

Facilitating collaboration between individual participants in a university-industry research and development project

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Abstract

Due to accelerated technology change and market globalization, university-industry collaborations have become increasingly important avenues through which organizations strive to gain competitive advantage. A recent research focus has concentrated on revealing collaboration success factors especially in knowledge creation context and exploring the role of design as a facilitator in the creation process. A Finnish university-industry research and development project was investigated to understand the grass-root level collaboration and the influence of a facilitator with design expertise. Ten semi-structured interviews were conducted and participative observation was carried out in project related activities. In the case, participating organizations work mainly independently, and the leadership of the project was not used to full potential. Moreover, the role of design was not considered to bring considerable value. Followed by results, factors enhancing interaction between participants in the project are analysed and discussed. Finally, practical activities to support collaboration are suggested.

Keywords: *university-industry collaboration, facilitation, knowledge creation, research and development*

1 Introduction

Due to accelerated technology change, market globalization and increased R&D costs, there's a growing number of various forms of strategic collaborations between companies and research organizations in order to gain competitive advantage [1, pp. 10–11, 2, 3]. It has been demonstrated that the key to competitive advantage of an organization is especially the acquisition, creation, transfer, and application of knowledge [4]. Furthermore, there are notions that design is a multi-functional activity that facilitates knowledge creation process in various contexts [5]. Considerable research has been dedicated to identifying factors for successful collaborative projects [6], but there are several open questions to be answered. First, although project success factors is a widely studied area, determining success factors in university-industry collaboration context needs further exploration [6]. Moreover, knowledge integration processes in R&D collaborations [7] and the role of design as a facilitating element in the process need to be better understood.

1.1 Research goals

To advance the understanding of interaction in a strategic R&D collaboration, this study sets out to identify factors that influence the success of a particular R&D project between research organizations and private companies on the micro-level. Furthermore, it intends to explore the role of a facilitator with design expertise in a collaboration project. The goal of the research is two-fold: first, it aims at contributing new knowledge to understanding how university-industry R&D collaborations work with a facilitating participant and second, from those insights deriving practical implications to support the project work.

1.2 Research setting

In this paper, a particular form of strategic collaboration is studied. The studied project was part of a nationally funded R&D program in Finnish health and wellbeing sector. These programs are university-industry partnerships established in Finland for speeding up innovation processes in the industry [8]. The goal of the case project was the design and development of new manufacturing technologies to blood sample devices. The project originally consisted of eight participating organizations, resulting in five participants (one company with the managing role, one research centre and three universities, one with the facilitating role employing the authors as researchers), as two companies and one research organization discontinued (figure 1). The role of the facilitating organization was to support collaborative events and to apply design-led working methods and tools to the project. It had no substance knowledge on the device development, but the aim was to bring combined know-how of engineering and design to the process. The research recorded in this paper was carried out during a nine-month period. Prior to this period, the research project had been running for approximately two and a half years.

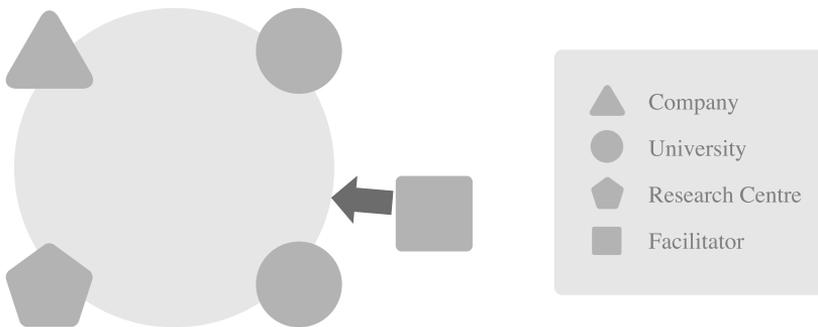


Figure 1 Participating organizations including the facilitating participant in the case project.

2 Theoretical background

As the aim of the study is not only to explore the role of the facilitator but also to form an understanding of the project dynamics as a whole, this literature review covers areas on success factors of collaboration projects, characteristics of learning and knowledge and finally, aspects of facilitating and managing knowledge creation.

2.1 Critical success factors of strategic collaborations

Several scholars have investigated success factors of strategic collaboration trying to find the recipe for collaboration performance [9]. Factors that have been able to identify to influence the project performance in general can be divided into 1) the formation and structural factors and 2) factors related to interaction processes.

During the formation phase of the project, several structural elements are agreed among collaboration partners influencing the project throughout its existence. What initially leads to a potential strategic collaboration is the complementary expertise of the participating organizations [10]. Organizations' know-how needs to be complementary for partners to be able to create new knowledge, and business strategies need to be aligned [10]. Differences between aims of the project participants might lead to competition and hinder the project progress [11]. Incentives to recognize and encourage collaborative behaviour should also be present to overcome challenges [12]. The project network model can be from loose to tightly integrated. The more strategic characteristics the collaboration has, the more actively participants should work with each other [13]. Finally, the ownership of the results of the project should be agreed in advance [10].

Second cluster of factors relate to interaction between project participants. These factors are seen highly important already in the formation phase but also need to be nurtured throughout the existence of the project. Communication, especially face-to-face is seen beneficial [12] and meetings as a communication platform are considered as moments of crystallizing the project by punctuating the on-going activity and leading people to make sense of the situation [14]. In addition to communication, trust is seen as a major determinant in collaboration between organizations [10, 12]. Similarly to communication linkages, trust needs to be built and maintained, and it is built mainly through personal interactions [12].

2.2 Organizational learning and knowledge creation

As knowledge is considered as an important factor to gain competitive advantage, it is crucial to understand the characteristics of it and the effect on learning [15]. Explicit knowledge is easy to transfer and it can be expressed in artefacts and processes. Tacit knowledge refers to personal and context-specific experience and it is best transferred through practice and social interaction. According to Nonaka and Takeuchi, learning happens when knowledge is continuously changing between tacit and explicit through four different modes: socialization, externalization, combination and internalization [16]. In order for organizational learning to happen, knowledge first needs to be converted through all four modes on an individual level before it can be transferred to team and organizational levels and finally reaching inter-organizational level.

There are contradictory opinions on the importance of various knowledge creation modes. According to Zack [17], tacit knowledge is more valuable in strategic collaborations, whereas Nonaka and Takeuchi argue that knowledge creation is fundamentally a social process and all modes of knowledge creation are equally important. Nonetheless, results point towards a significant emphasis on the sharing and active interaction between participants.

2.3 Facilitation and management of knowledge creation

Due to the changing characteristics of knowledge, suitability of different knowledge creating and transferring activities vary. This distinction in turn affects the discussion on the activities that best support the strategic collaboration. Knowledge creation in general can be supported by providing a proper context for facilitating group activities [16]. Explicit knowledge is best transferred in manuals, reports and groupware [4, 18]. However, if the knowledge is tacit, it is fundamentally important to support social processes like face-to-face communication and meetings to ensure knowledge blending [16]. It can be argued that design facilitates knowledge creation and transfer through being a knowledge broker or integrator [5]. Moreover, research organization can act as a knowledge broker, bridging and managing the collaboration. Key aspect is to enable actors to learn how to interact with each other. [19] In

practice, a way how design and a designer can potentially support knowledge creation processes, is the visual communication of ideas and concepts through images, metaphors and models [5, 14].

When addressing management, the key insight is that rather managing the knowledge itself, the organizations “must manage the social environment in which motivated people are allowed to think and work together” [4 p. 233]. Furthermore, especially in innovative projects, the management should be iterative [10] to maintain the right scope [1]. Finally, management personnel play a major role in the performance of the project, emphasizing both strategic top management and operative coordinating roles [6]. The additional role of facilitating collaboration in the project is yet to be explored in the literature, which forms the rationale for doing this study.

3 Methodology

Case study approach [20, p. 9] was chosen, in order to understand the collaboration process between individual participants including the influencing factors behind it, and due to the nature of the research setting. A single case was chosen due its “particularity and ordinariness” [21, p. 445] and approached through qualitative methods as they are especially suitable for understanding the meaning of situations, events and actions and the influence of a particular context within which the participants act [22, pp. 19–20]. As case study research typically relies on multiple sources of data [20, p. 19, 28], two main research methods, interviews and observation, were used.

In the case, purposive sampling [23] was used to select employees from all participating companies and research organizations in order to collect a variety of experiences on the phenomenon [24, p. 57]. To broaden the perspective, persons from both researching and managing role were selected and interviewed. As a main method of data gathering, ten semi-structured interviews [25] were conducted individually. Eight interviewees were from research organizations (one manager and one researcher from each research organization) and two from participating companies. Topics in the interviews included goals and motives of the project, communication, collaboration, roles and management aspects. Interviews lasted from 20 minutes to 1 hour and 30 minutes averaging at 45 minutes. In addition to interviews, observation was conducted to complement data collection. Observation was done by visiting organizations’ premises while conducting interviews and by participating project related meetings. Research method was carried out as participative observation, where researcher participates in the group activities as desired, yet the main role is to collect data and the group is aware of researcher’s activities [26].

As qualitative research analysis is characterized by inductive approach, a constant comparative method [27] was used in this study to analyse research data. Data analysis contained inductive and deductive round. In the first inductive round, relevant units of meaning were searched in the data, selected one by one, compared to other units and categorized. In the second analysis round, all research data was reread deductively comparing it to themes found in the first round. Additional supportive units of data were looked for and data categories were adjusted based on new findings. Finally, all themes were analysed and checked for supportive and negative opinions [24, p. 141].

To overcome challenges of research validity and reliability, several triangulation methods were used to attain a more complete and accurate interpretation of the phenomenon [22, p. 76, 28]. First, a broad range of persons was selected to maximize possible point of views. Second,

several data collection methods were used to add richness to the data [28, 29]. Third, multiple researchers were involved in observation [29], and two-person teams conducted two out of ten interviews [30, p. 741].

4 Results

Four main themes emerged from the research data. Collaboration aspects, communication and managerial aspects seemed to majorly affect the project work, while resources process issues was a supplementing theme.

4.1 Collaboration

Every research organizations interviewee (eight in total) stated that the work is done individually. Three of them mentioned that the work was independent from the beginning, and four interviewees stated that participants were not encouraged to collaborate with each other. Participating research organizations were in contact only with the coordinating company and another research unit, either within the same organization or one closely located. Three interviewees considered past design workshops organized by the facilitator as positive but two of them were questioning the added value of the activities and ability to integrate the workshop findings to the everyday research work.

4.2 Communication

Eight interviewees described the interaction between participants in face-to-face situations to be often formal. Interaction happened in official meetings, and interviewees felt that these situations left no room for spontaneous or more in-depth conversation. Meetings were not considered as most productive and were described more as a one-way reporting rather than two-way communication events. Several interviewees also stated the fear of openly expressing ideas and revealing research results during these meetings, while the high number of participants in the meetings also reduced the free-form conversation.

Eight interviewees out of ten felt that face-to-face communication is the most effective way to interact compared to other communication channels. However, they stated it was not used enough. Especially researchers felt that they did not communicate enough with each other and hoped that their role could be more participative. An online portal had been set up for project management and communication purposes, but interviewees stated that it was not used to full potential. Four interviewees did not have user credentials and another four interviewees admitted that they had only seldom used the portal. Two interviewees reported that the portal was complicated to use.

4.3 Managerial aspects

Interviewees mentioned that several personnel changes occurred during the project, among them the coordinator of the project. Two respondents admitted that personnel changes seemed to reduce the progress of the project, as new participants had to get on board and familiarize themselves with the project. The importance of two managerial positions, the director of the program and the coordinator of the project, were highlighted by the interviewees. The director was in charge of the early launch of the project and report gathering. The coordinator of the project was expected to be in charge of the daily operations of the project e.g. calling for meetings and sending reminders to report submissions.

According to all research organization interviewees, the objectives of the companies were not clear and research organizations lacked feedback and guidelines. Research participants especially hoped for more direction and firm sense of the research need. Three interviewees

described that especially challenging aspect in this project was the changed form of the project model. Previously, nationally funded projects were led by research organizations. In this case, the project leadership was changed to be private companies' responsibility. The company interviewees acknowledged that they did not fully internalize the role change and could not exploit the leadership opportunity to its full potential.

4.4 Process and goals of the project

Five interviewees mentioned that there were no specific milestones in the project. As there was no division of shorter time slots, meetings were regarded as a means to keep attached to the project and to create a sense of urgency to proceed in the research. All research organization respondents stated that the research in the project should be applied rather than basic to be in line with their organizations' vision. In addition, several respondents hoped that their work would be meaningful, and that it would be relevant to the companies.

The project was seen by the research organization interviewees primarily as a means to produce publications and enhance their area of expertise. Company interviewees saw the benefits in new product and technology concepts resulting in future products. What was common to all participants was that they saw the project as a platform to create new contacts and new partnerships. Three interviewees said that being and staying part of the project was itself considered to be a success.

5 Discussion

Results of the research data enlighten the understanding of factors affecting strategic university-industry collaborations on a micro-level. Following the two-fold research goal, results are first reviewed against findings from literature. Theoretical discussion is followed by a list of practical implications to support the project work.

5.1 Theoretical implications

Independent nature of collaboration seemed to be one of the major characteristics of the project. Several interviewees admitted that they were only working on their area of research although at the same time, many stated that the work was well divided into concrete tasks for each participating organization. It is challenging to consider was the work independent due to the task division or project management. It seems that participants were well selected complementing each others' area of expertise. However, the amount of effort put to encouraging the participants to collaborate during the project was fairly low. For the creative functioning of the team, a reasonably frequent interaction should occur [31], especially in a situation where participants are fairly differentiated [16]. Otherwise, the synergy and focus of the project might evade. Despite the efforts of bringing design methods to the development they were not considered to bring much added value. Design methods might fit universally to any development process regardless of the domain area, but implementation of them might need to be subtler and focus on very basic, such as the use of visualization in project documentation, prototypes and facilitating collaboration, in order to fully exploit the use of them as means to knowledge integration. Correspondingly, design facilitator might need to possess both design and specific domain knowledge in order to fully enhance the development of a technology and to integrate design into the development.

Approaching the results from knowledge creation perspective [16], knowledge externalization from implicit to explicit was well present in official project meetings. Due to the low level of conversation in the meetings, the level of understanding and digestion of the knowledge remains unknown. As Nonaka and Takeuchi argue, the chance of discussing the

topic and asking details improves the externalization between individuals. Combination of explicit bodies of knowledge happens also in meetings, but how the knowledge is stored into a system remains unknown. The project online portal partly worked as a storing system, but its usability and accessibility were inadequate to save important tacit knowledge. As a whole, Nonaka and Takeuchi's framework might be beneficial for supporting this project and systematically facilitating all four modes of knowledge conversion. There is evidence that supporting a variety of knowledge communication practices and even emphasizing the social nature of learning is crucial to the project [32]. A failure to provide one of the knowledge conversion modes might hinder the learning [33].

Based on the interview results, IPR rules reduced the project progress and communication. There is no common agreement in the literature how the rules should be organized, only that they should be agreed prior to commencing the project. In the case, rules were agreed upfront, but what caused the major obstacles in the project was the dilemma of trying to learn and trying to protect own core know-how, noted by several scholars. Trust and active interaction might reduce the fear of unfair sharing of the benefits of the project outcomes.

Differences between academic and company participants were mostly seen in varying aims and benefits of the project. Although both parties have different personal goals, they should nonetheless strive for a common target. Huge gap between private and common benefit may indeed result in tensions in the collaboration, increase the racing behaviour and affect the amount of resource allocation [11]. As several interviewees argued that being able to stay in the project is already a benefit per se, it can be concluded that goals at least partly overlap. However, how a successful project, meeting anticipated goals, is seen, especially in a collaborative environment, is highly a subjective issue and opinions on success vary among participants [34, 35]. Nevertheless, if the goal of a project cannot be clearly articulated, measuring the project successfulness and benefits of the project becomes even more challenging. Looking at the interviewees' responses on the benefits of the project, it could be hypothesized the goal to be two-fold: to form and to enhance collaboration between participants in the industry and to create concrete products and services in the future. Two-fold goal might be however difficult to implement as varying goals are measured differently with varying supportive project models and ways of working.

The collaboration was also affected by the change of management responsibility from research organizations to private companies. Companies seemed not to fully understand and fulfil the potential of leading the research work and being in charge of the project. This decreased daily activities such as feedback and guidance in the research work. With regard to management roles, project coordinator was in the operative role, managing and supporting day-to-day activities. In this role, however, challenges were identified as the person was changed during the project and due to the small number of companies, coordination duties were accumulated to one person's responsibility. In addition to managerial duties, the role has significance in creating a culture of collaboration [36]. Without a culture that recognizes, encourages and rewards knowledge sharing, efficient knowledge transformation activities will not occur [37]. In this situation, a facilitator can give additional support, however, a facilitator might need to have domain knowledge in addition to design knowledge or closer collaboration with the manager of the project, in order to fully support the collaboration.

Some notions of iterative development with regard to innovative process were identified as the project scope was changed over the course of the project. Other milestones however were not identified. There are implications that the actual level of innovation in project activities

does not correspond to the associations and expectations for innovativeness as the project was regarded as one ordinary project among others.

5.2 Practical implications and actions proposed to facilitate the project work

To support the project collaboration, several practical initiatives were generated. These initiatives target to supporting the micro-level collaboration between project participants.

1) Arrange researcher meetings

Several researchers longed for a possibility communicate on concrete research work. A researcher meeting would work as a forum to discuss practical challenges in research. The number of attendees should be limited to ensure a freeform discussion.

2) Design more effective meeting procedure and organize meetings in advance

To enhance different knowledge conversions i.e. knowledge externalization and socialisation, a more effective meeting procedure should be designed. Participants should be encouraged to openly present challenges and successes in their research. Specific goals should be set before the meeting so that the target of interacting is clear and that the accomplishment of the goals could be reviewed after the meeting. A detailed task list should be created indicating the task itself, the responsible person and the next concrete action steps. In addition to solve the contradiction of high number of meeting attendees and the need for free-form discussion, a possibility for one-to-one discussions after the official meeting should be provided.

3) Use visualization in meetings to facilitate communication

A visual participant map indicating each participating employee, including their names, background, main work duties and contact details could prove to be useful. Furthermore, complex concepts take explicit form in visualizations and tangible prototypes.

4) Diversify knowledge creation modes

As a whole, various knowledge creation modes should be applied in the project work. In addition to meeting procedure changes, the use of online communication channels should be encouraged.

5) Clarify roles and responsibilities and goals of the project

If the desired outcome of the collaboration projects are formed based on private sector wishes, the business potential of the outcomes of the project should be emphasized. Demand for research, procedures and activities to attain the outcomes of the project should be articulated more clearly.

6) Integrate facilitation to domain knowledge

In order to reach full potential of facilitating a project, design activities should be tightly integrated in the project domain knowledge.

6 Conclusions

Due to the increased technology and market change, companies and research organizations collaborate more and more outside organizational barriers, as potential innovations reside in the intersection of different bodies of knowledge. This study aimed at taking an in-depth look on one particular R&D project in Finnish health and wellbeing sector, investigating the interaction and collaboration between individual participants and exploring the role of a facilitator in the project. Based on the results of the interview and observation data, several practical recommendations were proposed to support the project work.

Offering an in-depth understanding on one form of a collaboration in a certain setting, this study indicates that behavioural factors and relationships between individual participants play a major role in collaborations, and although considered obvious, facilitating interaction and information exchange has to be emphasized. External facilitator in the project might impact positively in the project, however design should be understood as knowledge integration

activities. Regardless of the collaborative efforts, in order to create meaningful outcomes, goals of the project and the role of participants should be nonetheless clarified. As a whole, this study produced a set of micro-level activities to facilitate university-industry collaboration, which is yet to exist in literature despite the vast collaboration research efforts.

As this study focused on one type of university-industry collaboration, the results are subject to some limitations. First, the low number of company representatives might have diminished the richness of the data in regards to business perspective. Second, as the study was rather explorative, contributions to the general body of knowledge are somewhat limited. To further understand the role of design, the facilitation of and methods used in a university-industry project would be interesting to explore. Moreover, further study on how to better create mutual communication channels across organizational barriers could be attempted. Finally, the influence of IPR on the openness of communication creates interest for further research.

References

- [1] J. R. Harbison, P. P. Pekar, and W. F. Stasiar, *Smart alliances: A practical guide to repeatable success*. Jossey-Bass San Francisco, CA, 1998.
- [2] S. Chen, "Task partitioning in new product development teams: A knowledge and learning perspective," *J. Eng. Technol. Manag.*, vol. 22, no. 4, pp. 291–314, Dec. 2005.
- [3] T. J. Campione, "Making Research Collaborations Succeed," *Res. Manag. J.*, vol. 46, no. 4, pp. 12–15, 2003.
- [4] N. Rolland and D. Chauvel, "Chapter 11 - Knowledge Transfer in Strategic Alliances," in *Knowledge Horizons*, C. Despres and D. Chauvel, Eds. Boston: Butterworth-Heinemann, pp. 225–236, 2000.
- [5] P. Bertola and J. C. Texeira, "Design as a knowlsfw agent: How design as a knowledge process is embedded into organizations to foster innovation," *Design Studies*, vol. 24, no. 2, p. 181-194, 2003.
- [6] T. Barnes, I. Pashby, and A. Gibbons, "Managing collaborative R&D projects development of a practical management tool," *Int. J. Proj. Manag.*, vol. 24, no. 5, pp. 395–404, Jul. 2006.
- [7] S. Liyanage, P. F. Greenfield, and R. Don, "Towards a fourth generation R&D management model-research networks in knowledge management," *Int. J. Technol. Manag.*, vol. 18, no. 3/4, p. 372, 1999.
- [8] Tekes, "New Strategic Centres to boost innovations in Finland." Print MarkPrint Oy, 2011.
- [9] R. M. Kanter, *When Giants Learn To Dance*. London: Routledge, p. 415, 1994.
- [10] M. Dodgson, "Learning, Trust, and Technological Collaboration," *Hum. Relations*, vol. 46, no. 1, pp. 77–95, Jan. 1993.
- [11] T. Khanna, R. Gulati, and N. Nohria, "The dynamics of learning alliances: competition, cooperation, and relative scope," *Strateg. Manag. J.*, vol. 19, no. 3, pp. 193–210, 1998.
- [12] B. Von Stamm, *Managing innovation, design and creativity*. Wiley, p. 429, 2003.
- [13] R. P. Lynch, "Principles and practice of corporate alliance management," *Eng. Manag. Rev.*, vol. 18, no. 3, pp. 22–43, 1990.
- [14] M. Eneberg, "Enabling Design Service Facilitating Inter- and Intra-Organizational Sensemaking," in *Design Research Society 2012: Bangkok*, vol. 02, pp. 460–467, 2012.
- [15] M. Polanyi, *Tacit Dimension*, Reprint 19. Gloucester: Doubleday & Company, p. 108, 1966.
- [16] I. Nonaka and H. Takeuchi, *The Knowledge creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press, p. 284, 1995.

- [17] M. H. Zack, "Developing a Knowledge Strategy," *Calif. Manage. Rev.*, vol. 41, no. 3, pp. 125–145, Apr. 1999.
- [18] R. M. Grant, "Chapter 2 - Shifts in the World Economy: The Drivers of Knowledge Management," in *Knowledge Horizons*, C. Despres and D. Chauvel, Eds. Boston: Butterworth-Heinemann, pp. 27–53, 2000.
- [19] F. Lind, A. Styhre, L. Aaboen, "Exploring university-industry collaboration in research centres," *European Journal of Innovation Management*, vol. 16, no. 1, pp. 70-91, 2013.
- [20] R. K. Yin, *Case study research: design and methods*, 4th ed. Thousand Oaks: Sage Publications, p. 219, 2009.
- [21] R. E. Stake, "Qualitative case studies," in *The Sage handbook of qualitative research*, 3rd ed., N. K. Denzin and Y. S. Lincoln, Eds. Thousand Oaks: Sage Publications, pp. 443–466, 2005.
- [22] J. A. Maxwell, *Qualitative research design: An interactive approach*. Thousand Oaks: Sage Publications Inc., p. 153, 1996.
- [23] M. N. Marshall, "Sampling for qualitative research.," *Fam. Pract.*, vol. 13, no. 6, pp. 522–5, Dec. 1996.
- [24] P. Maykut and R. Morehouse, *Beginning Qualitative Research - a philosophic and practical guide*. London: The Falmer Press, 1994, p. 194.
- [25] B. Dickey-Bloom and B. F. Crabtree, "The qualitative research interview," *Med. Educ.*, vol. 40, no. 4, pp. 314–21, Apr. 2006.
- [26] B. B. Kawulich, "Participant Observation as a Data Collection Method," *Forum Qual. Sozialforsch. / Forum Qual. Soc. Res.*, vol. 6, no. 2, 2005.
- [27] B. Glaser and A. Strauss, *The discovery of grounded theory: Strategies for qualitative research*. Hawthorne, NY: Aldine, 1967.
- [28] K. Eisenhardt, "Building theories from case study research," *Acad. Manag. Rev.*, vol. 14, no. 4, pp. 532–550, 1989.
- [29] M. A. Pettigrew, "Longitudinal Field Research on Change: Theory and Practice," *Organ. Sci.*, vol. 1, no. 3, pp. 267–292, Aug. 1990.
- [30] K. M. Eisenhardt and L. J. Bourgeois, "Politics of strategic decision making environments : in high-velocity: toward a mid-range theory," *Acad. Manag. J.*, vol. 31, no. 4, pp. 737–770, 1988.
- [31] R. Leenders, J. van Engelen and J. Kratzer, "Systematic design methods and the creative performance of new product team: do they contradict or complement each other?," *J. Prod. Innovat. Manag.*, vol. 24, no. 2, pp. 166-179, 2007.
- [32] J. L. Cummings and B.-S. Teng, "Transferring R&D knowledge: the key factors affecting knowledge transfer success," *J. Eng. Technol. Manag.*, vol. 20, no. 1–2, pp. 39–68, Jun. 2003.
- [33] J. Feller, a. Parhankangas, R. Smeds, and M. Jaatinen, "How Companies Learn to Collaborate: Emergence of Improved Inter-Organizational Processes in R&D Alliances," *Organ. Stud.*, vol. 34, no. 3, pp. 313–343, Mar. 2013.
- [34] S. Davenport, J. Davies, and C. Grimes, "Collaborative research programmes : building trust from difference," *Technovation*, vol. 19, pp. 31–40, 1999.
- [35] T. Barnes, I. Pashby, and A. Gibbons, "Effective University–Industry Interaction: A Multi-case Evaluation of Collaborative R&D Projects," *Eur. Manag. J.*, vol. 20, no. 3, pp. 272–285, 2002.
- [36] L. G. Knudsen, "Collaborative R&D Capabilities: In Search of Micro-Foundations," 2009.
- [37] W. Wu and Y. Yezhou, "Organizational knowledge transformation and its influencing factors in individual, team and organizational level," *Int. J. Netw. Virtual Organ.*, vol. 8, no. 3/4, pp. 192–208, 2011.