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Intentional Creation of Innovation Networks: An Exploratory Multi-Case Study from German Industry

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Abstract. Due to its promising effects on the economic development, innovation networks have been recognized as an important instrument for the industrialization of regions and nations. Therefore, the creation of innovation networks has been fostered by national and regional innovation systems, as several EU nations are launching clustering and networking incentive programs. For example, the German Government initiated in 2002 an incentive program to foster the creation of innovation networks between SMEs, large enterprises, and research institutes. This research aims at identifying different strategies used in practice for the intentional creation of innovation networks by means of a multi-case study on a German enterprise that adhered to the German Government incentive in order to create nine networks during the past three years. Through this exploratory study, we were able to identify three distinctive strategies used by the network managers for the intentional creation of innovation networks: Cooperation Project, Partner Alignment, and Activity Alignment.

Keywords: Innovation network, network creation, network strategy, case study research, innovation policy, Germany

1 Introduction

National Innovation Systems have been implementing several policy measures aiming at strengthening the economic performance and welfare of nations. Both developed and newly industrialized countries and regions regard innovation strategies and policies as a systemic process with a specific socio-cultural, institutional and R&D environment [1]. The fostering of innovation networks through public or private initiatives is one of these policy interventions implemented in the EU regions [2]. This is a consequence of the several industrial economy theories that emerged arguing that network forms of organization (innovation networks, industrial networks, clusters) are important instruments for the economic development of regions and nations [3–5].

National Innovation Systems have been often defined in the literature (e.g.[6, 7]). In these definitions the importance of linkages and relationships between institutions - enterprises, universities and government research institutes -, along with the production and diffusion of knowledge and technologies among them is mentioned

recurrently. These linkages are formed through private or public incentives. Innovation Networks defined “as the linkages between organizations (companies, universities and regulatory agencies) in order to create, capture and integrate the many different skills and knowledge needed to develop complex technologies and bring them into the market” [8], strongly relate to National Innovation Systems, since these can be fostered under their incentives and agendas [9].

Koschatzky and Sternberg [10] discovered through the European Regional Innovation Survey (ERIS) that regions develop at different rates through innovation networks that constitute the regional innovation system. Their study also indicates that Germany has a well networked innovation system. Over the years the German innovation policy has shifted away from traditional R&D funding schemes and toward a focus on collaborative R&D projects and the establishment of regional clusters thereby stimulation interregional competition [11]. According to Nooteboom [9] Germany is oriented towards more enduring network relations, which increases its innovative capability. Dohse [11] and Eickelpasch and Fritsch [12] analyze and compare many of the innovation network fostering programs implemented in Germany. One of these programs is the ZIM-NEMO program, which is the focus of this research.

The German government started the ZIM NEMO initiative in 2002 with the goal to elevate the technological basis of small and medium sized enterprises (SMEs) and increase inter-firm-university networking, thereby increasing their technological competencies [13]. The initiative started in East Germany under the name of Netzwerkmanagement-Ost NEMO – Meaning: Network Management East - and was enlarged to the whole country in 2008 under the program called ZIM (Zentrales Innovations Program Mittelstand - Central Innovation Program for Middle sized Industry)-NEMO. This initiative consisted in sponsoring the administrative costs for the network management up to 90% in the first year, 70% in the second, and 50% in the third year. The networks are created intentionally under a specific technological scope, with the objective of establishing cooperative projects and synergies. These networks are composed by SMEs, large enterprises (LEs) and research organizations - such as universities and research laboratories. The creation of these networks is actively coordinated by a network manager [14–16].

The networks are selected for funding through the following evaluation process: 1) Groups with a minimum of 6 partners (SMEs, LEs or Research Institutes) and a network manager are invited to submit a network concept proposal; 2) The proposals are evaluated according to three criteria: technological strategic interest for Germany, potential market existence, and network manager curriculum; 3) Proposals are selected for fund, rejected, or selected for further elaborations.

Although research on the network form of organizations is ample, the intentional creation of innovation networks have not, so far, been much studied. Further insights into the strategies of successfully creating these networks at a managerial level would assist both network managers and policy makers. Therefore, the study presented in this paper aims at contributing to the identification and characterization of the strategies adopted for the intentional creation of innovation networks.

The remainder of this paper is organized as follows. Section 2 reviews the literature on the emergence of networks in general, and defines the network-level of study and the networks under analysis. Section 3 explains the research method used

for this empirical study. Finally, sections 4 and 5 present the research results and conclusions.

2 The Creation of Innovation Networks

Networks have been studied from various perspectives of analysis - interpersonal, intra-organizational, and inter-organization [17] – and based on different theoretical frameworks. The emergence of networks has been object of study for many years mostly as a natural occurring phenomenon. Barringer and Harrison [18] consolidate the literature on this matter and present six theoretical paradigms used to explain the natural emergence of networks: transaction cost economics, resource dependence, strategic choice, stakeholder theory, learning theory, and institutional theory.

Several authors have contributed to the understanding of how the behavior of networks can be intentionally influenced. Some focus on the firm level [19] whereas others focus on the network level [14, 20–22]. Moreover, various conceptual frameworks have been suggested for the creation and management of innovation networks (e.g: [23–25]). However, contributions, based on studies from empirical data, towards strategies for the intentional creation of networks have so far been scarce. Human and Provan [15] focus on the evolution of intentionally created networks and implicitly mention creation strategies. More recently, Thorgren et al. [26] analyze innovation performance as a function of governance type, network structure and incentive type. Olsen et al. [27] investigate 101 networks fostered under a program from Innovation Norway, similar to the ZIM-NEMO program. They point out the drivers of success for networks: network design, network content and structure, network management, and team spirit, anchoring, involvement and knowledge transfer. Ritala et al. [28] focus on networks evolution from explorative to exploitive, and distinguish between “coordinating by commanding” (i.e. network management) in a later exploitive network state, and “coordinating by enabling” (i.e. network orchestration) in an earlier explorative network state.

Innovation networks have been defined by several authors [8, 14, 29]. More specifically, we adopt here the definition of Calia et al.[8], considering Innovation Networks “as the linkages between organizations (other companies, universities and regulatory agencies), in order to create, capture and integrate the many different skills and knowledge needed to develop complex technologies and bring them into the market”. By focusing on the need to bring technologies to the market, this definition accurately describes the goal of the ZIM-NEMO innovation networks.

As with networks in general, innovation networks can have different characteristics which will be discussed next.

Network Structure. The structure of innovation networks may be distinguished between a “network of organizations” and a “network organization”. While the former refers to any group of organizations or actors that are interconnected with direct or indirect exchange relationships, the term “network organization” refers to networks that contain a finite set of parties [20]. The existence of strong ties in a network structure leads to a larger share of resources and information. Weak ties lead

to a share of more novel information between the partners [30]. Ahuja [30] points out the advantage of a balanced weak and strong tie mix in a network.

Network Governance. Provan and Kenis [16] distinguish three different sets of possible governance forms for a network organization. First, participant-governed networks are governed by the members themselves with no separate and unique governance entity. Second, lead-organization-governed networks occur normally in vertical, buyer/supplier relationships, especially when there is an unbalanced distribution of power in the network. In this scenario, all major network-level activities and key decisions are coordinated by a single participant. Third, in a Network Administrative Organization (NAO) a separate administrative entity governs the network and its activities, acting often also as the network broker.

Main Activities (Exploitation vs. Exploration). In the study by Bierly et al. [31] innovation networks are claimed to have exploration and exploitation activities within firms. While in exploration innovation networks there is a greater emphasis in developing new technologies for innovative products and services, exploitation networks aim to enhance current capabilities for current products or processes. Supply networks would be a good example of the latter.

Geographical Span. Innovation networks can be local or have a global span depending on their regional concentration. Clusters, for instance, are a type of network with high regional concentration [4].

Value System. Möller et al. [32] define and discuss the importance of the value-system in intentionally formed networks that contain a finite set of parties. Three types of networks can be generally identified based on their value-systems: 1) - Vertical networks (ex. supply networks); 2) - Horizontal networks (ex. competition alliances, market and channel access/cooperation alliances); 3) - Multidimensional value nets (MDVN) (networks including partners aligned on the horizontal and vertical value system). For networks to function correctly, partners should not be completely aligned horizontally or vertically, since this fact may lead to direct competition inside the network [33]. The networks under analysis in this study are considered MDVNs.

3 Research Methodology

The research question driving this study is: “What are the strategies used to intentionally create innovation networks?” Due to the exploratory nature of the research, the case study method was selected as an appropriate research methodology [34]. For this purpose a multi-case study was carried out involving nine innovation networks created between 2009 and 2013. These innovation networks were fostered by a German consulting enterprise that received funding from the incentives created by the German Federal Ministry of Economics and Technology (ZIM-NEMO program, introduced in section 1), and acquired additional revenues from R&D project funding. Although created under the same firm, each innovation network has a separate network manager, different network partners, and operates within a distinct industrial setting. By focusing only on networks created under the same policy

program, network variability due to external factors, such as different incentives, is somewhat reduced.

In researching network organizations, three levels of analysis are widely accepted [17]: interpersonal, intra-organizational and inter-organizational. As the purpose of our research is to study the strategies for the creation phase from the point of view of the network administrative organization (NAO), we selected the innovation network as the unit of analysis. This focus provides a holistic approach and the study of the network as a whole as described by Provan et al. [33]. Regarding the characterization of the studied networks, they all have a network organization structure, initially weak or non-existent ties (to the time of the creation of the network), a NAO governance model, conduct mainly explorative activities, possess a global span, and a multidimensional value net (MDVN) system.

The data collection method used was semi-structured interviews with network managers and three to four partners of each innovation network. The interviewees from enterprise partners were the CEO's of the companies and the research leaders from the research institutions. Each network manager was questioned regarding the context in which the idea for the network arose; his/her initial expectations for the network; the strategy and tools used for the creation of the network; his/her current network experience and critical issues; and what, in his/her opinion, would be the future of the network. Carrying out interviews to several network partners allowed data triangulation and increased the validity of the study. Partners thought to have different opinions from within the network were selected in order to obtain a more insightful picture. Network manager advice was used in selecting the partners to interview. All interviews were conducted in the interviewees' native language (German) and recorded when consent was given. Only two interviewees did not give consent to be recorded. In these cases notes were taken simultaneously to the interview. Other materials such as projects internal documents and partners profile descriptions were also used as data sources to complement the information from the interviews. Table 1 shows an overview of the different networks studied in terms of sector, partners, and year of creation, ongoing projects and key interviewees.

Table 1 - Innovation networks overview. E - Enterprise; RI - Research Institution; PE - Project in Execution; Project in Planning; PI - Project in Idea; N/D - No Data Available; NM - Network Manager; NP - Network Partner.

No	Main field of activity	No. of Partners		Active Period of the NAO	No. of Projects and budget (€)			No. of Interviewees		Main Strategy
		E	RI		PE	PP	PI	NM	NP	
1	Hybrid Sensors	15	1	01/2010 - Ongoing	6 4,8M	5 0,5M	N/D	1	3	Partner Alignment
2	Electric Mobility	23	5	12/2011 - Ongoing	5 11M	6 4M	3	1	3	Cooperative Project
3	Algae for high-value	17	6	04/2012 - Ongoing	0	2 7,3M	12	1	3	Partner Alignment
4	Industrial LEDs	17	3	10/2012 - Ongoing	6 3,8M	14 8,7M	5	1	3	Cooperative Project
5	Biomass for Energy	23	13	10/2011 - Ongoing	5 1,2M	3 2M	15	1	3	Field Alignment
6	IT	13	1	01/2012 - Ongoing	4 0,8M	1 0,7M	N/D	1	3	Partner Alignment

7	Smart Grids	16	3	04/2011 - Ongoing	0	17 23M	66	1	4	Partner Alignment
8	Wind Energy	17	9	07/2012 - Ongoing	1 0,5M	3 5,7M	52	1	4	Field Alignment
9	Drones	7	6	01/2013 - Ongoing	0	3	2	1	3	Partner Alignment

Data was analyzed with the assistance of a case-level partially ordered meta-matrix as suggested by Miles and Huberman [35].

4 Strategies for the Intentional Creation of Innovation Networks

The innovation networks presented in Table 1 were created intentionally. This means that the mechanisms available for the emergence of networks [18] did not necessarily exist in the first place. For this reason, the network managers employed different strategies to ensure a sustainable environment where the network partners could come together and foster new innovation projects. Based on the actions described by the network managers, and the perceptions of the network partners, this study identifies three strategies used by the network managers to ensure the creation of the network environment, namely: Cooperative Project; Partner Alignment; and Field Alignment. Characteristics of these strategies in terms of partner ties [30], partner complementarities [20], knowledge transfer [17] and project generation are summarized at the end of this section in table 2,

Table 2 - Characteristics of the identified strategies.

Strategies	Characteristics			
	Partner Ties	Partner Complementarities	Knowledge Transfer	Project Generation
Cooperative Project	Active participation in project creates stronger network ties over time	Partner competencies complement each other well, but network will be compromised if partner exits network	Higher transfer of tacit knowledge, due to stronger ties	Main project guaranteed. Smaller amount of weak ties could be responsible for lower amount of project ideas.
Partner Alignment	Weaker ties with low danger of partner competition	Good partner complementarities. Network flexibility to adapt to new or restructured projects.	Information transfer between partners.	Project breeding environment. Pressure to create projects to ensure partner commitment.
Field Alignment	Weak ties with danger of partner competition	Large variety of competencies. Complementarities not guaranteed. Danger of competency overlapping.	Highly novel information transfer between partners	Idea breeding environment. High Pressure to create projects to ensure partner commitment.

4.1 Cooperative Project

The Cooperative Project strategy is probably the most straightforward of the three. In this strategy the manager starts by planning a large R&D project that addresses a specific emerging market, or a specific problem proposed by a large enterprise. The partners are screened and selected to be acquired into the network based on their specific core-competencies to tackle a certain part of the project. This strategy has the benefit of guaranteeing that every partner is actively engaged in the network during the planning and execution of the project. During this time networking and informal ties tend to occur within the network. Network number 2 is a good example where this strategy was well implemented. There is however a risk inherent to the Cooperative Project strategy: if key partners opt to leave the network and project, the whole network may be compromised, since its replacement might be difficult to achieve. In an attempt to use this strategy, in Network 4 some of the key potential partners refused to participate in a cooperative project. The network manager was able however to implement a different project concept, thus ensuring the future of the network while maintaining the same strategy.

4.2 Partner Alignment

While not having a concrete R&D project as a goal, the Partner Alignment strategy aims at providing a network partner mix of competencies and characteristics that will maximize the probability of concrete projects emerging after some networking events and workshops. Two aspects are vital to use this strategy: (1) the competencies of the network partners must be complementary; and/or (2) they should be active in different market segments. This ensures that there are no direct competitors in the network. Network managers that were using Partner Alignment as the main strategy emphasized the importance of carefully assessing possible competitors. Partners can have the same competencies as long as they are not active in the same fields, as can be the case in MDVNs [20]. Since the competencies needed to create the network are less specific as in the Cooperative Project strategy, the manager has a larger potential partner base at his disposal. The network will also be more resilient in case a certain partner decides to abandon it. In more than one project it was shown necessary to substitute a partner during the creation phase of a project. The higher flexibility this strategy provides to the network, made partner substitution and project reformulation an easier task. Evidence from the case studies showed, however, that since network partners were not involved in an R&D project at the time of network beginning, their commitment towards the network became reduced. This eventually led some partners to abandon the network.

4.3 Field Alignment

The Field Alignment strategy provides the largest potential partner base. Managers using this strategy approached potential network partners based on the fact that their

field of activity was aligned with the field of activity of the network. The main advantage of this strategy is the high amount of network partners that can exist along with diverse and novel information and competencies. Since with this approach it takes generally longer to generate concrete R&D projects, the network manager must sometimes incentivize the network partners to participate in the network by other means, other to R&D project collaboration. Network 5 is a good example of the Field Alignment strategy. In this case, the network manager highly invested in Public Relations related work, such as the organization of events with networking activities and public presentations.

4.4 Final Remarks

During the interviews different partners expressed different expectations from the network: Easier access to market, higher visibility, access to partners and projects, and access to networking and new ideas. It is up to the network manager to ensure the correct strategy is being used. Network managers, active in the networks with highest ongoing projects and highest budgets, emphasized the importance of knowing their partners well and interacting with them as much as possible.

The coordination skills that are required by the network managers in these networks are consistent with the “coordinating by enabling” (i.e. network orchestration) defined by Ritala et al [28].

5 Conclusion and Future Work

This study analyses nine intentionally created innovation networks financed by the German ZIM-NEMO program, in order to identify and characterize strategies used to intentionally create innovation networks. All nine networks were created under the same incentives, thereby decreasing variability due to external factors. The networks are analyzed as a whole network in a multi-case study with the network as the unit of analysis in order to ensure a holistic approach, as mentioned by (Provan et al, 2007). The end result is the identification of three strategies used by the network managers to create innovation networks.

Understanding how these strategies influence networks may be helpful in sharpening the definition of policy initiatives in order to create innovation networks more successfully. The successfully implemented innovation networks of the type analyzed in this study have been shown to foster the creation of new industrial products and services [1, 13], and may in the future very much contribute as well to the economic growth and regional productivity [4, 10].

This is an intermediate study of a research project with the goal of creating a knowledge base platform to support the creation phase of innovation networks. To complement these results the end work of the research project will count with the analysis of other networks created under other circumstances. For this purpose, at least, the networks created in Portugal will be object of future study.

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