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Institutional Entrepreneurship, Power and Knowledge in Innovation Systems

Institutionalization of Regenerative Medicine in Tampere, Finland

Abstract

In this article, we ask what is the place of institutional entrepreneurship in an (regional) innovation system. The main research questions addressed are (a) how does a new science-based concentration of innovation become institutionalized in an innovation system, (b) who are the institutional entrepreneurs and what do they actually do in their efforts to institutionalize new beliefs, practices and activities within a system, and (c) what knowledge institutional entrepreneurs do need and what kind of power do they exercise in the institutionalization process. We add new knowledge to studies focusing on innovation systems by revealing how new elements are attached into it. We also add power and knowledge to the study of institutional entrepreneurship and institutional change. The empirical analysis identifies the main phases of institutionalization, key actors in different phases and their strategies of influence. This paper is based on the analysis of secondary data and 28 interviews with key actors.

Key words: Institution, institutional entrepreneurship, power, knowledge, innovation system, regenerative medicine

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1 Introduction

Studies focusing on innovation systems highlight the need for better understanding of institutional change (Lundvall et al, 2002, page 255). Additionally, it has been observed that various actors often need to innovate against the logics of the innovation system that is supposed to support them (Hung and Whittington, 2011). Consequently, we focus on what actors actually do when they aim to boost the institutionalization of new concentrations of science-based innovation instead of studying the presence and/or absence of actors, as often is the case (Uyarra, 2010; Uyarra and Flanagan, 2010, page 683). We use the concept of institutional entrepreneurship the aim being to complement the relatively established focus of (regional) innovation system studies that primarily address organizations (actors as components of systems), rules of the game (institutions), interaction patterns (networks), innovation activities, knowledge flows and recently also knowledge bases (see e.g. Asheim and Gertler, 2005; Asheim and Isaksen, 2002; Asheim et al, 2006; Braczyk, Cooke and Heidenreich, 1998; Cooke, Uranga and Etxebarria, 1997; Sternberg et al 2010; Papaioannu et al 2009).

The concept of institutional entrepreneurship adds to our knowledge of how social actors work to change the institutions that govern innovation systems but also their own activity. It improves our understanding of the ways in which power is exercised in institutionalization processes, and how actors strategize and mobilize tangible and intangible resources for institutional change (Garud, Hardy and Maguire, 2007). As observed by Washington and Ventresca (2004), the institutional entrepreneurship literature has not only made a valuable empirical and theoretical contribution to our understanding of agency but also of institutionalization as an on-going multi-actor process. Institutionalization is here defined as a process of a new practice, activity, norm, belief, or some other institution, becoming an established part of an existing system, organization or culture. As Scott (2001) maintains, institutionalized practice has attained a high degree of resilience, and has become almost a rule in collective thought and social action (Mignerat and Rivard, 2012, page 128). Furthermore, d'Ovidio and Pradel (2012) add that the formation of collectives of actors who defend the emergence of a new institution are an essential part of the institutionalization process.

We investigate institutional entrepreneurship and the institutionalization process by using the emergence of regenerative medicine in Tampere, Finland, as a case in point. It constitutes an interesting case for analysis for two reasons. First, regenerative medicine is a novel branch of medicine as well as, potentially, a medical business with highly interdisciplinary characteristics. Second, despite its relatively short history, the concentration of regenerative medicine in Tampere is locally, nationally and internationally recognized as a source of innovation. It is a case of how a new element can become institutionalized in a knowledge-producing sub-system of an innovation system (on sub-systems of an innovation system, see Autio, 1998).

The main of the paper is to identify the place of institutional entrepreneurship in innovation systems. The three interrelated research questions we set out to address are (a) how does a new science-based concentration of innovation become institutionalized in an innovation system, (b) who are the institutional entrepreneurs and what do they actually do in their efforts to institutionalize new beliefs, practices and activities within a system, and (c)

what knowledge institutional entrepreneurs do need and what kind of power do they exercise in the institutionalization process. We aim to add to the few studies that have focused on institutional entrepreneurship in the context of innovation systems (e.g. Drori and Landay 2011; Hung and Whittington 2011; Ritvala and Kleymann 2012; Sotarauta and Pulkkinen 2011). We contribute to the institutional entrepreneurship literature by exploring the important but understudied link between institutional entrepreneurship and innovation systems, focusing specifically on institutional agency, power and knowledge.

2 Conceptual framework

2.1 Institutional entrepreneurship

By employing the concept of institutional entrepreneurship it is possible to tackle a common pitfall of regional innovation studies, namely ‘the constant temptation to want to “read off” individual behaviour from national (or local) institutional structures’ (Gertler, 2010, page 5). Institutional entrepreneurship literature is based on DiMaggio’s (1988) observation that organized actors not only comply with institutions but consciously aim to create them or to transform existing institutions. As DiMaggio (1988, page 14) argues: ‘new institutions arise when organized actors with sufficient resources see in them an opportunity to realize interests that they value highly’. Battilana, Leca and Boxenbaum (2009) remind us that these actors can be organizations or groups of organizations or individuals or groups of individuals. Institutional entrepreneurs are actors who initiate divergent changes and actively participate in the implementation of them. These efforts reflect the many strategies adopted by relevant groups of actors aiming to break away from the path previously followed and create new ones. Pacheco et al (2010, page 978) maintain that the sociologically oriented institutional theory focuses on ‘the organizational field and the ways actors engage in entrepreneurship in a quest for legitimacy’. Institutional entrepreneurs need to be able to (a) challenge existing rules and practices and (b) institutionalize the alternative rules and practices they are striving for (Garud and Karnøe, 2003).

Institutional theory treats institutions as socially constructed rule systems, norms and/or institutionalized practices and belief systems that produce routine-like behaviour (Pacheco et al, 2010, page 980). As such, institutions are an interesting target of investigation as they, by definition, imply permanence and stability. Institutions are resistant to change by nature. There are often sanctions for actions deviating from what is framed as right by institutions in one way or another. Battilana et al (2009, page 67) pose the question central to all the studies focusing on institutional entrepreneurship: ‘if our norms and collective beliefs are institutionally determined, how can human agency be a factor in institutional change?’ The freedom of institutional entrepreneurs to forge change is not only limited by the very same institutions they aim to change (Battilana, 2006; Leca and Naccache, 2006; Seo and Creed, 2002) but when grasping the opportunity to change institutions, institutional entrepreneurs also take considerable risks.

According to Battilana et al (2009, page 67) studies on institutional entrepreneurship have consequently been criticized for ignoring institutional pressures and thus portraying actors as some kind of disembodied agents – heroes of institutional change (Meyer, 2006, page 732). The few existing studies on institutional entrepreneurship in innovation systems convincingly

challenge the rationalistic and heroism-inclined line of research by revealing the collective and processual nature of institutional entrepreneurship (Drori and Landau, 2011; Hung and Whittington, 2011; Ritvala and Kleymann, 2012; see also Forbes 2012). A study on functional foods shows that institutional entrepreneurship is often an unplanned, highly personal and intuitive form of agency (Ritvala and Kleymann, 2012) and, in his study on nanotechnology, Kulve (2010) reveals the patchwork nature of institutional change and the ways in which institutional entrepreneurs 'softly' frame the conditions for future development. Interestingly, he also points out the significance of timing by analysing the 'waiting games' needed to reduce the uncertainties around new technologies. Drawing on their action research of institutional changes in academic research in the Basque Country, Karlsen et al (2012) conclude that institutional entrepreneurs proved to be important in the long run as they bridged macro level (policy) and micro level (academic research) in a process of cogeneration. In their study on institutional change concerning science in Israel, Drori and Landau (2011) stress the power of vision in institutional change and especially the way existing visions produce continuity but interact with new visions that push for institutional change.

2.2 Power

The observations from the earlier studies, referred to briefly in the previous section, locate institutional entrepreneurship not in the attributes of individuals but in the relationships connecting actors in an institutionalization process. Institutional entrepreneurship is not about specialized and specific roles but diffuse processes in which different actors have different ways to influence the course of events. Therefore, it is important to understand what kind of power the key actors exercise and how power relations evolve over time with institutional change.

Power is 'the capacity of some persons to produce intended and foreseen effects on others' (Wrong, 1997, page 2). We also need to take into account the power of social systems and structures, i.e. the fact that institutions are actually both subjects and objects of change and/or stability. As Foucault (1980) claims, belief systems gain power when groups of people accept a belief system and take it for granted. Belief systems define the arena for many actors, affect institutional design, and are often institutions in themselves (Foucault, 1980) and therefore, we also need to acknowledge the relational effect of social interaction and see power as the relational effect of social interaction (Allen, 2003, page 2, page 60–64). In the empirical analysis, we use the three forms of power identified by Sotarauta (2009): interpretive power, network power and institutional power.

Interpretive power refers to power deriving from the skills and/or expertise of an actor to create a new vocabulary and a new way of seeing innovation systems and core innovation activities. The power to frame issues discussed, to lead sense-making processes and hence to influence what issues are on the agenda and what are not, and consequently also who is involved in the interactive communication loop, are ways to mould social filters that render some courses of action easier than others (Rodríguez-Pose, 1999, page 82; Rodríguez-Pose and Crescenzi 2008, page 52). Actors with network power have resources to convene other actors for dialogue and remove obstacles of communication between various actors. They can utilize the resources and competencies of their partners, set the agenda, resolve conflict, enable

information flow, build trust, orient people to their places and roles, inspire and excite. Interpretive and network power do not refer to efforts to seek consensus but efforts to create common ground for shared thinking and joint efforts to transform the institutions for the future (Sotarauta, 2009).

Even though interpretive and network power were highlighted in the study on regional development officers (Sotarauta, 2009), the importance of institutional power should not be neglected. This refers to the power to act and decide and the power to create institutions and formulate official strategies, i.e. direct power exercised by official actors. Institutional power involves also the power to direct resources. It is assumed here that the forms of power that institutional entrepreneurs exercise stretch from collective and integrative action (enabling, power to do) to instrumental abilities that provide actors with influence at the expense of the others (power over) (Allen, 2003, pages 51–52).

2.3 Three facets of knowledge

To mobilize actors and competencies, institutional entrepreneurship requires, alongside power, the capacity to integrate various forms of knowledge. In the innovation system literature, two main approaches to knowledge predominate. First, knowledge is contemplated using simplified distinctions as tacit/codified, implicit/ explicit and local/global (see Tsoukas, 1996, Orlikowski, 2002). Second, knowledge is often seen as a matter of content, signifying the rationalistic strategy that treats knowledge as an independent factual object and which relates it to an 'exact' science (Allen, 2003). If we consider institutional entrepreneurship as a diffused process aimed at shaping the institutional set-up for innovation, we need to consider knowledge more broadly and also take into account social interactive processes relating to its generation and exploitation. We follow Yakhlef's (2010) approach which includes three facets of knowledge: 1) knowledge as content referring to what is known or the corpus of knowledge that does not belong to any particular individual or context, 2) knowledge as a set of knowledge-productive practices and processes, and 3) knowledge as a relation to a knowing subject, where the cognizing unit is individuals-in-interactions, which means individuals who are co/interdependent on one another's knowledge (Yakhlef, 2010, page 45).

Consequently, the process of generating new knowledge for institutional change is to be seen as a distinction between 'belief formation' and 'knowledge justification' (Longino, 2002). Belief formation is a process that is motivated by an individual's or a group of individuals' drive, interest and passion for knowledge. It is based on the cognitive abilities of individuals to generate ideas. To achieve the status of what counts as knowledge, the process of belief formation requires the process of knowledge justification. The justificatory process cannot be seen from the individual's point of view since it requires discursive interactions with others if a belief is to become part of the community knowledge base. For their part, the justificatory processes vary between different communities. What comes to count as knowledge for a certain community is defined by the community's standards of justification, which are socially institutionalized in a given space and time (see also Yakhlef, 2010).

3 The case, data and methodology

3.1 Regenerative medicine in Tampere

The case in this paper deals with the emergence of regenerative medicine in Tampere. The term 'regenerative medicine' was coined in 2000 and is now widely used to describe biomedical approaches to heal the body by the stimulation of endogenous cells to repair damaged tissues, or the transplantation of cells or engineered tissues to replace diseased or injured tissues (Riazi, Kwon and Stanford, 2009; see also Lysaght, Jaklenec and Deweerd, 2007; Mason and Dunnill, 2008b). The basic unit in regenerative medicine is a stem cell. Stem cells are biological cells found in all multicellular organisms. The potential of stem cells in clinical treatments is based on their multi-potent ability. Stem cells are able to regenerate tissues and organs and act as building blocks for all tissues in the body (Nordfors, 2007; NIH, 2010; Regea, 2010).

Regenerative medicine has grown rapidly in the past decade and the scientific achievements have created hopes of new treatments for severe incurable diseases, such as diabetes, Parkinson's disease, cancer and heart diseases. The promise of regenerative medicine is very exciting but simultaneously the cost of product development, and most notably clinical trials, for the high-end applications is very high (Mason and Dunnill, 2008a, page 351). Simultaneously, regenerative medicine faces constant complex ethical and legislative questions. Much of the stem cell based research is covered by statutes concerning clinical medical research in general and only a few countries have adopted legislation devoted to stem cell research per se. The legislation on stem cell research, and especially on human embryonic research, varies widely in Europe. In Finland, the ethical atmosphere and the legislation have been mostly permissive (Nordfors, 2007).

The core of this case is the Regea Institute for Regenerative Medicine that is a joint institute under the administration of the University of Tampere. Regea was founded by the University of Tampere, the Tampere University of Technology, the Pirkanmaa Hospital District, the Pirkanmaa University of Applied Sciences and Coxa, the Hospital for Joint Replacement in 2005. The focal research areas are stem cell research and research combining stem cells and biomaterials. The focus is on R&D that enables the design of new forms of treatment based on tissue engineering. Regea has numerous academic and firm partners locally, nationally and internationally (biomaterial engineers, clinicians, cell biologists, technical experts, animal model experts, and so on). One of the strategic partners is the Tampere University of Technology. Its department of Biomedical Engineering represents the highest expertise in biomaterials and tissue engineering, as well as biomeasuring, in Finland.

3.2 Data and methodology

The empirical study began with a literature review of the history of Regea, as well as stem cell research based on written material from the Internet, relevant journals, dozens of related newspaper articles, Regea's annual reports, respective policy documents and minutes of Regea's founding planning group. Drawing on the secondary data, the history of Regea and related activities were constructed chronologically. The main aim of this exercise was to describe the case and its evolution from the early days to the present day focusing on a

sequence of events and critical incidents. This phase identified a generic development pattern and critical incidents for further data gathering and analysis.

Next, 28 people, involved in different phases of the process under scrutiny, were interviewed. Six of the interviewees were employees of Regea (the director, the team leaders and the quality manager) and the rest of the interviewees were from local and regional development agencies, Tampere University Hospital, the Universities, the Finnish Funding Agency for Technology and Innovation and the Finnish Medicines Agency. The interviews followed the idea of the narrative interview (see Czarniawska, 2006) augmented with thematic clarifications. The themes were: (1) *Temporal change*. When the interviewee participated in the process, what happened and why? What were the critical incidents and significant events, and why were they significant? What actually happened and when, and who did what in these events? When did these events occur? (2) *Institutions*. What kinds of institution enabled and/or hampered the development of regenerative medicine in Tampere? How were institutional obstacles overcome? (3) *The roles of the actors*. Who influenced the course of events, how and why? The main aim was to construct a narrative of the sequence of events to identify the actions of key people in their efforts to influence the process and thus to find out what drives process and how these kind of processes are intentionally directed to serve several fields of interest.

4 Sequence of events and the institutional entrepreneurs carrying them forward

4.1 How does one grow an upper jaw within a stomach muscle?

The point of departure here is the fact that in 2008, for the first time in the world, a patient's upper jaw was replaced with a bone transplant cultivated from the stem cells isolated from the patient's own fatty tissue, as illustrated in Figure 1. The patient had lost roughly half his upper jaw because of cancer and traditional medicine was unable to offer remedial treatment. Today, after the surgery, based on the technology created by Regea with its collaborators and carried out by the Helsinki University Hospital, the patient is able to live a normal life with a normal upper jaw. In the process, the scientists were able to produce new bone cells by combining stem cells and biomaterials and then growing them into a jawbone of the correct shape and size (with the aid of a titanium frame) inside the patient's stomach muscle. Over a period of six months, the contents ossified and were filled with blood vessels. The designed bone and the surrounding muscle were then removed, together with the blood vessels, and fitted in place (Suomen Kuvalehti, 2008; Bionext, 2010). This operation was a continuation of successful clinical treatments undertaken in 2007, in which two patients with bone deficiencies were treated, jointly with the Tampere University Hospital, with a combination of fat stem cells and biomaterials. By the end of 2010, based on this technology, approximately 30 patients with serious bone deficiencies had been treated in Finnish hospitals (Bionext, 2010). In comparison, by early 2010, analogous treatment (external to the Regea network) has been received by only one patient in Germany (Tekes, 2010).

The breakthrough upper jaw operation and the successful clinical treatments were critical incidents that were part of the institutionalization process of regenerative medicine. The whole process can be divided into four main phases: (a) sowing the seeds of change; (b) collective belief formation; (c) launch of activity; (d) institutionalization.

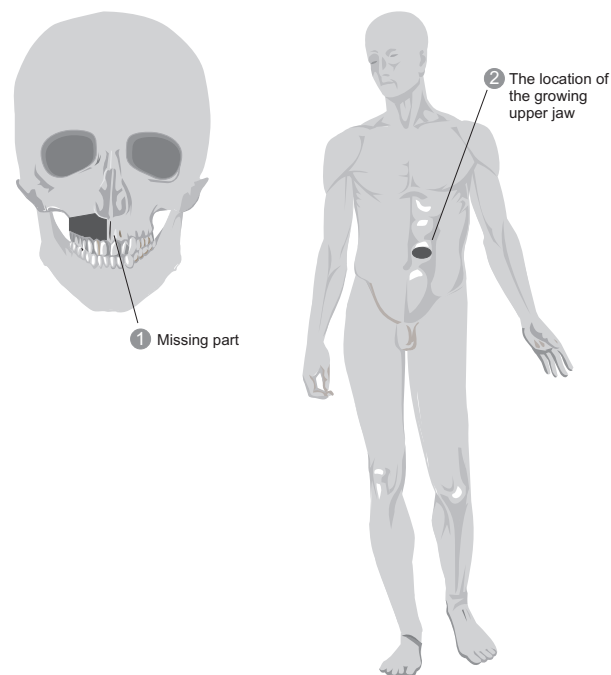


Figure 1. Illustration of the missing part of the upper jaw and the location of the upper jaw inside the stomach muscle (authors' own drawing based on Suomen Kuvalehti 2008)

4.2 Sowing the seeds of change

The sowing of the seeds of change dates back to 1986 when Professor Pertti Törmälä and Pentti Rokkanen, a surgeon, produced a bioabsorbable screw for repairing bone fractures – the first in the world. In order to launch new products in the European and US markets, Törmälä and his group established the first two enterprises. Since then, the industry has evolved and today Tampere is acknowledged as one of the key centres of biomaterials in Finland (Restructuring and Development of Biosciences in Finland, 2007). In the 1990s, the focus of global biomaterial research started to change. It began to shift from bioabsorbable implants towards stem cell biology. At the same time, regenerative medicine had just started to progress rapidly, with tremendous hype as well as hope. The most positive commentators argued that regenerative medicine would become one of the three main forms of medical treatment alongside medication and surgery (Valtakari, Rajahonka and Tikkanen, 2007). The most negative commentators, for their part, argued that regenerative medicine is full of empty promises and more hype than actual treatments (for more, see Brown, 2003; Nadig, 2009). In Tampere, the key actors in the field of biomaterials started to realize the potential offered by stem cell biology for research as well as for local biomaterial firms. Importantly, local science capacity in relation to stem cells and regenerative medicine in Tampere was fairly well established. Professor Timo Ylikomi and his group conducted research on adult fat stem cells at the University of Tampere and several research groups at the Tampere University of Technology and the Technical Research Centre of Finland (VTT) were involved in research on biomeasuring (biological and physiological measurement of human beings).

The first seeds of change were sown in this ground as, in the late 1990s, Professor Timo Ylikomi and Professor Pertti Törmälä took the lead in initiating a new development trajectory that eventually led to the facial bone replacements introduced above. Both of them believed that there was ‘something more’ in their research, and more widely in their fields, something that, if applied correctly, might lead to new business, other forms of societal benefits, or to boosting the competitiveness of existing biomaterial firms locally. This ‘scientific hunch’ was based on their expertise and long experience in their own fields. The two professors individually introduced the idea of having an organization for regenerative medicine in Tampere. The idea was fresh at that time; the ‘human spare parts’ industry (regenerative medicine) had just truly begun to emerge. The professors were prevented from taking rapid action by two institutional obstacles: (a) the academic orientation of the University of Tampere which focused more on academic excellence than the proactive search for new innovations or business ventures, and (b) the scarcity of funds and know-how in supporting innovation and commercialization in this field.

In retrospect, it is possible to see what the outcomes of the science in question has been and the successful treatments provide us with a convincing story that there was indeed something in the air. At that time, nobody was able exhaustively to explain what the possible outcomes might be and hence the first steps were hard to take. This is hardly a novel situation in the advent of a science-based innovation. By definition, innovation challenges prevailing mind-sets and practices and is often born in a climate of ambiguity, uncertainty and a lack of clear vision (Lester and Piore, 2004); as in this case, the inventors lack the capacity to simplify the story and convince the resource-holders outside the scientific core about the future potential of the innovation.

4.3 Collective belief formation

It is often difficult for policy-makers, funding bodies, and possible beneficiaries to see the actual innovation through the hazy cloud of scientific reasoning seasoned with general business noise generated by hype and hope, speculations and often fairly hollow innovation policy rhetoric, more embedded in wishful thinking than factual evidence. This was also the case in the early phases of the process under scrutiny. On the one hand, formal institutions (the funding system, universities) as well as cognitive-cultural institutions were not immediately supportive. On the other hand, there was a local economic development system in place that proved crucial in keeping the process in motion. A local support community external to the academic spheres started to emerge to support the search by two professors for new solutions to exploit the opportunities ‘in the air’.

The support community appears here as a crucial enabling factor for the institutional entrepreneurship process to proceed without breaking. We define a support community as a group of actors having a feeling of fellowship with others as a result of sharing common attitudes, interests and objectives in terms of willingness to assist the process with all possible means at their disposal. In this case, the support community consisted of local and regional economic development actors as well as interested experts from the universities and the Tampere University Hospital. The realization of these kinds of ideas is at the core of their work and many of them also shared the conviction of the professors that science is there for the

improvement of society and it ought to be commercialized if possible. Simultaneously with the intensifying local discussions, the tissue engineering industry (regenerative medicine) witnessed an ever-accelerating global growth (Lysaght and Reyes, 2001). This, of course, boosted enthusiasm and belief in local capacity and fairly quickly the support community decided to aim for a global business; Törmälä's experience that this can actually be done and his status as a local role model in translating science into practice was a strong impetus in undertaking the process.

The Centre of Expertise Programme for Health Care Technology proved to be especially important in the support community and beneficial for the continuation of the process. First, there were development officers working for the programme whose job it was to boost university–society (including business) interaction in the fields relevant to this case; second, they followed closely the latest developments in the field and were quick to realize that there was indeed a lot of potential in the local human fat and biomaterial research. Consequently, in collaboration with other local and regional development agencies, they were also able to take the lead in making the issue more understandable for the wider policy audience, decision makers and resource holders, i.e. for actors with institutional power but not in-depth content knowledge.

To boost the process, the support community assigned an official planning group that was excited about the global prospects and composed a business plan for a new business venture through funding from the Employment and Economic Development Centre (a state development agency at the regional level). In early 2002, there was a strong belief that the new venture would obtain funding from venture capitalists. However, in the course of 2002 the situation began to change and by the end of the year it was already clear that there was more global hype and hope than real business opportunities. Even though the number of firms active in the field globally did not decline dramatically, the financial community's faith in regenerative medicine began to diminish. Despite public sector investment in R&D, the industry had not yet succeeded in producing a single profitable and commercially successful product (Lysaght and Hazlehurst, 2004). The technology was not sufficiently mature, the safety of the clinical applications was not adequate and true business opportunities were on the distant horizon.

Consequently, the local planning group in Tampere realized that it would not be possible to accomplish the business plan – there was no global business. There was no business and hence no venture capital; the entire field appeared risky and enthusiasm started to wane. However, it did not wither away entirely. The local potential was seen as too promising not to be developed further and therefore the discussion shifted, emphasizing both the basic and applied research idea. If there was no business opportunity, then let the research capacity at the university be strengthened by launching a major research project. Although the emphasis shifted from business to research, the idea of implementing a business venture remained the main focus. The target was only postponed to the future.

4.4 The launch of research activity

The launch of research activity saw not only a new emphasis but also new actors taking the lead and those who had been in the forefront in the previous phases gradually moved to become backstage operators. Instead of establishing a business venture, the launch of activity included three main actions: (a) the establishment of a tissue bank;ⁱ (b) the eventual establishment of the Regea Institute for Regenerative Medicine; (c) the recruitment of person(s) to lead Regea.

After a series of negotiations between all the main parties in 2002, the Employment and Economic Development Centre committed to take part in the funding of Regea's establishment and especially the funding of a Good Manufacturing Practices (GMP) level laboratory and clean room facilities. Another important funding body was the Pirkanmaa Hospital District (which owns and runs Tampere University Hospital). One of the reasons behind the decision of the Pirkanmaa Hospital District to become involved in Regea's establishment was that the quality requirements for tissue bank operations changed dramatically at that time. In Finland, tissue bank operations had typically been taken care of by the hospitals themselves. The new National Tissue Act and the European Union's Tissues and Cell Directive (2004/23/EC) set strict quality requirements for tissue banks in terms of storing and handling human tissues. The Pirkanmaa Hospital District had two options: they were either to reorganize and upscale their own tissue bank internally or to outsource the operations to some other organization with the required facilities. Regea, with its new facilities due to be established, was a good option in terms of coping with the changing situation; changes in the regulatory institutions opened new doors for Regea.

The collective belief that was constructed in phase two proved to be sufficiently enticing to a broader range of stakeholders. Now there was a broader and shared belief of the prospects and requirements of regenerative medicine – a concrete project to work with – and making a tissue bank was a crucial step for future development. At this point, it was significantly easier for the resource holders and decision makers to see what might lie ahead. Also the leadership of the University of Tampere became engaged and consequently Regea was established as a research project in 2004 under the Institute of Medical Technology at the University of Tampere.

In 2005, Regea became an independent joint institute under the administration of the University of Tampere. Although Regea was an academic institute, its focus was distinctly on clinical applications, not primarily on basic research; its motto is 'from research to clinical care'. Regea started to conduct stem cell research early in 2005 and succeeded in implementing its first clinical treatment in 2007 (Regea, 2010). At that stage, it seemed that there were only enabling factors such as a strong knowledge base and research capacity in the field, an endowed professorship to the University of Tampere conferred by the city of Tampere, and successful recruitment. The most visible of the recruitments occurred when Regea succeeded in recruiting a world-leading Finnish scholar, Professor Outi Hovatta, from the Karolinska Institutet in Sweden to Regea due to the professorship endowed by the City of Tampere. Aspects to her credit in Regea's early days were twofold: (1) Regea's stem cell research began quickly because of her know-how and she also brought with her the first seven embryonic lines from the Karolinska Institutet to Regea, which was one of the factors

underpinning the expeditious start of stem cell research in Tampere; (2) Regea became, more or less instantly, a credible player in the academic and funding spheres and it also gained considerable media visibility in Finland. As stated above, the changing legislation and consequent establishment of the tissue bank operations also had a remarkable role in enabling the surfacing of Regea. In addition, the atmosphere in terms of new innovative ideas in the field of biotechnology was favourable in Tampere. In 2003, the City of Tampere launched the BioneXt Tampere programme aimed at the further development of the city's biotechnology sector.ⁱⁱ

At the end of the third phase, Regea not only had scientific and clinical credentials but also global media attention. The future looked nothing but glorious. In practice, the process was far from the aspirational goal. Regenerative medicine in Tampere was still more a collection of research projects than a concentration of established research and innovation. In 2009, the basic funding from the University of Tampere covered only approximately one-fifth of the total budget. The rest of the budget was generated primarily through project funding from such funding bodies as the Finnish Funding Agency for Technology and Innovation (Tekes), the Academy of Finland (research councils) and the Employment and Economic Development Centre.ⁱⁱⁱ In addition, grants from other funding bodies, foundations and associations formed an important part of the funding. Consequently, only three of the total personnel (appr. 50–60 persons incl. doctoral students), had permanent positions while the others were employed through fixed-term contracts because of the non-permanent nature of the funding (Regea, 2009).

4.5 Institutionalization

In the fourth phase, renewed support from both inside and outside the research and clinical community was required to institutionalize all that had been accomplished in the earlier phases. Breakthrough operations opened up new ways to treat severe tissue damage and made the prospects of custom-made living spare parts for humans a step closer to reality. In the fourth phase, one of the main issues was the commercialization of the technology created with limited financial resources available in the country. There had been several attempts to find a way to do so, but the board of Regea and related actors were unable to find a viable way to accomplish this, specifically from Finland, without selling the patents abroad. Second, among the strategically important issues was whether, how and when Tampere University Hospital, or some other hospital, would change its routines to integrate regenerative medicine into its standard repertoire. At this point in time, the treatments were hugely expensive but if they did not become a standard part of the hospital operations, the cost would not decrease. Additionally, if the number of treatments were to grow, Regea would need to go through a series of expensive clinical trials necessitated by pharmaceutical legislation. So far, the institutional obstacles had kept the number of treatments at a low level.

Additionally, regenerative medicine is a field of science that requires patient and long-term funding to revolutionize medical care and therefore the main issues also include the scarcity of long-term research funding in the system as a whole and within the universities involved. To remove this and other institutional obstacles, in 2010, the University of Tampere merged Regea and the Institute of Medical Technology and thus established a new organization named

the Institute of Biomedical Technology (IBT). The University of Tampere also started to formalize collaboration with the Tampere University of Technology and in 2011 a joint platform, BioMediTech, with more than 200 scientists was established for future collaboration. The City of Tampere launched a vision that Tampere would become the centre of human spare parts in Finland and the Finnish Innovation and technology development fund (Tekes) granted BioMediTech €10 million in funding and substantial sums from other funding sources were also raised. Regenerative medicine research, side by side with other branches of biomaterial research, became institutionalized in the local as well as national system; nonetheless, it has not yet been institutionalized as a permanent element of hospital treatments and/or business. It is clear that these are the directions the newly established organizations are aiming for side by side with scientific research.

TABLE 1. Chronology of key events, actions and actors.

Phase and year	Key events and actions	Key actors
<i>Seeds of change</i>		
1986–1990	Bioabsorbable screw and the establishment of the first biomaterial firms	Two professors with their groups
Late 1990s	Emergence of regenerative medicine globally	
1997–2000	First informal discussions concerning an organization for regenerative medicine in Tampere	Two professors
<i>Collective belief formation</i>		
2001	Global growth in regenerative medicine	
2002	Creation of an official planning group	Support community
2002	Business plan for a new venture	Local planning group
End of 2002	The decline in global expectations	
2003	Turn in discussions to emphasize basic and applied research	Local planning group and the leadership of UTA
<i>Launch of activity</i>		
2002	Funding for a GMP level laboratory and clean room facilities	Leadership of UTA
2003	BioneXt Tampere Programme	City of Tampere, Finn-Medi Ltd and the universities
2004	New tissue act and tissue and cell directive Establishment of Regea as a project	Leadership of UTA and local planning group
2005	Establishment of tissue bank and Regea as an independent joint institute	Director of Regea
2007	First clinical treatments	Research and clinical community
<i>Institutionalization</i>		
2008	First breakthrough treatment	Research and clinical community
2011	Merger of Regea and IMT → IBT	Leadership of UTA
2011	Establishment of BioMediTech	Leadership of UTA and TUT
2012	Tekes grants €10 million funding for BioMediTech	

4.6 Key actors and their spheres of influence in the main phases of institutionalization

The first of the research questions in this study was: How does a new science-based concentration of innovation become institutionalized in an innovation system? The case study clearly shows that a process of institutionalization is far from a linear process flowing from identification of a need to planning and finally implementation. Rather, it involves a series of interrelated decisions and actions crossing many policy boundaries as well as involving several institutional entrepreneurs. This confirms the observation of Ritvala and Kleymann (2011) that institutional entrepreneurship is a process and collective action. To institutionalize a new science-based concentration, institutional entrepreneurs exert influence not only within the boundaries of the organizations and communities that authorize them, or within their ‘own policy domains’, but also beyond them. This study shows how, long before the actual launch of a new activity, there are phases during which the new ideas begin to emerge without clear

shape or understanding of what their meanings might be. The initial emergence of ideas is followed by belief formation, resulting in a collective, but generic, understanding of what might be at stake. Only after these phases can the actual institutionalization take place.

Next, we aim to answer, phase by phase, two other research questions: Who are the institutional entrepreneurs and what do they actually do in their efforts to institutionalize new beliefs, practices and activities into a system? What knowledge do institutional entrepreneurs need and what kind of power do they exercise in the institutionalization process?

In the phase of sowing the seeds of change, the two professors were the institutional entrepreneurs as they launched the process. They did not know where it might lead, but they knew that there was 'something in the air' and something major ought to be done. They did not have the institutional power required to take major steps forward by themselves nor the knowledge in terms of policies that could be exploited, nor were they able to identify the processes to do so. What proved crucial in getting the process rolling was their expert power and in-depth understanding of the issues in question. The professors were able to tell stories about their research and its potential that were sufficiently convincing to engage other actors in a dialogue. The scientific knowledge base was the core, but the future prospects stemming from it needed to be reinterpreted for a wider audience in terms of decision and policy making; actors with interpretive power were needed to make things happen.

In the collective belief formation phase, the lead of the support community proved crucial. The support community emerged from local and regional development agencies, as well as universities, and consisted of individuals who were experts not only in health care technology and biomaterials but also local/regional innovation development processes and related policies. The support community engaged in a collective knowledge formation process concerning what might be gained by the commercialization of the kind of research at hand, i.e. what this was all about, how to proceed and what might be the sources of funding to make all this permanent in Tampere. The support community pushed the process forward by seeking differences and similarities in actors' interpretations and especially by being able to synthesize different ways of seeing the common issues and goals derived from them in collaboration with the scientific and clinical players. Scientific hunches were discussed in the light of local economic developments, national innovation policy and science policy, as well as health policies. In the second phase, the driving force was the support community, more specifically a small planning group assigned to plan for the next phase, employing adequate content knowledge complemented with the interpretive power that enabled it to make the wider societal and economic potential visible, as well as adequate policy knowledge to identify and integrate several local, regional, national and European policies that could be used as funding sources. In addition, the support community was able to create a convincing interpretation of the science-based business potential and, in the light of new global developments, to adjust to the emergent collective belief to place greater emphasis on academic research rather than the business venture. This proved important in moving from beliefs to action.

The case of regenerative medicine indicates that, during critical incidents, the role of local and regional development agencies as brokers in the knowledge justification process becomes pronounced. The academic community is not necessarily capable of navigating through the various policies and power regimes. Local and regional development agencies may not have

abundant financial resources or much understanding of the substantive issue but they are the ones who, at their best, can exert influence across the sectors and enable a collective dominant belief to emerge. This observation, for its part, shows how local/regional development agencies may not be in a position to launch new processes but how, as intermediaries between all the stakeholders, they may carry the process through the crucial early stages. What they have here is knowledge of relevant policies to be utilized as funding sources but, even more importantly, they are in a position to mediate so that different visions and lines of action can combine as one that provides the basis for a next phase. The support community was able to exercise wider interpretive and network power than the scientists; in the support community, for example, academic thinking and talk was translated into a policy language, and vice versa.

The fourth phase, the actual institutionalization of regenerative medicine, witnessed the first breakthrough treatments, the establishment of an institute, and further reorganizations of the institute, first within University of Tampere and later between the two universities. Here, collective belief showed the way and the question was essentially about how to make all the necessary decisions; thus, the institutional power exercised by the leaders of the universities was central in this phase. All this shows how belief formation and knowledge justification are at the core of institutional entrepreneurship and how the emergence of collective belief – and thus interpretive power – precedes the more visible forms of institutionalization: decisions and the establishment of organizations. The collective belief formation process that resulted in the institutionalization of regenerative medicine in Tampere was launched in the world of science but it was not able to progress without the knowledge justification that extended beyond the boundaries of the laboratory to the world of local/regional development.

5 Conclusion

This study adds to the literature on innovation systems by specifically focusing on institutional agency, power and knowledge. Conversely, it adds to the institutional entrepreneurship literature by exploring the important but understudied link between institutional entrepreneurship and innovation systems. We join earlier studies that call for a more nuanced understanding of how actors may change institutions in and for innovation systems (Hung and Whittington, 2011; Ritvala and Kleymann, 2012) by showing how different forms of knowledge and power evolve with a process while simultaneously guiding it. Most importantly, this study links purposive agency into the literature on innovation systems that has been criticized for seeing policy-makers and practitioners in a simplistic manner (Witt, 2003; Uyarra, 2010).

We show how long a process the institutionalization of a new element in the innovation system is. Institutionalization is the result of (a) several intentions being aligned in time and (b) continuous adjustment to surprises caused by changes in the institutional environment. As such, it is difficult to keep the process in motion so that it does not break down during critical incidents. The institutional entrepreneurship process is not a conscious and pre-designed process but rather a phase-by-phase process, an evolving search for next steps and visions. It requires different forms of knowledge and power in different phases. The process is a contemporary version of ‘muddling through policies’ (Lindblom, 1959), in which vision, strategy and network evolve with situations. Therefore, in line with Wrong (1997, page 3–10),

we acknowledge that the intentionality of power needs to be scrutinized fully to understand institutionalization, how institutional entrepreneurs influence each other and the wide spectrum of actors necessary to instigate change. In the course of the long process of institutional entrepreneurship, belief formation and knowledge justification are essential for the translation of different forms of power into influence and action. Therefore, the power exercised by institutional entrepreneurs is relational in nature. It draws as much upon dialogue and interaction skills as on expertise in substantive matters, legitimate power and formal authority. As institutional power follows convincing belief formation and justified knowledge and not vice versa, the question is more about strategies, tactics and the capabilities of purposive actors than simply 'who governs' (Dahl, 2005) and the possession of institutional power.

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References

- Allen J, 2003, *Lost Geographies of Power* (Blackwell, Cornwall)
- Asheim B T, Boschma R, Cooke P, Laredo P, Lindholm-Dahlstrand Å, Piccaluga A, 2006 "Constructing regional advantage. Principles, perspectives and policies", final report, DG Research, European Commission, Brussels
- Asheim B T, Gertler M, 2005, "The geography of innovation: regional innovation systems", in *The Oxford Handbook of Innovation* Eds J Fagerberg, D Mowery, R Nelson, (Oxford University Press, Oxford) pp 291–317
- Asheim B T, Isaksen A, 2002, "Regional innovation systems: the integration of local 'sticky' and global 'ubiquitous' knowledge" *Journal of Technology Transfer* **27** 77–86
- Autio E, 1998, "Evaluation of RTD in regional system of innovation" *European Planning Studies* **6** 131–140
- Battilana J, 2006, "Agency and institutions: the enabling role of individuals' social position" *Organization* **13** 653–676
- Battilana J, Leca B, Boxenbaum, E, 2009, "How actors change institutions: towards a theory of institutional entrepreneurship" *Academy of Management Annals* **3** 65–107
- Bionext, 2010, *Innovation for well-being 2003–2010* (Bionext, Tampere)
- Braczyk H-J, Cooke P, Heidenreich M, 1998, *Regional Innovation Systems: The Role of Governances in a Globalized World* (UCL Press, London)
- Brown N, 2003, "Hope against hype – accountability in biopasts, presents and future" *Science Studies* **16** 3–21
- Cooke P, Uranga M G and Etzebarria G, 1997, "Regional innovation systems: institutional and organisational dimensions" *Research Policy* **26** 475–491
- Czarniawska B, 2006 *Narratives in Social Science Research* 3rd edition (Sage Publications, Gateshead)
- Dahl R A, 2005 *Who Governs? Democracy and Power in an American city* First published 1961 (Yale University Press, New Haven)
- DiMaggio P J, 1988, "Interest and agency in institutional theory" in *Institutional Patterns and Organizations* Ed L G Zucker (Ballinger, Cambridge MA) pp 3–22
- D'Ovidio M, Pradel M, 2012, "Social innovation and institutionalisation in the cognitive-cultural economy: two contrasting experiences from Southern Europe" *Cities in press*
- Drori I, Landau D, 2011, *Vision and Change in Institutional Entrepreneurship* (Berghahn Books, New York)
- Foucault M, 1980 *Power/Knowledge: Selected Interviews and Other Writings, 1972–1977* (Pantheon Books, New York)
- Forbes T, 2012, "Institutional entrepreneurship in hostile settings: health and social care partnerships in Scotland, 2002–05" *Environment and Planning C: Government and Policy* **30**(6) 1100 – 1115
- Garud R, Hardy C, Maguire S, 2007, "Institutional entrepreneurship as embedded agency: an introduction to the special issue" *Organization Studies* **28** 957–969
- Garud R, Karnøe P, 2003, "Bricolage versus breakthrough: distributed and embedded agency in technology entrepreneurship" *Research Policy* **32** (2) 277–300
- Gertler M S, 2010 "Rules of the game: the place of institutions in regional economic change" *Regional Studies* **44** 1–15
- Hung S-C, Whittington R, 2011, "Agency in national innovation systems: institutional entrepreneurship and the professionalization of Taiwanese IT" *Research Policy* **40** (4) 526–538
- Karlsen J, Larrea M, Wilson J R, Aranguren M J, 2012 "Bridging the gap between academic research and regional development in the Basque Country" *European Journal of Education* **47** 122–138
- Kulve H, 2010, "Emerging technologies and waiting games: institutional entrepreneurs around nanotechnology in the food packaging sectors" *Science, Technology & Innovation Studies* **6** 7–31
- Leca B, Naccache P, 2006, "A critical realist approach to institutional entrepreneurship" *Organization* **13** 627–651
- Lester R K, Piore M J, 2004 *Innovation – The Missing Dimension* (Harvard University Press)
- Lindblom C E, 1959. The science of "Muddling Through. *Public Administration Review* **19** (2) 79–88
- Longino H E, 2002 *The Fate of Knowledge* (Princeton University Press, Princeton)

- Lundvall B-Å, Johnson B, Andersen, E S, Dalum B, 2002, "National systems of production, innovation and competence building" *Research Policy* **31** 213–223
- Lysaght M J, Hazlehurst, A L, 2004 "Tissue engineering: the end of the beginning" *Tissue Engineering* **10** 309–320
- Lysaght M, Jaklenec A, Deweerd E, 2007, "Great expectations: private sector activity in tissue engineering, regenerative medicine, and stem cell therapeutics" *Tissue Engineering: Part A* **14** 305–315
- Lysaght M J, Reyes J, 2001, "The growth of tissue engineering" *Tissue Engineering* **75** 485–493
- Mason C, Dunnill P, 2008a, "The strong financial case for regenerative medicine and the Regen industry" *Regenerative Medicine* **33** 351–363
- Mignerat M, Rivard S, 2012, "The institutionalization of information system project management practices" *Information and organization* **22** 125–153
- Nadig R R, 2009, "Stem cell therapy – hype or hope? A review" *Journal of Conservative Dentistry* **12** 131–138
- NIH, 2010, *Stem Cell Information*, Available from: <http://stemcells.nih.gov>
- Nordforsk, 2007 *Stem Cell Research in Nordic Countries. Science, Ethics, Public Debate and Law* for Nordforsk by the Nordic Committee on Bioethics (NordForsk, Norden)
- Orlikowski W J, 2002, "Knowing in practice: enacting a collective capability in distributed organizing" *Organization Science* **13** 249–273
- Pacheco D F, York J G, Dean T J, Sarasvathy S D, 2010, "The coevolution of institutional entrepreneurship: a tale of two theories" *Journal of Management* **36** 974–1010
- Papaioannou T, Wield D, Chataway J, 2009, "Knowledge ecologies and ecosystems? An empirically grounded reflection on recent developments in innovation systems theory" *Environment and Planning C: Government and Policy* **27**(2) 319 – 339
- Regea, 2009, *Regea Institute for Regenerative Medicine – Annual Report 2009*
- Regea, 2010, *Regea Institute for Regenerative Medicine*, Available from: www.regea.fi. [Accessed: 20 February 2010].
- Restructuring and Development of Biosciences in Finland*, 2007, Unpublished Memorandum for the Ministry of Education Prepared by the Working Group of Biocenter Finland, (Downloaded on 3 January 2011 from http://www.biocenter.fi/uploads/documents/Restructuring_and_Development_of_Biosciences_in_Finland.pdf)
- Riazi A M, Kwon S Y, Stanford W L, 2009, "Stem cell sources for regenerative medicine" *Methods in Molecular Biology* **48** 55–90
- Ritvala T, Kleymann B, 2012, "Scientists as midwives to cluster emergence: an institutional work framework" *Industry and Innovation* **19** 477–497
- Rodríguez-Pose A, 1999, "Innovation prone and innovation averse societies: economic performance in Europe" *Growth and Change* **30** 75–105
- Rodríguez-Pose A, Crescenzi, R, 2008, "Research and development, spillovers, innovation systems, and the genesis of regional growth in Europe" *Regional Studies* **42** (1) 51–67
- Scott W R, 2001, *Institutions and Organizations* 2nd edition (Sage, Thousand Oaks, California)
- Seo M, Creed W E D, 2002, "Institutional contradictions, praxis and institutional change: a dialectical perspective" *Academy of Management Review* **3** 222–247
- Sotarauta M, 2009, "Power and influence tactics in the promotion of regional development: an empirical analysis of the work of Finnish regional development officers" *Geoforum* **40** 895–905
- Sotarauta M, Pulkkinen R-L, 2011 "Institutional entrepreneurship for knowledge regions: in search of a fresh set of questions for regional innovation studies" *Environment and Planning C: Government and Policy* **29** 96–112
- Sternberg R, Kiese M, Stockinger D, 2010, "Cluster policies in the US and Germany: varieties of capitalism perspective on two high-tech states" *Environment and Planning C: Government and Policy* **28**(6) 1063 – 1082
- Suomen Kuvalehti, 2008, "Reino Leisti sai kantasoluista kasvatetun uuden yläleuan" *Suomen Kuvalehti* 31.1.2008

- Tekes 2010, *Bioteknologia.info* (Downloaded on 20 Feb. 2010 from <http://www.bioteknologia.info>)
- Tsoukas H, 1996, "The firm as a distributed knowledge system: a constructionist approach", *Strategic Management Journal* **17** 11–25
- Uyarra E, 2010, "What is evolutionary about 'regional systems of innovation'? Implications for regional policy" *Journal of Evolutionary Economics* **20** 115–137
- Uyarra E, Flanagan K, 2010, "From regional systems of innovation to regions as innovation policy spaces" *Environment and Planning C: Government and Policy* **28** 681–695
- Valtakari M, Rajahonka M, Tikkanen E, 2007, *Biomateriaaliosaamisesta liiketoimintaa. COMBIO-tekniologiaohjelman loppuarviointi*. Tekniologiaohjelmaraaportti 10/2007 (TEKES, Helsinki)
- Washington M, Ventresca, M J, 2004, "How organizations change: the role of institutional support mechanisms in the incorporation of higher education visibility strategies 1874–1995" *Organization Science* **15** 82–96
- Wrong D H, 1997, *Power: Its Forms, Bases, and Uses* (Transaction Publishers, New Brunswick)
- Yakhlef A, 2010, "The three facets of knowledge: a critique of the practice-based learning theory" *Research Policy* **39** 39–46

ⁱ Tissue bank is an organization dealing with the operations pertaining to the handling, preservation, storage, and/or distribution of human-based tissues or cells. The organization may also be responsible for the acquisition and research of the tissues and cells (source: Regea).

ⁱⁱ BioneXt Tampere is an investment and development programme that focuses on biotechnological education, top-level research, product development, clinical application and possibilities in international commercialization. The programme unites the strong technological expertise in the Tampere region with new biological and medical research (Bionext, 2010).

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