Perceived Proximity and Paradoxical Tensions in an Innovative Industry-Academia Consortium

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Abstract

We extend the management of paradoxical tensions literature to the inter-organizational level and analyze how paradoxical tensions are identified, perceived and managed in an open innovation consortium and how they relate to the perception of proximity by the different actors, following Boschma’s typology [1]. We study the actors’ perceptions, and the asymmetries thereof, concerning the intra- and inter-organizational proximities and paradoxical tensions in collaborative innovation.

1. Introduction

In this paper, we are studying paradoxical tensions and proximity in an innovation network. Proximity between actors in intra- or inter-organizational constellations has been shown to be a key prerequisite for interactive knowledge creation and thus innovation [2].

Innovation is created in interaction between human actors who together possess the knowledge that is of "requisite variety" [3], [4]. Paradoxically, both too little and too much proximity are dysfunctional for innovation [1]. Too little proximity does not allow the necessary human interaction for innovation. Too much proximity creates a lock-in phenomenon, because knowledge in the interaction process is not diverse enough. In addition, different actors may perceive proximity and tensions differently. Proximity between actors is relational, and the perceptions of proximity can be asymmetrical. Asymmetric perceptions create tensions that may be detrimental for collaborative innovation.

The context of our study is ICT SHOK (established in 2008), one of the six Strategic Centres for Science, Technology and Innovation in Finland (In Finnish: Strategisen huippuosaamisen keskittymä SHOK). The SHOKs are new public-private partnerships of companies, universities and research units, organized into non-profit limited liability companies for long term research collaboration to speed up innovation processes, to renew industry clusters and to create radical innovations[5]. Each SHOK carries out research that has been jointly defined by its members in the SHOK’s strategic research agenda. The SHOKs claim to be open innovation environments. They have been recently studied by Jarvenpaa and Wernick [6] from the point of view of open innovation in innovation networks. Our study seeks to deepen their analysis on paradoxical tension from the point of view of proximity [1] and taking into account recent studies on paradoxical tension [7].

The focus of the research is on the two first years of ICT SHOK’s existence, and on the interaction between its main actors: the companies, the universities and research institutes, and its management. We study the actors’ perceptions, and the asymmetries thereof, concerning the intra- and inter-organizational proximities and paradoxical tensions in collaborative innovation. Furthermore, we want to analyze in more detail the relationship between the tensions and the five proximity dimensions; cognitive, organizational, social, institutional, and geographical proximity [1].

2. Literature review

2.1. Proximity

Organization studies, innovation studies and regional studies have shown that proximity plays an important role on learning, knowledge creation and innovation [2]. Geographical proximity is often considered as an important driver of innovation, and a large literature has looked at the role and impact of industrial clusters on economic activity. However, being proximate is not restricted to the geographical dimension [5]. There is a multiplicity of "organized" proximities that do exist, referring to the ability of organizations to interact, process knowledge, learn interactively, develop competences, and generate innovative practices and products.
Boschma [1] delineates 5 forms of proximity (cognitive, organizational, social, institutional, and geographical) and reviews critically the link between proximity and innovation.

Cognitive proximity relates to the ability of organizational actors to share a partially common knowledge base and expertise leading to learning. It has a strong link to the absorptive capacity described by Cohen and Levinthal [8]. Cognitive proximity facilitates effective communication, but too much of it can lead to cognitive lock-in and cognitive traps [9]. An optimum must be found between the variety of knowledge as a source of innovation and the ability to collaborate (see also the multiple dimensions of cognitive distance as defined by Nooteboom [10], [11]).

Organizational proximity leads to the capacity to coordinate exchanges and creates a space of relations between organizations, with organizational arrangements such as contracts. The organizational proximity can be low (no ties between independent actors), moderate (loosely coupled network), or high (hierarchically organized firm or network). Organizational proximity helps controlling uncertainty and opportunism and therefore facilitates the transfer of complex knowledge. But too much of it creates lock-in, hold-ups in the case of asymmetrical power and size relationships, or low innovative activity hampered by bureaucracy or vested interests. A compromise between flexibility and control needs to be found.

Social proximity is defined in terms of socially embedded relations, such as those created by friendship, kinship or common experience. Social proximity provides trust-based social relationships that encourages learning, but can lead to an overload of trust and an underestimation of opportunism. Too much of it generates lock-in due to reliance on established ways of doing things.

Institutional proximity is associated to the institutional framework at the macro-level, such as laws, rules, cultural norms, routines and values. Institutional proximity offers stable conditions for learning, but an excess of it can lead to inertia and limited opportunities for newcomers to have a voice.

Geographical proximity is the spatial and physical distance between economic actors, both in absolute and relative meaning. There is a strong body of literature showing the advantages of co-location as it facilitates interaction and learning. The agglomeration of knowledge resources in specific locations may offer enhanced opportunities for innovation, which is one of the rationales for the creation of industrial clusters.

There is yet limited understanding about how these different dimensions of proximity are related to each other, if they may be complements or substitutes and how they influence innovation over time [1]. Clearly a new vision of innovation - beyond co-location - is emerging. Networks can be vehicles of knowledge creation and diffusion and the constant development of ICT enhances connectedness by providing new modes of communication and new channels for the emergence of communities.

2.2. Paradoxical Tensions

Literature on proximity shows that a difficult balance needs to be found between different forms of proximities - enough proximity but not too much, being proximate but distant, co-located and not at the same time. This forms a set of proximity paradoxes that need to be addressed. The management of paradoxical tensions literature refers mainly to intra-organizational issues, looking how organizations deal with their paradoxes and the tensions at the root thereof. We extend this vision to the inter-organizational realm and analyze how paradoxical tensions are identified, perceived and managed in an open innovation consortium (in the line of Jarvenpaa and Wernick [6]) and how they relate to the perception of proximity by the different actors (following Boschma’s typology [1]).

Theoretical work on paradoxical tensions [7], [12] categorizes them along four dimensions: learning, organizing, belonging, and performing. Learning paradoxes are the consequence of the transformation of dynamic systems, with the need to simultaneously build upon and destroy the past to create the future, combining elements of incremental and radical innovations. Paradoxes of organizing emerge from the simultaneous demands for control and flexibility, the need for collaboration and competition, and the coexistence of stability and change in organizations. The paradoxes of belonging come from the complex relationships between self and other, considering the relationships between individuality, group boundaries, and globalization. Performing paradoxes stem from the plurality of stakeholders and result in competing strategies and goals.

In their study of an open innovation network, Jarvenpaa & Wernick [6] identified four groups of paradoxical tensions: boundary paradoxes (industry vs. global competition), relationship paradox (cohesiveness vs. diversity), ownership paradoxes (joint creation vs. appropriation), and organizing paradoxes (predetermined vs. emergent). The paradoxical tensions in the network they studied were interlocking, making them particularly challenging to manage. They found that such open innovation networks require a complex repertoire of approaches to
avoid lock-ins, and a fluid structure in order to accommodate high levels of diversity in the knowledge base. Managers and partners of open innovation networks need to adopt a paradox approach if they want to address effectively the paradoxical tensions.

3. Data and Methodology

Field site and context

The official goals of the SHOKs are as follows [13]: (1) "generating top-level expertise on a global scale and the critical mass required by it for strategically selected fields.", (2) "producing globally new information and its efficient utilization.", (3) "Increasing the global appeal of Finland, which would generate an increase in international cooperation and funding."

The SHOKs are designed with an orientation towards the development of open innovation and contractual arrangements are made for the definition and transfer of ownership of the results of the research projects. SHOKs take the form of non-profit limited liability companies with medium term goals of impacting society within a 5 to 10 year time frame. They are essentially inter-organizational contract-based cooperative structures between companies, their networks, universities, and funding agencies.

The research context of this study is the interaction of universities, research institutions and companies inside ICT SHOK and its research programs. ICT SHOK focuses on information and communication technology, coordinating several separate research programs simultaneously. It is owned by 28 companies, 18 public research organizations (labeled hereafter PRO, representing universities and research institutions), and employs 9 people in its administrative staff [14].

Informants

The qualitative data used in this paper was collected in Finland between September 2009 and November 2011. The data consists of 28 semi-structured interviews with 29 ICT SHOK-affiliated interviewees working for public research organizations (PRO), companies or the administration of ICT SHOK. The length of the interviews varies between 25 and 96 minutes. The interviewees represented all organizational levels, from directors and managers to researchers and project coordinators within their respective organizations. Additionally some lawyers working for ICT SHOK have been interviewed. Table 1 presents the breakdown of informants by organization category, and table 2 presents the breakdown of informants by position within their respective organizations.

Table 1: Informants and affiliation to different organization categories. Note: several informants belong to more than one category

<table>
<thead>
<tr>
<th>Informant organization category</th>
<th>Number of informants in each category</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT SHOK</td>
<td>8</td>
</tr>
<tr>
<td>PRO</td>
<td>10</td>
</tr>
<tr>
<td>COM</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 2: Informants and categorization of position within their organizations. Note: several informants belong to more than one category

<table>
<thead>
<tr>
<th>Informant position category</th>
<th>Number of informants belonging to the category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>17</td>
</tr>
<tr>
<td>Research</td>
<td>7</td>
</tr>
<tr>
<td>Administration</td>
<td>3</td>
</tr>
<tr>
<td>Board</td>
<td>7</td>
</tr>
<tr>
<td>Lawyer</td>
<td>2</td>
</tr>
</tbody>
</table>

Data analysis

All interviews were transcribed and coded by a team of three researchers. The ATLAS.ti software package was used to support coding, iterative analysis, cooperative analysis and reporting of the findings. We met to discuss the codes and the themes that emerged, defined together that the label we used had the same meaning, and double checked the content of the interviews to reach agreement about our interpretative analysis. We also used all the publicly available secondary data about the ICT SHOK’s activities (reports, evaluation, press) to increase our insights about the specific context, history and organization of the ICT SHOK and of its sub programs.

Research programs

When considering the context of the ICT SHOK, three distinctive features need to be acknowledged. First, research inside the SHOK is markedly fast-paced and market-oriented, a classic mark of most ICT industries. Second, the ICT SHOK requires each of its research programs to be spearheaded by one large lead company, unofficially called a “locomotive”, which invests a significant amount of funding in the program,
provides a program manager from its staff, and takes overall responsibility of the program’s success. A public research organization cannot take this role, as SHOKs are intended to be company-driven research consortiums. Third, ICT SHOK’s research programs act independently, each having their own separate Strategic Research Agenda (SRA) and program steering group.

To date there have been nine ICT SHOK research programs (RP), out of which the first five, started between 2008 and 2010, are covered in our interview data. On the basis of this data it is challenging to fully assess whether or not the programs have been successful. What we report in the present study are our informants’ perceptions of the programs’ successes or failures, combined with the run-time of the programs.

To summarize, RP1 and RP4 got off to fast starts, ran for the full time of four years and are generally viewed as successes, while RP2 and RP3, which experienced painful and drawn-out preparatory phases, were cut after two years and are deemed failures. Interestingly, RP1 and RP4 are also described as the programs which were both the most centrally lead by one strong company, as well as the most homogenous, in terms of both unity of research agenda and composition of the participating actors, while RP2 and RP3 are described as more heterogeneous, but also as disorganized or poorly managed. Both of the latter programs also experienced trouble after losing their locomotive companies amidst the global financial crisis. They attempted to adopt alternative leadership structures to keep the programs running, but were denied permission to do so by ICT SHOK management and Tekes. Despite their perceived procedural successfulness, many complaints are made by several informants about the closed nature, secretive preparations and discriminatory practices of RP1 and RP4.

RP5 is an intriguing case, since it seems that in the inception of this program, which began more than a year later than the original four, the partners and ICT SHOK management have taken note of the lessons learned from the first programs’ successes and failures. From its inception onwards, the program has striven towards inclusiveness though geographically dispersed preparatory workshops and planning sessions. The still ongoing RP5 is described as diverse, open and very promising, and has successfully utilized agile management principles in its daily processes. It is seen as having successfully managed many of the tensions present in the initial four programs. A breakdown of each program’s runtime and informants’ perceptions of tensions, proximity and success is presented in table 3.

<table>
<thead>
<tr>
<th>Program</th>
<th>Time period</th>
<th>Consensus of perceived outcome</th>
<th>Consensus of perceived proximity of actors</th>
<th>Paradoxical tensions perceived</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP1</td>
<td>2008-2012</td>
<td>Success</td>
<td>Proximate</td>
<td>Resource access, location</td>
</tr>
<tr>
<td>RP2</td>
<td>2008-2010</td>
<td>Failure</td>
<td>Distant</td>
<td>Location, temporal orientation</td>
</tr>
<tr>
<td>RP3</td>
<td>2008-2010</td>
<td>Failure</td>
<td>Distant</td>
<td>Location</td>
</tr>
<tr>
<td>RP4</td>
<td>2009-2012</td>
<td>Success</td>
<td>Proximate</td>
<td>Resource access, location</td>
</tr>
<tr>
<td>RP5</td>
<td>2010 ongoing</td>
<td>Success</td>
<td>Distant</td>
<td>Attempts at managing tensions perceived in earlier programs</td>
</tr>
</tbody>
</table>

4. Results

In our analysis of the interview data we have identified numerous tensions related to collaborative innovation, both paradoxical and non-paradoxical. However, three paradoxical tensions that are manifested on the inter-organizational level emerged as our key findings: the tension of resource access, the tension of location, and the tension of temporal orientation. These tensions are widely acknowledged amongst our 29 interviewees, and appear also to be the most prevalent ones when our informants discussed major challenges in public-private collaborative innovation in the context of the ICT SHOK. This allows us to describe and analyze how the paradoxical tensions are identified, perceived and managed by various actors.

When managing collaborative innovation activities, the actors need to be both proximate enough to collaborate and distant enough to produce novel results, which is a classic paradoxical tension. Firms involved in a network of collaboration need to develop skills of ambidexterity that relates to the ability of managing proximities [1]. An added challenge is the fact that the actors involved in the management of paradoxical tensions often have asymmetrical perceptions of the nature of these tensions, and may even disagree whether the tensions exist or not. In the
following sections we will present the three key paradoxical tensions, describing their roots in proximity terms.

**Resource access**

The most prevalent tension we have identified in the data is the *paradoxical tension of resource access*. By resource access we mean in this case the access of potential partners to the to-be-formed ICT SHOK research collaboration and its respective funding possibilities. In this paradoxical tension, actors may perceive that they need to make a choice between opting to exploit their existing, proximate relations with other actors to engage in relatively quick and painless collaboration to gain access to funding, or to seek distant prospective partners to exploit the innovation potential of heterogeneous partners. It quickly became evident to us that despite the apparent and intended openness of the call for participation in the research consortium, the strong (considering the inter-organizational context) organizational, cognitive and social proximity of several key players in the close-knit ICT-sector of Finland created in some cases an uneven playing field for potential partners of the consortia being formed. Due to their common ties originating from previous inter-organizational collaboration, similar schooling and common social networks, these players were able to heavily influence the generation of the research agendas of research programs and modify them to fit their own needs. When the call for research program proposals was finally publicized, some groups had already had a year to prepare their ideas and were fast-tracked to acceptance. This led some research programs to be composed mostly of organizations and people who had already conducted joint research on the same topics for years.

This tension is a challenging one for all involved, as it seems to be identified mostly by those actors which perceive themselves to be amongst those “left outside” the inner circles. Since the tension is not universally identified and perceptions regarding it are asymmetrical, there has not been a unified attempt to manage the tension.

Furthermore, as at the time of the majority of the interviews the research programs had been in motion for only one to two years, mostly the benefits of high organizational, cognitive and social proximity, which tend to be most prevalent when organizing innovation collaboration, were visible to the stakeholders of the projects. High organizational proximity between the participating organizations enabled the transfer of complex knowledge, which the participants had already been engaged in for years, and reduced uncertainty and opportunism, ensuring that there were no “bumps in the road”. Hence potential issues such as IPR rights and rewards for investment did not develop into significant conflicts. High cognitive proximity between both organizations and individuals facilitated fast and effective communication, making the organizing period of the consortia relatively painless and swift compared to the groups of actors without a common professional language. Finally, high social proximity between the individual actors eased collaborative learning through making the dissemination of tacit knowledge easier, and lessened the risk of opportunism through trust earned earlier in the relationships. However, the numerous downsides of organizational, cognitive and social proximity, the lock-in of established ways of acting, the lack of novel information, the inability to identify new possibilities, the risk of involuntary knowledge spillover, the underestimating of the risk of opportunism, as well as general inflexibility, were not yet evident in to the interviewees in the time scope of the data. An extensive, non-partial evaluation of the success of the SHOKs, conducted by a group of neutral international evaluators is expected to be published late in 2012 and will provide further measures of performance.

**Location**

The second tension we identified, the *paradoxical tension of location*, is closely linked to the first one as both are related to access into the research programs, but is more focused on the dimension of geographic proximity. This is further divided into two streams of high geographic proximity related tension, the “Ring-bias” and the “Finn-bias”. Like in the resource access tension, this paradoxical tension may cause actors to feel that they need to make a choice between physically proximate, easy collaboration partners, and physically distant, more unknown partners. The Ring-bias refers to Ring III, an important bypass highway which circulates around the Helsinki metropolitan area. It is a common joke in the capital region that “there is no life outside Ring III”. Indeed, it is the perception of many informants that many of those ICT SHOK-partners located inside the ring have tried, and to some extent succeeded in, keeping those outside the ring outside the loop when it comes to ICT SHOK research collaboration. The Finn-bias refers to the SHOK funding rules outlined by Tekes, which allow only a “company operating in Finland” to acquire funding in ICT SHOK. The rule of thumb seems to be that a company needs to have significant R&D operations in Finland to be eligible for Tekes-funding. Several informants complained about this, since they feel that many of their non-Finnish collaboration partners could greatly benefit the consortia.
This tension is interesting, because even in the short time frame of interviews (2009 to 2011) clear progress has been made in resolving it. The Ring-bias was widely identified by various informants, and many influential actors within the ICT-sector voiced their disapproval to Tekes. As a way of managing this tension, the fifth research program, RP5, started a year later than the first four ones, was prepared by conducting geographically dispersed workshops to determine its agenda and participants. The Finn-bias has likewise been identified widely and is perceived symmetrically by most actors, and attempts at managing it through negotiations have been made throughout the interview period to come up with “flexible solution” to allow non-Finnish companies to contribute. By 2011 no significant steps to resolve the issue with Tekes had been made, but some actors had devised unorthodox means to circumvent the tension by bending Tekes funding rules.

In contrast to the resource access tension, the location tension may have been so apparent to various actors that the ICT SHOK was forced to swiftly manage the tension. There may have been too many people who were a part of the “Finnish inner ICT-circles” that were excluded through geographic bias for the issue to be left alone. On the other hand, also many informants inside both Ring-III and the Finn-ring expressed their concern over the disadvantages of high geographic proximity, such as the lessening of learning ability and regional lock-in.

**Temporal orientation**

The third and final key tension identified in our data is the paradoxical tension of temporal orientation. This tension differs from the two first tensions in the sense that it is has its roots in too much distance, in this case cognitive and institutional distance, as opposed to too much proximity. This paradoxical tension may cause actors to feel that they need to choose between commercially viable, short-term development and scientifically relevant, long term research. It is mostly, but not solely, manifested within the “University – Company” tension identified by Wernick [15] within all SHOKs, and is closely related to the “Industry-driven vs. Globally Competitive Research” paradox identified by Jarvenpaa and Wernick [6] in four of the six SHOKs.

To summarize, the tension is one stemming first from a cognitive and institutional distance between Tekes and actors mostly belonging to the PROs on the one side, and ICT SHOK management and the partner companies on the other side. The state, represented in this case by Tekes, is largely responsible for the formulation of the ground rules for running a SHOK. They explicitly state that the focus of the SHOKs shall be on mid-to-long term, pre-competitive, high quality research, meaning that the expected time to impact of the research could be up to twenty years. This is in line with the thoughts of most researchers working for PROs, who tend to shun research that is too fast-paced and market-oriented. On the other hand the ICT SHOK management and partner companies stress that, due to the nature of the ICT-business, the time-span of the research should be much shorter, with some informants calling for results in as short a time as three months.

Key informants consider research in the ICT SHOK to be very market-oriented and fast-paced. This is especially evident with the so-called “Business ecosystem” programs that have been started to allow for more industry driven research. These programs feature PROs only as subcontractors, have less public funding, and introduce a more closed innovation system as opposed to the supposedly open innovation research programs.

According to several informants on both sides of the debate, this tension is a constant challenge within the public-private consortia. The views on the subject are somewhat dissimilar, making it an asymmetrically perceived tension. The tension was unmanaged for a long time in the initial four programs. However, RP5 has recently attempted to manage this tension through the appointment of representatives from both companies and academia in joint-leadership positions.

Here the informants’ perceptions of the tension reflect Boschma’s [1] list of the problems faced by innovators lacking cognitive and institutional proximity. Communication is difficult and knowledge is hard to transfer between actors with distant temporal orientations. However, just as is the goal of the SHOKs by combining the research efforts of companies and PROs, sufficient cognitive and institutional distance may help to facilitate innovation and generate truly novel ideas. The cognitive nature of this distance is reflected by some of the respondents hinting at the educational background of the different partners, opposing PhD-like research to commercial-oriented research, alluding that Master’s level participants lack the ability to understand the fundamental nature of “real” research. On the other side there is an institutional nature of this tension, as the two environments – private firms and academia – follow different sets of norms of temporal orientation, varying from time-to-market in a hypercompetitive market to time-to-publication.

5. Discussion and conclusions

In this paper, we were looking at paradoxical tensions and proximity in an innovation network
formed of both public and private partners. As illustrated in our cases, proximity is an important antecedent to the emergence of paradoxical tensions. Managing paradoxes also means managing the effects of the different level of proximities.

However, the classic vision of proximity tends to be static, with level of proximities being fixed and analyzed at the macro-level. Our vision is that proximity is a much more dynamic phenomenon. Our data indicates that it does change across time and can be influenced and managed, as was demonstrated in RP5. Proximity can and should be organized [5] and issues of proximity should be identified early on in the process of developing innovative consortia.

When proximity issues are unidentified or asymmetrically perceived, they become extremely difficult to handle and can create conflicts and lead to non-cooperative behaviors. In our data we saw several cases of asymmetry of perceptions regarding the impact of specific types of proximities on the development of cooperative or uncooperative dynamics in the network. Such asymmetries lead to a strong discrepancy between the expectations and the outcome of the cooperative relationship, a situation that generally leads to the unfavorable evolution of alliances [16].

The stories of success and failures reported by our informants brought us to question the very nature of the successful processes that were referring to. The two “successes” we studied were mainly reproducing old coordination routines between extremely proximate partners which had already cooperated for a long period of time, or were embedded in power relationships (partners, suppliers, program leader owning part of the other partners) like in RP1 and RP4. This kind of interpretation of success seems to be limited to the procedural aspects of the program, with the actual innovation results of the program remaining hidden. In both of the “failure” cases (RP2 and RP3), the locomotive company left the program and the remaining partners were confronted to a leadership void, having to try to develop themselves new cooperative routines from scratch. They veered toward over-management by reporting (RP2), or were confronted by procedural inflexibility from the part of the ICT SHOK management and Tekes. ICT SHOK management refused the proposals that a group of SMEs would coordinate a program (as in RP2 and RP3), while Tekes forbade a foreign-based firm from taking over the locomotive position (as in RP3). In both cases, after a period of two years, the partners were willing to continue their cooperation and had identified opportunities, but their programs were nevertheless terminated. Some informants inside the terminated programs felt that the decision to shut down their emerging networks had been made a long time ago, and there was no space for real negotiations.

Our data strongly indicates that developing skills of “paradox management” [12] is a key for the development of innovative knowledge co-creation in an open innovation consortium. The everyday situations faced by partners in this open innovation consortium were typical examples of paradoxical tensions. In order to optimally manage such consortium, the paradoxical nature of the situations must be fully embraced by integrating early on paradoxical management tools and procedures. It also means that resources have to be multiplied as the coordination of a diverse network of partners, the bridging of different levels of distance are costly. For instance, multiple heads of research projects, rather than the classical vision of only one leader of project, could help handle the management of paradoxical tensions. In RP5, such elements were integrated, from specific interventions to promote the geographical diversity, to the integration of agile management methodologies to enhance multi-level communication and dynamic work processes.

An optimal structure for the consortium will not emerge automatically; it needs to be iteratively generated, by embedding multiple feedback loops and dynamic adaptation capabilities across the network. We found that the “locomotive” principle, the fact that an important partner should lead and coordinate the research efforts, is a paradox killer, a strategy by which management was effectively trying to eliminate a paradoxical tension instead of attempting to manage it. This principle of a single program leader “locomotive” is basically antithetic to the paradoxical nature of the innovation process. Messy processes and multiple approaches to the cooperative work need to be integrated and accepted by the programs management. Developmental interventions may be used to mediate the effects of proximity and alleviate the risks of lock-in and unfavorable alliance development.

6. References