Agile Knowledge Networking

A novel approach to research collaboration between industry and academia

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***Abstract*—The paper presents a novel approach to interaction between industry and academia, in the form of a knowledge networking program as implemented by a telecommunications company. Compared to traditional in-house R&D, this program represents an agile and "lightweight" approach to getting access to scientific knowledge supporting the company's quest for disruptive innovations. Supported by a team of student trainees, the program facilitates interaction with a large number of top academic scholars worldwide. The paper reports experiences and lessons learned from the program so far, and discusses areas of further improvement in terms of managing the collaborative R&D process and cultivating the networking capability of the company.**

Keywords-knowledge networking; industry-academic collaboration; networking capability; collaboration capability.

I. INTRODUCTION

The innovation capabilities of an organization are closely related to knowledge creation [1][2]. According to the open innovation concept, rather than developing new products and services through internal R&D processes, the knowledge needed for innovation increasingly resides outside the corporate boundaries [3]. This again places increasing emphasis on the organization's capability for managing external relations and partnerships, often referred to as networking capability [4] or collaboration capability [5]. Collaboration between industry and researchers in academia is an important source for disruptive innovations [6], but managing collaborative R&D projects between industry and academia also implies potential challenges related to cultural differences and goal incongruence [7].

Since the concept of knowledge networking (KN) was suggested in the late 1990s [8], organizations have experimented with different knowledge creation and transfer processes based on network interaction. Still, there is a need for more empirical studies that can contribute to identifying guidelines for innovation through knowledge networking and R&D collaboration.

In this paper, we present an example of an innovative and agile form of knowledge networking undertaken by the Elisa Corporation, a Finnish telecommunications company. Through Elisa Knowledge Networks, interaction with a broad set of leading scholars is facilitated for identifying and supporting disruptive innovations in the company. The concept of agility in this context refers to "a business-wide capability that embraces organizational structures, information systems, logistics processes and, in particular, mindsets" [9, p. 37], with flexibility as a key characteristic. We report on the experiences and lessons learned from the KN initiative so far, and discuss possible areas of improvement including the role of technology support.

The remaining paper is structured as follows. Section II gives a brief overview of related research, and Section III introduces the Elisa Knowledge Networks program. Section IV presents the methodological approach for this study, and Section V presents the key findings in the form of experiences and lessons learned. The findings are discussed in Section VI and Section VII presents conclusions and implications.

II. RELATED RESEARCH

A. Key Definitions

In this section, we present definitions of some key terms that are used in the discussion of the findings from our case study.

Mitegra et al. [4] define networking capability as "the set of activities and organizational routines which are implemented at the organizational level of the focal company to initiate, develop, and terminate business relationships for the benefit of the company" (p. 741). They further detail the concepts into three components referring to the initiation, development and termination of the relationships.

Blomqvist and Levy [5] present the somewhat broader term of collaboration capability for conceptualizing knowledge creation and collaborative innovation in networks. They define the term as "The actor's capability to build and manage network relationships based on mutual trust, communication and commitment" [5, p. 31]. This is presented as a concept for analyzing relational interaction on different levels, including individual, team, intra-organizational, and inter-organizational. Similar, the Global Collaboration Index Model presented by Frost and Sullivan [10] includes collaboration capability as "a forward-looking construct that represents an organization's orientation and infrastructure to collaborate". The organization's culture and structure and its application of collaborative technologies are defined as components of collaboration capability. Collaboration capability in itself facilitates the updating of

 ISBN: 978-1-61208-436-7

old capabilities, and the internal or external development of new ones. It could thus be seen as part of the firm's transformational capacity, i.e., its capacity to continually redefine its product portfolio on the basis of the technological opportunities created within it [5][11].

B. Managing R&D Innovation Processes

Several studies have focused on challenges in managing innovation processes and research collaboration [3][6][7][12]. Among the key challenges identified is providing adequate follow-through of the innovation process so that the mindset of open innovation is also implemented in the existing work routines and daily operations [3][6]. Also, for industry-university collaboration, several potential conflicts have been identified in terms of cultural differences, conflicts over IP rights, and different priorities and time horizons [7].

Almeida and Soares [13] also point to the challenges related to information and knowledge management in project-based R&D institutions, involving different disciplines, cultures and ways of working. They outline recommendations for a digital enterprise information management (EIM) infrastructure, combining Wikis, communication tools (e-mail, Skype) and a central content management system for preserving the project results. In a similar vein, a case study of knowledge networking practices in a large, multinational corporation [3] shows how the implementation of a collaboration platform integrating various social networking tools has been important for supporting the open innovation strategy and knowledge-sharing capabilities of the company.

In terms of suggested solutions for meeting the different challenges, Barnes et al. [7] present an extensive framework for managing collaborative R&D projects. Among the most important factors in this framework is the existence of a collaboration champion, defined as "an individual with great enthusiasm for and commitment to the venture, who is also influential and well-placed within the partner organization" [7, p. 399]. Also, a method of partner evaluation to ensure genuine interest and commitment, ensuring mutual benefit in terms of appropriate balance between academic objectives and industrial priorities, and continuity of personnel, have been identified as critical success factors [12].

III. ELISA KNOWLEDGE NETWORKS

Elisa is a telecommunications, ICT and online service company serving 2.3 million consumer, corporate and public administration organization customers. The company is the market leader in Finland in mobile subscriptions, and in 2014 it employed 4100 persons with a revenue of 1.54 billion euros [14].

The Knowledge Networks program was initiated in 2011, as an initiative by the company's Vice President of Business Development. The company earlier had an internal R&D unit of 14 employees, but the research activity was not seen to be sufficiently targeted towards the needs of the business units.

The Research Collaboration objective of the KN program is stated as to "identify novel disruptive innovations in the scientific community based on selected focus areas". A disruptive innovation is here defined as "A new technology, product, service or business model that will either disrupt the company's existing business or create a new business opportunity by introducing a new domain of offerings that will dwarf some of the existing offerings or totally replace them". The disruptive innovations may be related to four domains: business model, services, products and technology. The current list of disruptive innovations identified by Elisa Knowledge Networks through interviews with academic scholars includes: computer-assisted communication, healthcare co-creation, privacy control, industrial internet, software defined networks, smart device interconnections, and brain-machine interfacing.

The Knowledge Networks team is led by the Vice President of Business Development who has 20 % of his position allocated for this, and a team of 2-3 trainees who are master students recently graduated or in the final stage of their studies. In addition, the program has a steering group of four top level managers in the different business areas of the company, who meet once a month for status updates and approval of new academic contacts identified by the KN team. As all costs related to the initiated collaborative R&D projects are covered by the business units, the costs of the KN team operations only represent a small fraction of the costs for the former R&D unit in the company which amounted to more than 1.5 million euros.

The KN activities are organized in a 'funneling process' where candidate academic scholars are first identified through scouting by the trainees or from internal or external hints. The selected scholars are then invited for an online meeting, and in the case of mutual interest for further collaboration the scholars are suggested to the steering group for initiating collaboration with the business units. The criteria applied in the scouting process are that the scholar should be a world class scientist doing research in one or more of the company's focus areas, having a track record of industry collaboration, and being affiliated with a highly distinguished university or research centre. Further, although as a low priority criterion, the scholar should be well funded. This again is due to the "lightweight" nature of the KN program, where most of the research projects initiated are not funded by the company other than for covering expenses related to travel and data collection, etc.

The KN team develops regular performance reports for the Elisa executive board. In the period from 2011-2014, 743 academic scholars were contacted, of which 142 were approved for further collaboration. Of these, 85 were from institutions outside Finland. In the same period, more than 20 research collaboration projects were initiated.

The KN team uses a Microsoft Sharepoint database and Excel spreadsheets for storing information on the contact with scholars and the projects initiated. Employees in the company can get access to this information by request, but it is so far not made openly available. For online meetings with the scholars, they use the company's desktop video conferencing system. The KN network arranges internal seminars that can be accessed online, and that are also recorded for later view.

 ISBN: 978-1-61208-436-7

IV. METHOD

Data for this study was collected through interviews with different stakeholders involved in the knowledge networking activities in Elisa, and analysis of different documents from the KN network.

A total of twelve semi-structured interviews with sixteen informants were conducted in the period from May to September 2014. These included:

- Individual interviews with four members of the KN steering committee (including one online interview)
- Group interview with three trainees in the KN team
- Individual interviews with four representatives from the company's business units (including two online interviews)
- Online interviews with five academic scholars in the KN network (including a group interview with three scholars)

Eight of the informants were interviewed at the Elisa headquarters in Helsinki during a one day visit, while the remaining interviews were conducted using the company's desktop conferencing system for the internal employees and Skype for the academic scholars.

All interviews were taped and transcribed in full. The interview transcripts were annotated, and then analyzed for experiences and lessons learned from the KN activities till date.

A preliminary report of the results were also discussed and validated with the KN coordinator and two KN trainees in a meeting in March 2015, then also providing an update on current actions in the KN team.

V. KEY FINDINGS

In this section, we present key findings from our study in terms of experiences and lessons learned from the KN program so far, and possible areas of improvement. As presented in Section IV, data for this study was collected through interviews with different stakeholders involved in the knowledge networking activities, and analysis of different documents from the KN network. The reported experiences and suggestions thus represent the perspectives from different stakeholder groups.

A. Experienced Benefits from the KN Program

Overall, the company representatives interviewed report positive experiences from the KN program. They regard this way of getting access to cutting edge research as more effective than through the former in-house R&D department, and delivering more benefit to the business units.

While the company does not currently have metrics in place for analyzing the outcomes of the research projects initiated, the informants point to several examples of successful interactions with academia that have led to important input to the company's strategy development in terms of areas to be focused. Several of the informants also point to that even if most contacts with the academic scholars do not lead to any further collaboration it is still valuable to read about and learn from their research work, and that the research articles often give more insight than superficial consulting reports. Also, several of the informants state that it is to be expected that not all contact initiatives give results:

"*In venture capital operation there is the golden rule that based on ten ideas or ten investments there will be one successful and nine failures, and that is very ok. And I think very much this kind of knowledge network operation is like an internal venture capital operation, they are ventures, there is a high risk because they are future-oriented.*"

(Member of KN steering group)

They also point to that the KN initiative in the company can be seen as part of transforming the company to become a more agile and international organization.

The academic scholars interviewed also state that being invited to research collaboration by an industrial company is exceptional, as it is normally the other way round. The initial invitation email is also well prepared in that it refers explicitly to some of the researcher's work, thus managing to make the candidate scholar curious (and perhaps also flattered) and therefore (s)he does not discard this as spam. The willingness of the company to share their data (from surveys, etc.) with researchers and students for further analysis is also emphasized as positive. As an example, the company is currently inviting scholars to conduct big data research on raw data from selected base stations in their mobile network.

The trainee program is also emphasized as a success, with the trainees being praised by both the company informants and the scholars as premium students who are effective in their approach. However, some suggestions were made regarding the length and format of the trainee period, which will be reported in the next section.

B. Challenges and Areas of Improvement

Overall, the informants point to that the KN program is still in an early, ramp-up phase, and that some initial challenges thus can be expected.

The key challenge reported by both the members of the steering group and the business unit representatives concerns the hand-over of academic contacts from the KN team to the business units. It is here considered crucial to create sufficient ownership of the research projects from the business. If not, with the hectic work pace, handling the introduction of the research contact may simply be regarded as extra work from the business persons. As reflected by a business representative on how the hand-over process could sometimes be perceived by the business unit:

"[…] *"this is a good researcher, catch!" (laughter) "Ah, what do I do with this guy? Now I need to use five hours a week to keep it going". And that is often reason enough to say no".*

One of the informants also pointed to the "not invented here" syndrome as a barrier towards taking on the responsibility for new research projects that they have not themselves initiated.

Some argued that the trainees could take on a stronger coordinating function for the research collaboration projects, and thus support the business units in this process. But a challenge to this is the relatively short duration of the trainee program, typically lasting 3-4 months. Several informants

thus expressed concern that during this relatively short period of time, the trainees did not get the possibility to take on more challenging tasks beyond administering the contact with the scholars. However, based on his experience, one business representative also pointed out that one should be careful about delegating too challenging tasks to the trainees, such as negotiating contracts. It should here be noted that since the time of this interview study, the length of the trainee period has been somewhat extended, to four months as KN trainee followed by four months as a trainee in one of the business units.

The turnover of trainees was also raised as a challenge by the academic scholars interviewed. As projects could typically span 1-2 years, this would imply contact with 4-5 trainees during the course of the project. While the trainees were generally perceived to be well prepared, this was seen to result in a lack of continuity and to cause some confusion about who was the current point of contact in the company. The scholars also expressed some frustration with the process of establishing the project agreement taking too long, resulting in delay in the project schedule which again could lead to conflicts with other commitments and deadlines for the academics. This is also supported by one of the company representatives, who expressed concern that the company could lose face towards the scholars.

The fact that most of the projects were unfunded was also stated to affect the scholars' priority and commitment:

"*Because they are not a client, they are more like a beneficiary, so I think then it changes a little bit the power structures. Because we don't really owe them too much. I mean, of course we want to help them, but obviously they are not paying, and we are doing the work, so…*".

This was seen in contrast to the rather strict liability clause enforced by the company in the project agreement, involving a penalty of 50.000 euros in the case of any confidentiality breaches.

Also, some of the informants in the company stated that unfunded projects did not tend to receive the same focus and expectations as funded projects:

"*When you pay for something the quality is usually a bit better, and you get committed a lot more than to something which is for free*".

However, the KN coordinator still argues in favor of non-funded projects as the norm, in line with the lightweight nature of the program and regarding the contact with the scholars as the main focus rather than the projects as such.

The general impression among the informants is that the KN program is not yet very visible in the company. This is despite regular online presentations and workshops conducted. However, the KN team is currently working on improving this, through establishing a dedicated site on the company intranet and also running monthly online seminars. A challenge regarding intranet presence was stated to be that the company has too many sites, thus making it difficult to get an overview.

VI. DISCUSSION

Through their Knowledge Networks program, Elisa has transformed their R&D activities from an internal, resource-demanding operation not perceived to fully meet the demands of the business units, to a lightweight and agile operation facilitating flexible interactions with a large number of world-leading researchers in different domains. As pointed to by the informants, this can be seen as part of an overall transformation towards a more internationally oriented company.

While it is still early to measure the output of the KN program, the accounts provided by the informants of projects and ideas initiated through the contact with the research scholars indicate that the program fulfils the overall intention of this partnership, i.e., to engage in research collaborations that could not otherwise be justified in-house [11]. Also, the Elisa employees interviewed were generally positive about the KN program, characterizing it as a "valuable asset" for the company. The scholars were somewhat more mixed in their feedback, pointing out some challenges related to contractual arrangements and project management. Still, they were also positive towards the partnership program.

In comparison with the guidelines for managing R&D collaboration suggested in the literature [7], several of the critical success factors are in place in the KN program. The KN coordinator definitely serves the role of collaboration champion, in terms of commitment to the program. And as a Vice President, he also meets the definitional criteria of being influential and well-placed within the company [7]. The only potential challenge related to this role is the high dependency on one person, making it somewhat vulnerable. In effect of this, the company has now decided to dedicate one more person to the KN team, to assist the coordinator with some of his tasks.

Further, the process for scouting and selecting scholars works well, and the KN team has succeeded in engaging a large number of researchers who bring expert knowledge on focus areas related to potential disruptive innovations. However, as pointed out by the informants, timing is a critical issue, as even though a scholar may possess relevant knowledge for the company there may not be sufficient basis to initiate a project at this exact time. While the informants still regard the academic contact to be of possible value regardless of this, for the trainees in the KN team this represents more of a challenge in 'rejecting' a scholar after the initial contact. This also makes it difficult to contact this scholar again later.

According to the conceptualization of networking capability by Mitegra et al. [4], the Elisa Knowledge Networks program can be seen to demonstrate good relationship initiation capability in terms of attracting valuable partners. But in terms of relationship development capability, the program still experiences some of the challenges frequently mentioned related to establishing effective R&D partnerships. The main challenge here is related to the hand-over of the academic contact from the KN team to the internal business unit, and ensuring ownership in this. If sufficient follow-through is not provided, time pressure and the "not invented here" syndrome may act as barriers towards the further engagement of the business units. As the internal visibility of the KN program was still

 ISBN: 978-1-61208-436-7

considered low, this also represents a challenge in creating buy-in for the research collaboration initiatives.

Also in managing the relationship with the scholars, some concerns were raised by both the scholars and company employees about the process of initiating the projects taking too long, and the company not being 'professional' enough in their handling of the scholars. The turnover of trainees was also pointed to by the academics as a challenge in maintaining a focal point of contact in the company. Given that most of the research projects are not funded by the company, these challenges could easily lead to some demotivation among the researchers or at least to a lack of prioritization.

As documented in previous studies, an ICT collaboration infrastructure is regarded an important element for supporting knowledge networking and open innovation [3, 13]. The KN team also uses several tools in for managing information and communicating with scholars, e.g., SharePoint databases and desktop videoconferencing. However, a recommendation would be to make the database of scholars and projects searchable for all employees. Even if this may not be considered useful for all, marketing this opportunity can still contribute to the internal awareness of the KN program and to facilitating an open innovation mindset among the business units [3]. Further, there is a potential for increasing use of social networking tools, facilitating knowledge exchange among the Elisa employees. Integrating this in an enterprise information management infrastructure can facilitate organizational learning through sharing results and best practices across the research projects [13].

With reference to the collaboration capability construct, the KN program in Elisa can be considered strong in its orientation and organizational infrastructure for collaboration, while the application of collaboration technologies is still at an early stage.

Finally, it should be reminded that the KN program is still in an early stage of development, and that it is yet too early to document extensive output measures. Also, several of the issues raised here are currently being addressed by the company, such as routines for project initiation and follow-through, more systematic assessment of completed and disbanded projects, extended trainee period, stronger presence on the company intranet, and use of social media (Twitter) for informing about projects.

In terms of further development of the KN program, a possibility could be to extend the current dyadic relationships between Elisa and each academic scholar to a real network, by connecting scholars with similar or complimentary research interests and skills to form research teams focusing on joint topics. This could then even further support an open innovation strategy for the company. However, this would also entail additional coordination challenges, and is so far not part of the company's further plans.

VII. CONCLUSION AND IMPLICATIONS

The case study presented in this paper illustrates an agile approach to knowledge networking that has demonstrated several benefits over the former in-house R&D organization. The cost effective and flexible KN operation has facilitated contact with a large number of leading academic researchers, resulting in important insights for the company and over 20 collaborative research projects initiated so far. In addition, the KN operation includes a trainee program that gives valuable experience for master student graduates, also resulting in further employment in the company for several candidates.

The study has also pointed out several challenges in the management of the collaborative R&D process, especially regarding the hand-over of the academic contact from the KN team to the business unit to create internal ownership of the projects. Further, effective follow-through and coordination of the research partnership is important for ensuring continued commitment from the partners.

The study supports the findings from previous research on the importance of a collaboration champion, and balancing industry and academic objectives.

With reference to the concept of networking capability, the Elisa Knowledge Networks demonstrate strong relationship initiation capability but can still improve further its relationship development capability. In terms of collaboration capability, the KN program scores high on orientation towards collaboration but does have a potential for further utilization of collaboration technology and social software to support the knowledge networking. It is also recommended that the company provides shared access to their KN database, to facilitate extended knowledge sharing in the company.

The findings reported in this paper can serve as inspiration and benchmark for other companies seeking to develop their knowledge networking capability in partnership with academia. However, as a caveat it should be noted that this form of collaborative R&D partnership requires that influential persons in the company take a genuine interest in the potential contribution of academic research, as is the case with the Elisa KN coordinator and the members of the steering group. Further, the industry partner should be willing and interested in sharing their experiences and data to support the research activities, of which this article represents an example.

Further research should conduct more systematic assessment of the results from the R&D collaboration for both the company and the academic partners, and contribute to develop suitable metrics for this. Also, in-depth studies of how different collaboration technologies can support knowledge networking activities are needed to develop this practice further.

ACKNOWLEDGMENT

I am grateful to the Elisa Knowledge Networks coordinator Kimmo Pentikäinen and his team for facilitating and participating in the study, and to the Elisa employees and the academic scholars interviewed for sharing their insight and experience.

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 ISBN: 978-1-61208-436-7