ASSESSMENT OF TEAM BASED INNOVATION IN A PRODUCT SERVICE SYSTEM DEVELOPMENT PROCESS

Mattias Bergström[a], Vinit Parida[b] and Christian Johansson[c]

Luleå University of Technology, Luleå, Sweden.
Email: [a]*mattias.bergstrom@ltu.se,* [b]*vinit.parida@ltu.se,* [c]*christian.johansson@ltu.se*

Innovation is often measured based on how the product performs on the market. This makes it difficult to measure the performance of a team since the time to develop a product may take several years. In this paper we show the importance of creating a common ground and facilitation in a team, two aspects that is not easy measure, but should be assessed. We also discuss innovation on three interrelated organizational levels, the operational, which is the development team and in focus in this paper, the managerial and the strategic level. We found that companies need indicators to measure and/or assess performance on all three levels and that more research is needed to find the inter-links between the levels to prescribe measures and assessment points.

1. INTRODUCTION

Innovation has been a hot topic for the past decade because it provides companies with a strategic advantage leading to competitiveness in a turbulent business environment. In this study, we hold a process view on innovation, which stresses the importance of the process to develop an innovative product, i.e. from idea to development to commercialization. Here, the Product-Service System (PSS) concept [1] is an interesting perspective that adds a level of complexity relative to a traditional hardware based product. The change in business model, from hardware being the only value carrier to the service as the main value carrier and the hardware merely being a risk and expenditure, means that PSS will require radically new approaches for innovation. Innovation begins with a divergent design phase to find a wealth of possible ideas to a design problem, which in itself is often not defined; hence, the start position is often unclear [2]. The ambiguity in these early phases is relatively high and the problem is referred to as a "wicked problem" [3]. This further complicates the measurement of innovation, because the problem is defined when it is solved; there is no 'the solution' to 'the problem' in a cause and effect manner, and there is only 'a solution' based on the definition of the problem [4]. "*Fail often, to succeed sooner*" [5] is a mantra that is used by IDEO, a leading design firm, shedding light on innovation as being born out of many ideas, which needs be examined to sift out the grains of gold that is the next innovation. This requires more concrete definition and criteria by which to judge the quality of the ideas and perhaps more importantly the process of innovation [6].

The 'exploit' and 'explore' paradigm can shed light on the activities and the driving forces of change in a company. In an exploit paradigm the goal is to reduce cost through an increase in productive efficiency or by simplifying and reducing the cost of the product, e.g. through lean production, or in product development to focus on lowering costs and reducing times in the product development process. Exploit is important for companies to stay competitive in current segments with existing products. However, it can be argued that companies cannot only rely exploitative activities, they also

need to pursue an explore paradigm, where they as a balance to the sustaining paradigm also pursue radical innovations. Being able to develop radical products and services secures a strategic position for the company. If companies fail in developing radical innovations they are likely to fall behind their competitors, who may develop radical innovations and change the landscape of the market [7]. For example, companies selling typewriters lost their market share to companies selling computers. In light of this discussion, we focus on teams working on explorative projects that are established with the aim to development radical innovations. These teams usually have longer time for development and for them it is crucial that they are somehow assessed during the development phase to ensure success.

Most companies would measure the success of innovations based on their performance in the market. When making measurements and assessing the quality of a result it is common that companies measure those aspects which are possible to be measured as opposed to which might be necessary to be measured [8]. For instance, measuring product cost is relatively easy, however measurements cannot rely solely on cost or economically driven numbers, the true success of an innovation can only be measured once the product is launched in the market and it starts to generate revenue, this would typically be a lengthy process. The difference between an assessment and measurement is that the latter can easily be quantified while an assessment is qualitative in its nature. Since measurements of innovation success on the market are made too late to influence the innovation process, assessments of the innovation process, that are designed to evaluate whether the innovation process is on the right track or not, is a key aspect that needs focus. As the product ideas are significantly new with unknown references [4], these assessments represent a challenge for companies.

In a company there are three levels, the operational, the managerial and the strategic level. Actions and decisions on one level usually have influence on the other levels, making their interplay interesting to investigate further [9]. In this paper we will mainly address the operational level issues, where we find team based innovation, i.e. the teams that are performing the early phases of innovation. Innovation is often performed in teams, with individuals from many different disciplines and with different tasks to manage in the development effort. The team members collaborate closely and "*think together*" [10] to find new ideas and to refine those into innovative products and services. The research presented in this paper builds on an explorative study, investigating the innovation processes and its application by design teams working with design in a Swedish manufacturing company. This paper argues that to be truly beneficial for a design team, measurements of innovation on an operational level needs to take on a loose definition. The main purpose is to *explore how to develop indicators to assess the innovation process, allowing the team to gain insights on their performance in the early stages of a project, when developing radically innovative products.*

2. THEORETICAL BACKGROUND

In engineering design the drive for finding more efficient processes for the conception and creation of new products have sprouted a number of paradigms, e.g. integrated product development [11], etcetera, which focuses on the concurrent activities in the product development chain. In integrated product development the goal is to increase the quality of products but perhaps more importantly to reduce the time to market. Designing is carried out in a team and is therefore a social activity [12]. Teams that are comprised of a diverse set of people, have a better chance in being innovative because they have a multitude of perspectives [13]. To utilize the full potential of a team it is important to communicate and build on each other [14]. However, communication in these heterogeneous teams is challenging and the team members may therefore perceive the interactions as less effective [13].

Bergström [15] found that the individuals of a team share their respective understanding of the task, in this process the team will find a shared understanding. Shared understanding hinges on team communication and without a shared understanding the task of the project the team collaboration will break down, [15]. When a team is using utterances to reach a shared understanding [16], the process is referred to as grounding [17], which is the process of negotiation using utterances to reach a common ground [17]. Yet, some interpret grounding as the process of creating the same understanding [18] of a design problem, thus eliminating the differences in opinion and representations. This is groupthink [19],

where agreement is sought at all cost, but without any shared understanding. A process that transcends from a low understanding and low agreement, and thus high in uncertainty and ambiguity, into an agreement and a creation of shared understanding is prescribed to defer from groupthink [19]. In designing this process also incorporate body language, small skits and drawings of a concept to fill in the gaps [15] of the utterances. When a team collaborates using artifacts, tangible or intangible as a means to cooperate across boundaries and different disciplines, the artifact may be referred to as a boundary object [20]. The boundary object works as a means to bridge the gap in the cooperating party and is used to transmit information and knowledge to achieve a shared understanding. Of note is that the boundary object may mean different things to different people [21], however it is in the difference of interpretation and understanding of concepts that the inspiration for ideation and novel ideas can be found [15].

The facilitator, whose role is to support the process, is not quite a moderator and not quite a coach but somewhere in between. The facilitator does not stand on the sidelines watching the team perform, rather he is part of the interplay of the team. Thus, an important trait of the facilitator is his or her ability to enable engagement, involvement and commitment in the team. The facilitator guides the team and is responsible for the process. An extended discussion about the characteristics of a facilitator can be found in McFadzean [22].

There have been a number of attempts to quantitatively measure the efficiency of team-based innovation. One example is measuring the number of noun phrases [23], where an increased number of noun phrases indicate more innovative results from the team. Another quantitative measurement is the number of ideas that is conceived in the group. A problem with these types of measurements is that they need to be performed by an outsider and analyzed separately to give feedback to the team. An approach, which allows the team to be instrumented [24] in their activities, may be preferred. In that case the team can determine their performance themselves as part of their design process and the instrumentation can be used to improve team performance.

3. METHOD

The empirical basis for this explorative study is found within a global company in the manufacturing industry. The studies were exclusively conducted in Sweden, however in the meetings remote partners connected via telephone to participate. The study reported in this paper is explorative and is seen as the first stage in the design research methodology [25]. The methodology has its basis in ethnographic methods [26], where in situ observations of both collaborative co-located and collaborative distributed team meetings have generated data. All meetings have also been videotaped; these videos serve as a permanent record and have been used together with field notes for later analysis [27]. A total of ten meetings have been followed and the collaborative activities have been videotaped. Videos in combination with field notes have supported the analysis of the design activities. Moreover, due to use of different data sources we are able to reach higher level of validity through data triangulation [28]. To report the empirical findings, excerpts of the meetings are presented. After each excerpt a short analysis is presented to frame the excerpt.

4. COMMON GROUND AND A SHARED PERSPECTIVE IN A TEAM

The excerpts presented in this section originate from the observations of co-located and distributed meetings. The process of grounding [17], i.e. creating a common ground or shared understanding [16] were to some extent present in all observed meetings but is most apparent in the excerpts that were selected for this section.

Excerpt 1: In a co-located meeting there is a discussion on the point of view as to how the team perceives their design and how they suppose they will proceed. One of the designer asks; '*how do you mean this or that…*'

In Excerpt 1, the team is mainly relying on utterances to negotiate a common ground. The utterance '*how do you mean this or that...*' is typical in the grounding process and the aim of the discussion is to share the perspective which is achieved as everyone is invited to share their point of view within the context of the discourse.

> Excerpt 2: In a co-located meeting, there has been a discussion going on between the three designers for some time. They are negotiating what to enter in a spreadsheet that they are currently working with. One of the designers say '*I do not understand this...*' while he is pointing to the screen, '*I do not know what to do with it*'. One of the other designers explains by putting it in another context to help everyone share his understanding.

What takes place in Excerpt 2 is that that the discussion touches on many facets of the problem and allows the entire team to think together. In this case it is perhaps not the common ground that is of importance it is rather, the process, the way that the team reaches a common ground. In these kinds of multifaceted discussions with many turn takings the problem is scrutinized and many aspects is surfaced until a shared understanding is reached. However, the process is often more complex than using mere utterances, as it can involve referencing to other media, as seen in Excerpt 3.

> Excerpt 3: In a co-located meeting, one of the designers brings up a PowerPoint presentation that he finds relevant for the ongoing discussion. When the presentation is displayed on the screen he points to a diagram to explain his point. After some time, the group also uses a piece of paper with a sketch to help them in their discussion. One of the designers uses his hands to support him in his referencing. The discussion continues and they have differentiated opinions on the matter. When they finally reach a common ground the team enters the decision in a spreadsheet.

In Excerpt 3 the team cannot solely rely on utterances to negotiate a common ground. As a complement they add visual imagery through both PowerPoint presentations and sketches alongside the use of body language, this was also found in previous studies [15]. At some points in this discussion it was not even clear if they are developing the same machine. In those cases the visual imagery and the use of body language can work as a boundary object [20] to help the team in their collaborative efforts. There was also a lot of knowledge transfer; the team is sharing their experiences or what they have found out individually about the different manufacturers etc. However the aim of the discussion is to reach a shared understanding of the issue.

> Excerpt 4: In a distributed meeting, one designer is explaining what he is doing. The designer says; '*Just to share the line of thought with everyone...*'

In Excerpt 4, by '*... sharing the line of thought...*', the designer is effectively making his strategy visible for everyone by announcing what he is planning and it seems to put everyone at ease. It is not only important to create a shared understanding of the product itself but also the process on which the collaboration in a team is built. Due to that the geographical distance creates a barrier for the collaborating party, this way of explaining the next step in the process, becomes even more important when working in a distributed team.

5. FACILITATING ACTIVITIES

A meeting is more efficient with a facilitator that drives the meeting — and more importantly the process — forward. The role of a facilitator [22] is more extensive as the person guides the participants through a process and makes an effort to get the most out of a meeting and the attending participants. The role of a facilitator can either be official, that is, the role is assigned to someone, or unofficial, that is, anyone can take on the role in an ad-hoc fashion. When the role of a facilitator is assigned officially that person is empowered to drive the meeting forward and plan for activities to occur.

The Excerpts in this chapter originates in observations of both co-located meetings and distributed meetings.

Excerpt 5: The designers have a brief discussion on where to go next in the project. The atmosphere seems to be a bit laid back. One of the designers is asking open-ended questions, to get the discussion going. He aims to get some of the answers he needs for the documentation. He is also interested in comparing people's point of view.

Excerpt 5 shows the need for an explicit process rather than relying on ad-hoc initiatives by individuals to derive a method of working. Open-ended questions are always good to ask, they usually get the team engaged and willing to share their perspective. A facilitator of the process usually asks these kinds of questions. In this case, there is no facilitator, therefore the team themselves take on that role in an ad hoc manner. Whenever someone suggests a way forward, they are taking on the role of the facilitator and the communication is more fluent. The role of the facilitator is important since it is s/he who will assist the team in finding the right method to continue the work.

Excerpt 6: In a distributed telephone meeting, with participants from the US, France and Sweden, the designer from Sweden is acting as facilitator. He is giving cues to the supplier from the US to give him input. As the US supplier is presenting, the Swedish designer is asking questions. It seems as though this is not the first time that they have had this kind of meeting. The American supplier is using his mouse cursor to point to particular parts of interest in the shared PowerPoint presentation. When the designer from Sweden makes a suggestion, the American supplier is responding affirmatively.

Excerpt 6 originates in a design review meeting, of the work of a supplier. The meeting is well prepared by the supplier; they are rarely deviating from the subject. There are few pauses, they are using PowerPoint and seem to only talk about what is covered in the PowerPoint. Since the PowerPoint presentation is prepared in advance and no one in the group seems to loose track in what is being discussed, one can interpret this as that they are reporting things that are already known, rather than covering novel content. The discussion centers on the technology and the supplier is sharing the results of their work with the French and the Swedes members in the team. It is a good discussion where the US supplier is able to communicate what he want successfully, at least to the Swedish member, which seem to be the facilitator of this discussion and generally responsible for driving the project forward.

In a follow up meeting, two designers decide to include one of their German colleagues, who connect to the meeting via telephone. The two Swedish members are sitting in a conference room in Sweden, Excerpt 7 and
Excerpt 8.

Excerpt 7: When the meeting has started, they are going through their expectations for the meeting, i.e. what do they want to achieve in the meeting. The Swedish designers ask their German colleague, who is off-site to comment on the agenda and goals for the meeting. They are using web-conferencing to share a PowerPoint presentation that they are working on together. One of the Swedish participants asks; '. . . *are you comfortable with what we have written. . .?*' and further he asks '. . . *are you happy in terms of the process. . .?*'. The others assure him that this is great.

In general it is an informal meeting, they are relaxed and the meeting flows well. They are still adhering to a structured agenda, even though the meeting is informal.

Excerpt 8: As the group summarizes the meeting and create actions, one of the Swedish designers asks; '*are you happy with the work we have been doing?*' The two others respond that they are very happy.

To ask everyone if they are happy with the process and with the work that the team is currently engaged helps to create a positive atmosphere in the meeting. It also allows everyone to get a say in the way that the meeting is moving forward and what will happen after the meeting. Being explicit with what is currently on the topic is typical for a facilitator and it is especially important in distributed meetings, as it is not easy for distributed partners to follow what is happening. It also allows the

distributed participants to work in parallel. Prior to the meeting, the researcher was told that this meeting would be with 'the magician', which was the nickname for the person that is quoted in both Excerpt 7 and Excerpt 8. He was given that nickname for his alleged ability to collaborate with people and both excerpts show this person's natural ability to facilitate a meeting.

In all of the observed meetings the role of facilitator was not explicitly addressed to a specific person. However the individuals in the teams took on the role in an ad hoc manner. The excerpts show that the role of facilitator is needed and therefore should be made explicit and teams should be aware that a facilitator may help improve team performance.

6. DISCUSSION AND CONCLUSIONS

As discussed earlier companies usually works at both explore and exploit plan of product development activities. In this study we have made a conscious choice to focus on explore activities as it strives for the development of radical products. Moreover, focus is on assessment at operational level, where innovative development teams work. The complexity faced by these teams can be expected to be greater than in the exploit paradigm, due to higher uncertainty [29].

The ongoing trend in engineering design is to speed up the product development process creating a smother and faster turnaround in each process step [11]. However, our effort is not to speed up the process rather to ensure that it has the qualities needed to reach innovation success. We have seen, based on many years of research in team based design and innovation, that there are many aspects of the work that can be improved [15]. However, in this paper we focus on the ability for a team to negotiate and reach a shared understanding as well as the teams efforts to facilitate the process. These aspects are important because an explicit innovation process with a battery of methods will help the facilitator find the right method to get the job done. An increased awareness of the grounding process in a team will enable the team members to communicate more easily. However, the effort must not only be to get along, this would imply groupthink [19] but rather to enable negotiations, find the differences, and build on each other to find the inspiration for novel ideas that may become innovations. Moreover, we also acknowledge that the two aspects are independent but also inter-related to some extent. For example, the role of a facilitator in the developing a common understanding between the team members can be crucial. Through his effort and vision he could direct the team members' attention towards issues that need clarification for improved understanding in the team.

However, we also recognize that the two aspects found crucial in the present study do not easily lend themselves to be measured. Nonetheless, they are as important or perhaps even more so than the aspects that lend themselves to be measured, for instance, the number of novel ideas, research and development spending, or patents. The tradition has been to focus on easily measurable items instead of focusing on the important measures [8]. The results of this study confirm a shift towards inclusion of subjective indicators. As we find to aspects which can be regarded as being highly subjective in nature, which may raises concern for several researches in the field of performance measurement. However, this is inline with recent development in performance measurement field, where study by Chiesa and Frattini (2007) [30] argues that subjective measures are equally valuable as objective measures. They further suggest that to make an appropriate assessment of subjective indicators, companies need to use independent experts that would evaluate certain processes and translate their evaluation into numeric value for further comparison. Thus, we would like to argue that although challenging, the two aspects of common understating and facilitating activities should be measured and would represent an important evaluation criteria for judging well-functioning innovative teams.

Another study by Parida (2006) [9], argues that large companies due to their complex organizational structure need to focus on developing measurement criteria that provides a holistic view. This means that assessment criteria at operational level need to be supported by changes at managerial level and strategic level. In an organization, the implications of these operational level findings have to be followed through at a managerial and also on a strategic level of the firm. The management level are mainly responsible for how to staff the projects, finding good leaders and assigning roles to allow for effective facilitation, budgeting the projects, attending stage-gate meetings and finding common

ground. In addition to this, the firm needs to define their project portfolio to clearly distinguish between radical and incremental innovation project. The requirements would differ in these types of projects. Coupled with this, managers needs to be aware of and manage the portfolio of people in their firm [31]. Essentially, they need to have the right people at right roles in the right projects at any given time.

In terms of strategic level, the implication of this study may not be directly visible as the focus areas at strategic levels are related to the entire organization instead of the team or project. The areas of concern at this level are related to the vision, mission statement, stakeholders, stakeholders' expectations and the strategy of the firm. Potentially, the most critical issue to consider in this regard would be to first identify if the company is actually striving for being radical innovations. If so, it naturally forms an activity of importance at the vision and mission statement. It is also possible that the stakeholders may have interest in driving the company to be more radical and explorative. This would mean that the company would employ a strategy that aims at developing radical products. However, the achievement of the vision would not be possible without the support process at managerial levels that leads to formation of teams at operational level that would likely share a common understanding and a pre-defined facilitator. Thus, the implication at operational level needs to be matched at both managerial level and strategic level and vice versa. Finally, most evaluation indicators are developed at strategic level and later are cascaded down to the operational level. However, it should also be possible for companies to identify indicators, which are driven by operational level to make sustainable changes at upper levels.

7. LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Like all research, this study has some limitations, which opens avenues for future research. First of all, we acknowledge that the two identified components are not the only components that may need to be measured at operational level for assessing innovative teams. There are many different aspects that can also be important for an innovative team. However, in this paper we have opted to discuss two, given that they were found to be importance in our analysis. Future studies are suggested to further validate the two identified aspects and identify other relevant aspects that are important for evaluating an innovation driven team. Second, although we have contributed towards the recent development in performance measurement literature, which stresses on the importance of subjective measurement, we are yet to provide an advance discussion on how they can be measured. This represents a challenging task, which calls for the attention of other researchers from the performance measurement field. Future studies should aim to develop this important research agenda and move towards establishing indicators for subjective measurements as well. Moreover, the knowledge from operational level needs to be adapted at managerial and strategic level. We believe companies, which are not able to follow this path of thought would not measure the correct indicators. Therefore, future studies are also encouraged to focus on inter-links between the three levels and captures crucial criteria at different levels.

ACKNOWLEDGMENTS

REFERENCES & ESSENTIAL BIBLIOGRAPHY

1. Tukker A. and Tischner U., *New Business for Old Europe*, SUSPRONET, 2004.
2. Randall, D., Harper, R. and Rouncefield, M. *Fieldwork for design — theory and practice*, Springer-Verlag, London, 2007.
3. Rittel, H. and Webber, M., *Dilemmas in General Theory of Planning*, in Journal of Policy Sciences, vol. 4, no. 2, pp. 155–169, 1973.
4. Buchanan, R., *Wicked Problems in Design Thinking*, in Design Issues, vol. 8, no. 2, pp. 5–21, 1992.
5. Thomke, S. and Nimgade, A., *IDEO Product Development*. Harvard Business School case #9-600-143, Harvard Business School, Cambridge, MA, 2000.

6. Cooper R.G., *Perspective: The Stage-Gate® Idea-to-Launch Process-Update, What's New, and NexGen Systems*, Journal of Product Innovation Management, 25, 213–232, 2008.

7. March, J.G. *Exploration and exploitation in organizational learning*, Organization Science, Vol. 2, No. 1, pp. 71–87, 1991.

8. Meredith, J.R. and Mantel, S.J., *Project management: a managerial approach*. 7th Ed. Hoboken, NJ: John Wiley & Sons, 2008.

9. Parida, A., *Development of a multi-criteria hierarchical framework for maintenance performance measurement: concepts, issues and challenges*, Doctoral thesis, Luleå University of Technology, 2006.

10. Törlind, P., Larsson, A., Löfstrand, M. and Karlsson, L., *Towards True Collaboration in Global Design Teams?*, in proceedings of ICED 05 Melbourne, August 15–18, 2005.

11. Andreasen, M. and Hein, L., *Integrated Product Development*, Springer, Berlin, 1987.

12. Bucciarelli, L.L., *Designing Engineers*, Cambridge, Massachusetts, MIT Press, 2002.

13. Phillips, K., Liljenquist, K. and Neale, M., *Is the Pain Worth the Gain? The advantages and Liabilities of Agreeing With Socially Distinct Newcomers*, in Personality and Social Psychology Bulletin, vol. 35, no. 3, pp. 336–350, 2009.

14. Kelley, T., *The art of innovation: lessons in creativity from IDEO*, America's leading design firm, New York: Currency/Doubleday, cop., 2001.

15. Bergström, M., *Probing for innovation: how small design teams collaborate*, Doctoral thesis, Luleå University of Technology, 2009.

16. Arias, E., Eden, H., Fischer, G., Gorman, A. and Scharff, E., *Transcending the individual human mind — creating shared understanding through collaborative design*, ACM Transactions on Computer-Human Interaction (TOCHI), vol. 7, no. 1, pp. 84–113, 2000.

17. Clark, H. H. and Brennan, S. E., *Grounding in communication*, in L. B. Resnick, R. M. Levine and S. D. Teasley (Eds.), Perspectives on socially shared cognition, Washington, DC: APA, pp. 127–149, 1991.

18. Visser, W., *Collaborative Designers' Different Representations*, In Proceedings of 16th International Conference on Engineering Design, ICED07, Paris, 2007.

19. Janis, I., *Victims of Groupthink*, Boston, MA: Houghton Mifflin, 1972.

20. Star S.L. and Griesemer J.R., *Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39*, Social Studies of Science, 19, 387–420, 1989.

21. Larsson A., *Making Sense of Collaboration: The Challenge of Thinking Together in Global Design Teams*, GROUP'03, 2003.

22. McFadzean E.S., *Developing and supporting creative problem solving teams: part 2 — facilitator competencies*, Management Decision, v. 40, issue 6 pp. 537–551, 2002.

23. Mabogunje, A. and Leifer, L. J., *Noun Phrases as Surrogates for Measuring Early Phases of the Mechanical Design Process*, Proceedings of the 9th International Conference on Design Theory and Methodology, ASME, Sacramento, California 1997.

24. Dym, C., Agogino, A., Eris, O., Frey, D. and Leifer, L., *Engineering Design Thinking, Teaching, and Learning*, Journal of Engineering Education, Vol. 94, No. 1, January 2005, pp. 103–120.

25. Blessing L.T.M. and Chakrabarti A., *DRM, a Design Research Methodology*, Springer Verlag, 2009.

26. Blomberg, J., Giacomi, J., Mosher, A. and Swenton-Wall, P., *Ethnographic Field Methods and their Relation to Design*, in Schuler, D. and Namioka, A. (Eds.) Participatory Design: Principles and Practices, Hillsdale, NJ: Lawrence Erlbaum, pp. 123–155, 1993.

27. Jordan, B. and Hendersson, A., *Interaction Analysis: Foundations and Practice*, in the Journal of the Learning Sciences, vol. 4, no. 1, pp. 39–103, 1995.

28. Yin R.K. *Case Study Research — Design and Methods*, Sage, Newbury Park, 2003.

29. Tushman, M.L. and O'Reilly, C.A., *Ambidextrous organizations- managing evolutionary and revolutionary change*, California Management Review, Vol. 38, No. 4. pp. 8–30, 1996.

30. Chiesa, V. and Frattini, F., *Exploring the difference in performance measurement between research and development: evidence from a multiple case study*. R&D Management, Vol. 37, No. 4. pp. 238–301, 2007.

31. Ready, D.A. and Conger, J.A., *Make Your Company a Talent Factory*. Harvard Business Review, June 2007.