ideological control are, for instance, identity-based control and regulation (231), and ideology and clan-based control (232). Common to these types of control mechanisms is that they try to manage aspects that influence individual behavior in an organizational setting, instead of focusing directly on behavior, for instance, through direct supervision, as suggested by Mintzberg (233).

In contrast to control mechanisms that influence behavior, Thompson (234) is a proponent of an increased individual responsibility that aims to control direct behavior. If something goes wrong, the individuals who contributed to the outcomes are defined and the reasons behind the outcomes are analyzed. The meaning is not to punish the individuals, but to build organizational structures, which are based on individual responsibility and that in the long run foster individual responsibility (234). Dixon-Woods and Pronovost (229) perceive that in healthcare, individual responsibility is inadequate concerning patient safety, as individual responsibility gives too much responsibility to the individuals in a complex system where local solutions might cause problems in other settings. For instance, practitioners might follow a hospital specific guideline, but when moving to another hospital the same guideline might have adverse effects (229). To this end, Dixon-Woods and Pronovost (229) question the adequacy of individual responsibility.

I agree with Dixon-Woods and Pronovost that individual responsibility might be inadequate, but I base my argument on different grounds: the healthcare profession is, in general, assumed to be self-monitoring building on an assumption that a healthcare professional does not aim to cause harm to patients by applying obsolete knowledge (235,236). However, such self-monitoring might be inadequate as implementation often requires change of old routines and improving of knowledge, which naturally activates a defense mechanism, where the old practice might be defended although proven to be obsolete (61). To this end, apart from individuals, even peers and collectives can continue with obsolete practice because changing practice is difficult. Consequently, managing beliefs and ideas as suggested by the socio-ideological approach (230), rather than managing direct behavior (233), is more in line with the implementation research approach on changing practice (61). Against this background, the fundamental question concerning

responsibility for implementation seems to be: Is there someone who is responsible for implementation and if so, who? One possible follow-up question could be: How is the responsibility for implementation created and managed?

Perhaps there are differences in responsibility for implementation between contexts where the management is focusing on *controlling behavior*, *influencing behavior* or *managing behavior through peer control*. For instance, the influencing behavior approach could create a strong ideology concerning evidence-based medicine (235), which in turn could be more conducive to responsibility for implementation, whereas controlling the healthcare personnel's use of guidelines could be less conducive to responsibility for implementation.

These insights concerning responsibility for implementation have practical implications encouraging a debate about responsibility for implementation at different levels (e.g., research producing, implementation facilitation and research using), and how one could increase responsibility for implementation. On the other hand, responsibility for implementation should be an important issue addressed in implementation research, and thus the insights from this thesis concerning responsibility for implementation could stimulate further studies and theory development in responsibility issues in healthcare.

Implementation knowledge

The policy-practice gap (95,96) regarding implementation implies that the research funding managers, who are one type of policymakers, do not apply knowledge from implementation research in decision making. The knowledge that they are assumed to lack is knowledge from implementation research. However, the findings in Study II indicate that the research funding managers possess certain implementation knowledge acquired from experience, rather than from science. These findings raise an important issue in the context of implementation research, which aim to produce output that can be used to plan, study and evaluate implementation (94), namely: Do research funders need knowledge of implementation research if implementation knowledge can be acquired through practical experience? Based on the findings in Study II, the answer would still be yes because the majority of the research funding managers, although defining implementation as a process, lacked a deeper understanding concerning the processual aspects, such as the identification of barriers and facilitators and tailoring of the strategies to barriers and facilitators. To this end, the policymakers that work in the intersection of healthcare and healthcare research would benefit from the output of implementation research. Despite this, the grounded model on implementation knowledge, developed in Study II, highlights the fact that knowledge

from implementation research is only one factor that can contribute to research funders' knowledge. This insight provides preliminary practical implications that experience, such as clinical research experience and clinical experience, can entail basic knowledge about implementation.

Many of the factors in the grounded model are factors that are difficult to influence through a short-term implementation intervention: clinical experience, general research experience, clinical research experience and industry experience. For instance, it would be difficult to design an implementation strategy that aims to increase one's clinical experience through a behavioral intervention. Further, clinical experience does not embody an underlying behavioral aspect that could be targeted to influence clinical experience. In contrast, the factors in the grounded model that can be influenced through implementation strategies are knowledge of implementation research and task relevance. As already stated, improving research funding managers' knowledge of implementation research would be beneficial. To address a lack of knowledge several implementation strategies could be applied, such as "using imagery" where a lot of information can be memorized by attaching the information to daily routines or through "chunking" where the information is divided into small stimulus patterns that are perceived as a whole (66). Also task relevance could be increased through several implementation strategies. Task relevance consists of several behavioral factors, such as knowledge and attitudes, which can be influenced, for instance, through "using imagery" or through "shifting perspective" where the individual takes someone else's perspective (66). Despite the rigidity of several of the factors in the grounded model, it still demonstrates the relevance of experience-based factors and further research can identify whether or not the model can also be applied to other areas of policymaking where experience could give knowledge, comparable to some findings, for instance, from policy research.

The grounded model is a contribution to implementation research theories, models and frameworks, which traditionally focus on practitioners and organizational aspects (237–239). Instead of pinpointing different facilitators and barriers to implementation, it highlights relevant aspects to understand research funding managers' implementation knowledge, which in turn can elucidate the research funding managers' possibilities to undertake different facilitative roles in relation to implementation. The grounded model also broadens the scope of implementation research beyond the healthcare context and practitioners, illustrating that the knowledge-practice gap can be addressed through aspects that are relevant before the evidence enters the healthcare context.

The explaining factors in the model are connected to self-assessed implementation knowledge, which is the research funding managers' own evaluation of their implementation knowledge. The findings illustrate that a certain perception of self-assessed implementation knowledge does not coincide with a certain implementation definition, which is line with previous find-

ings concerning the connection between knowledge and self-assessed knowledge in general (240). However, the model does not provide guidance on how to influence implementation definitions, which reflect the funding managers' knowledge of the phenomenon. Further, knowledge of something is not a direct determinant of behavior as several other aspects influence behavior, such as attitudes and evaluations of self-efficacy (i.e., whether or not the person trusts her capabilities to perform a specific behavior), but knowledge is an important prerequisite for many of the other behavioral aspects (66). To this end, studying knowledge, both definitions and levels of knowledge is important. Moreover, the grounded model focuses on a neglected actor (i.e., the funding managers), but the issue of implementation knowledge should be highly relevant for other actors as well. These can include governmental officials drafting policies concerning healthcare and healthcare practitioners themselves. If the findings apply to healthcare practitioners, the importance of experience-based knowledge could point to the need of exposing the practitioners to well-designed implementation strategies rather than intuitive strategies. One recent study protocol focused on the healthcare managers implementation knowledge aiming to provide competence building in implementation knowledge (241). To this end, the grounded model provides important insights into a timely topic. Consequently, the insights from this thesis concerning implementation knowledge could stimulate a debate concerning the need for and varying degrees of implementation knowledge in different levels.

IP nature in explaining inventors' and ISAs' behavior and institutional logics

The findings in Study III do not support the primacy of IPR ownership in influencing inventor and ISA behavior, rather the IP nature seems to be more connected to the roles and involvement of inventors and ISAs. Further, in Study IV the IP nature is connected to certain institutional logics, which are connected to high-tech respectively to low-tech innovations. All in all, the IPR ownership has some explanatory relevance, but its central place in policy and research could be questioned and could be at least complemented with a discussion concerning IP nature.

The findings of this thesis make an important contribution to understanding academic inventing by expanding the scope to low-tech innovations, which are not patentable, and indicating that there is a connection between the care logic and low-tech medical innovations. Despite the fact that university-based innovations cover a spectrum of innovations – both low-tech and high-tech – the predominant focus has been on high-tech innovations, and the early steps (e.g., patenting and licensing) in the innovation process. This

bias towards certain types of innovations has created a debate concerning academic inventing, which revolves around two institutional logics, namely the academic and the market logic (113,118). Often this binary relation of the academic and market logics has been perceived to lead to an uneasy co-existence of the two logics (113,118–121). This narrow view depicting academic inventing has three key consequences:

- 1) an incomplete view of the nature of academic inventing is received,
- 2) the conflict between the academic and the market logic during the early steps flavor the discussion concerning academic inventing, putting the emphasis on two contradictory forces, namely academia and the commercial world, and
- 3) low-tech/non-patentable IP, which embody important innovations that can improve patients' health, do not receive attention in policy circles, which in turn influences funding opportunities, but might also discourage innovators interested to exploit low-tech IP.

The findings from this thesis elucidate all these three concerns and illustrate the relevance of low-tech innovations/non-patentable IP for academic inventing, and how this kind of IP is connected to care logics. These insights could contribute to the policy debate concerning the primacy of different kinds of IPR ownership regimes by highlighting the relevance of IP nature. On the other hand, both IP nature and the care logic provide interesting avenues for theoretical understanding of academic inventor behavior.

Methodological considerations

The four studies that constitute this thesis address the two aims: (A) to examine the behaviors of the three actors, i.e., research funders, academic inventors and ISAs during an innovation process, and (B) to explore the influence of contextual factors (i.e., implementation knowledge, responsibility for implementation, IPR ownership, IP nature and institutional logics) on actors' behaviors. The underlying idea with focusing on actors was that facilitation in different forms is assumed to be able to influence innovation processes. Acknowledging the existence and importance of several different actors during an innovation process, I decided to focus on three actors that have not received adequate interest in previous research despite their important position. However, actors do not function in a vacuum during an innovation process but are influenced by different factors, which require the identification of key factors assumed to influence actors' behaviors. The identification of factors is a limitation in this thesis as it builds on a subjective view about the importance of certain factors. There are several other factors, such as the regulation of medical technology (approval required in the US from the Food and Drug Administration vs. CE marking required in Sweden), procurement

of medical technology (no procurement process in the US vs. a strict procurement process in Sweden), previous experience of innovators from commercializing medical technology (ranging from high to low experience). Some of these factors were mentioned by the respondents, but none of these were deemed as central by them. However, the interview guides did not focus on these alternative issues, and thus it is possible that important aspects may have emerged if the focus had been on any of the alternative factors. Consequently, I do not claim that the factors covered are the only relevant factors. The same argumentation is applicable to the selection of the actors. Also here, several other actors could have been selected and studied.

All four studies in this thesis build on a qualitative method. Qualitative studies are often a good starting point if existing knowledge and understanding concerning a phenomenon is inadequate (242). Against this background, qualitative and quantitative methods could be depicted as complementary in a way that qualitative studies explore an issue (e.g., hypothesis generating, theory building) and quantitative studies test the generated hypothesis or proposed theory (196). To this end, Studies I-IV were conducted as explorative examinations concerning actors and issues, where knowledge is inadequate or points to different directions. Studies II-IV constructed grounded models which all can be applied further in quantitative designs, whereas Study I identified an issue, responsibility for implementation, which can be examined through a quantitative design at different levels. Studies I-IV built on semi-structured interviews as the fundamental source of data, combined with data from homepages, databases and documents. In qualitative research as well as in quantitative research, validity and reliability are two core concepts, which can be used to assess qualitative research (196). In addition to these two, reflexivity is an important issue in qualitative research (242). Each of these will be discussed below.

Creswell (196) proposes eight different strategies to improve *validity* or the “accuracy” of the findings from qualitative research: 1) prolonged engagement, 2) triangulation, 3) debriefing, 4) negative case analyses, 5) clarifying bias, 6) respondent validation, 7) thick descriptions, and 8) external audit. Creswell (196) argues that in each study at least two of the strategies should be employed. To this end, Study I employed *triangulation*, *clarifying bias* and *thick descriptions* of the cases studied, whereas Study II relied on *triangulation*, *clarifying bias*, and *debriefing* by a couple of external reviewers, who conducted one form of interrater reliability test of the coding scheme. Studies III and IV employed *triangulation*, *clarifying bias*, *respondent validation*, *thick descriptions* of the innovation processes and, rigorous *external auditing* by several leading authors in the field. Consequently, several measures were undertaken in each of the four studies to increase the validity of the findings.

Despite these measures, Studies I-IV all have certain weaknesses that impact validity. In Study I, the research funders were not asked to check the

initial findings concerning their roles and perceptions on responsibility as they were extremely difficult to get hold of. In Study II, the same decision was made concerning the funding managers' implementation knowledge. If the respondents in Studies I-II had been asked to check the initial findings they might have pointed out something that was missing or misinterpreted. Consequently, the lack of respondent checking might decrease the validity of the findings (196). In contrast, in Studies III and IV the respondents were asked to validate the innovation process journeys (capturing, for instance, the roles and practices of different actors and the factors influencing the process), but few of the respondents replied and in general few issues were raised by the respondents, suggesting that the interpretation of the data was in line with their understanding. In Study III and IV it would have been beneficial to prolong the research process and add new cases that aimed to confirm or disconfirm the findings. For instance, search for low-tech cases where no care logic was present or identify high-tech cases where the activities were based on care logic. As resources were limited, it was not possible to search for confirming and disconfirming cases which means that the validity of the findings may be decreased when only confirming cases are included (196).

Reliability, in turn, in qualitative research deals with the coding of the data, and one central issue is the process of conducting intercoding (196). These concerns were addressed in each of the four studies within the limited resources that a PhD project has to deal with. In Studies I-IV, one researcher coded the interview transcripts, which could decrease reliability of the coding and eventually the findings (196). To counterbalance this and increase reliability the coding schemes were reevaluated and meticulously discussed by the involved researchers in Studies I-IV. The aim was to reach an agreement concerning code names and the quotes backing up the codes and the final coding schemes were drafted based on consensus between the involved researchers. All final codes were backed up by quotes in Studies I-IV. In Study II, four other researchers, independent from the project, were asked to organize the interview data into first-order categories, second-order themes and finally into aggregate dimensions. All codes that had less than 75% convergence between the four coders were recoded. The final coding was based on a consensus between the three authors.

Reflexivity is about the researchers' preconceptions and understanding of the studied issues. No one starts from a clean table and although qualitative research does not aim to test hypotheses there still are some preconceptions that are visible in a qualitative inquiry. Being aware and open about the preconceptions is important in qualitative research (242). In Study I-IV certain preconceptions influenced the study design, for instance, in Study I the implementation related roles were assumed to differ based on the funder type, and thus this was one of the issues that was used to select cases. In Study II, the closeness to implementation and type of research funded were assumed

to influence implementation knowledge. In Study III and IV the IP nature and IPR ownership were assumed to influence roles and practices, and thus cases providing variation in IP nature and IPR ownership were selected. These kinds of preconceptions always influence the study design and when reflexivity is taken seriously they can also guide the study design (196). The downside of preconceptions is however that the study is put on a certain path and, although inductive, there is only certain space within which the findings can vary. For instance, in Study II, the implementation definitions were not pre-defined by researchers, but the respondents cannot go “outside” implementation definitions as the researchers have decided to assess implementation knowledge through implementation definitions.

Further research

This thesis and its findings open up several interesting avenues for further research, but the main avenues discussed here build on the three outlined theoretical and practical implications. Responsibility for implementation was studied connected to research funding managers, but as indicated this issue raises an important question in the healthcare context, namely who is responsible for improvement of care. As suggested previously, there might be differences in responsibility for implementation between contexts, where the management is focused on controlling direct behavior, influencing individual behavior or controlling collective behavior. Future research could study who is responsible for implementation and in which way the different management styles influence responsibility for implementation. Different designs could be employed, such as direct observation of management in hospital wards combined with existing outcome data concerning the adherence to guidelines. Future research could examine which types of ideologies or institutional logics can be distinguished in the healthcare context, and how these influence responsibility for implementation. For instance, the care logic might incorporate different elements of the academic logic and put more or less emphasis on patient preferences. This process could start with certain clinical areas and interview healthcare practitioners in order to identify themes and explore feasibility for a large-scale survey study.

The second main implication dealt with the research funding managers’ implementation knowledge, but as previously stated this raises a broader issue, which is highly relevant in the implementation context, namely what implementation knowledge do the healthcare practitioners at the frontline of implementation have. To this end, future research could examine the healthcare practitioners’ implementation knowledge and whether it is mainly experience-based or science-based, and how their implementation knowledge influences implementation of new findings and treatments in their units. Several designs could be employed, such as survey concerning

knowledge and existing data concerning adherence to guidelines and implementation of guidelines. The third main implication from this thesis and the third avenue for further research concerns the IP nature. Future research could review a large number of innovations and study whether the IP nature is the key factor influencing inventors and ISAs behavior. Moreover, it would be essential to examine whether the assumed connection between the care logic and low-tech medical innovations hold in large scale innovation samples, and whether the IP nature has explanatory power outside the medical domain. In order to conduct large scale comparisons of university-based innovations, which focus on aspects outside patenting and licensing a database should be constructed together with a proxy for involvement and care logic.

Conclusions

The studies included in this thesis have not only contributed to an increased understanding of the behaviors of three important actors during innovation processes and how different factors influence their behaviors in detail, but also elucidate in which way the factors are relevant in their own right. Studies I-II focus on research funders and research funding managers and examine funders' roles, perceptions of responsibility for implementation and the research funding managers' knowledge of implementation. The results concerning the research funders' roles support previous findings and identify a role (i.e., monitoring implementation outcomes) that has not previously been discussed in the literature in relation to research funders. Responsibility for implementation in turn, has not been previously examined – neither concerning research funders nor other implementation-related actors. To this end, the results provide important insights into research funders' perceptions of responsibilities for implementation, but also pinpoint an important issue, which deserves further attention, namely, who is responsible for implementation of research results. Study II develops a grounded model to understand and explain funding managers' implementation knowledge. Implementation knowledge has not received much interest in previous research, where the focus has been to produce knowledge that can be used to plan, study and evaluate implementation. Further, the interest in policy research has been on science-based knowledge, whereas the grounded model highlights the importance of experience-based knowledge, such as clinical experience, in constituting the basis of implementation knowledge.

Study III, focuses on the roles and involvement of academic inventors and ISAs, and how the IPR ownership and IP nature influence their roles and involvement. The results are not in line with previous understanding concerning the importance of IPR ownership, and highlight that in addition to IPR ownership attention could be given to IP nature. Further, elaborating the

existing understanding concerning different types of IP, the results show that a distinction between patentable and non-patentable innovations should be made as the roles and involvement are influenced differently by these two types of IP nature. Study IV, focuses on inventor practices during innovation processes and aims to understand both the influence of logics and the individual strategies employed by the inventors to deal with the logics. The results show that the context of academic inventing can be distinguished from other settings with multiple institutional logics, as in general, there is no interaction between logics, in contrast to the literature's assumptions of logic cooperation and logic conflicts characteristic for settings with multiple logics. Further, the influence on behavior is exerted through a unique logic instead of a constellation of logics as one would assume concerning settings with multiple logics. Finally, the results indicate that the individual strategies to deal with multiple logics coincide with the influence of the logics, showing in general a pattern of entrenching instead of a pattern of segmenting and bridging of logics, as assumed in existing research. In addition to this, Study IV uncovers a new logic in the field of academic inventing, namely the care logic, contributing to the existing discussion concerning the prevalence of the academic and the market logic in the context of academic inventing. The results in both Study III and IV highlight the relevance of studying low-tech medical innovations/non-patentable innovations as these kinds of innovations display distinct patterns in terms of inventor and ISA behavior, but also which institutional logics are prevalent, which are not covered if the focus is only on high-tech innovations.

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