INTERNATIONAL DESIGN CONFERENCE - DESIGN 2006
Dubrovnik - Croatia, May 15 - 18, 2006.

DESIGN 2006

INTEGRATED INNOVATION CAPABILITY

C. Buergin

Keywords: innovation management, innovation capability, integrated management, innovation assessment

1. Innovation as a future task

The capability to innovate is of particular relevance for business growth. This demonstrates the McKinsey Quarterly survey of over 9'000 global business executives: the majority (43%) of executives selected the capability to innovate as the most important factor for growth for the next five years. 71% selected faster pace of technological innovation as an important success factor on profits. According to the survey intense competion (77%), satisfying sophisticated customers (64%) and substitutions by competitors (60%) are constraining factors for growth [Carden, Mendonca et al. 2005]. In this context the big question to pose: How to define innovation capability and how to improve the innovation capability of a company to meet the challenge and the opportunitities in the market.

The desired output of a company's innovation capability is more or less clearly definable: First to enable business growth and high profits and second as a precondition to develop the right innovations with the right price and the right quality as fast as the relevant situation in the market and competition change. But what are the input factors for innovation capability which enable the desired output – such as the innovation process to advance ideas to products or the innovation resources to support the innovation process. In theory numerous research concerning success factors of innovations on company- and project level exist neither being consolidated in an overall concept of innovation capability nor processed in a way that the concept may be applied in everyday business life.

Thus this contribution presents on the one hand a concept to visualise the input factors of innovation capability in the context of the business environment. And on the other hand an outlined instrument and the appropriate procedure shall be presented to support companies in practice to measure and to develop their innovation capability continuously.

2. Definitions

In the field of business management in this case innovation management the definitions of terms are crucial to understand the issue and to avoid discussions about terms. The following definitions shall give the base for the term "Integrated Innovation Capability".

2.1 Integrated Management

The description "integrated management" characterises a holistic view on a company's tasks. It bases primarily on the approach, that the accomplishment of management tasks need a frame of reference, which allows for the increasing complexity and dynamic task sharing in a systemic way. First systemic signifies, that several parts of a company execute different tasks in an independent way, but as a whole align consistently. Further systematic performance is characterised by its crosslinking between the different parts of the system. Next the basic openness of systems necessitate the embedding of companies in its environment [Tschirky & Koruna 1998].

2.2 Innovation Management

Innovations are normally just successful, if they don't have a coincidental character, but prepared and achieved systematically and the innovation process is coordinated. For this purpose it requires an innovation management. Resultant following tasks:

- Set goals for innovations to implement in the company.
- Make decisions for the development of innovations and to the economic configuration.
- Design, regulation and controlling of the innovation process.
- Creation of an organisation to provide the success of innovations.
- Design of an information system to embrace the whole innovation process.
- Development promotional social relationships in the company. [Bircher 2005]

2.3 Types of Potentials

In literature the terms potential and capability may be applied as synonyms thus the definition of innovation capability bases in this case on the definition of innovation potential by Tschirky. Potentials signify latent or effective available constellation within a company, which by company activities may be made available for the benefit of all stakeholders and of the company itself. With regard to the developing of an integrated innovation capability management approach following potentials come to the fore: Innovation-, human-, management-, know-how, technology-, purchase-, marketing-, finance- and cooperation-potential. To specify: The cooperation potential as a design of collaborations may multiply the other potentials (e.g. by strategic alliances). Finally the various types of potentials are sequenced by processes. These potentials define as a conglomerate the potential of a company. The company's potential is embedded and relates to opportunities in the business environment, which as well may be described as potentials. The strategic task of management is to fit the strength of the company to the opportunities in the environment [Tschirky & Koruna 1998]. Porter defines five forces [Porter 2004] to analyse its business sector and its characteristic to provide a basis to map out an (innovation)-strategy . Thus the business environment is characterised by the elements customer, supplier and competitor. Partners & networks (e.g. strategic alliances with suppliers, cooperation with universities) are as well situated in the business environment, as described before, which enable a multiplication of potentials.

2.4 Innovation Capability (Innovation Potential)

Dreesmann

According to Dreesmann innovation potential is defined as six fields of competences (professional competence, personal competence, constructive competence, social competence, methodical competence, participating competence) and three constraining levels (social surrounding, organisational frame, innovation system) [Tschirky & Koruna 1998].

Meier

Meier defines innovation capability as an interaction of different elements as strategy, resources, processes, methods, tools, organisation and culture which in interaction enable the success of innovation and the success of the whole company [Meier, Fadel et al. 2004].

Pleschak & Sabisch

Pleschak and Sabisch define innovation capability by following factors:

- Managers and employees with their qualification, their know-how and their professional and methodic competence.
- Material and financial resources of a company
- Management system and standard of organisation
- The specification of the innovation system and its embedding in inter organisational networks
- Focus on the most promising innovation and implementation of an optimal ratio of product-, process-, and organisational-innovations.

- Innovative climate in the company, which is affected by a creative and open working atmosphere, by promoting and stimulation of new ideas, by attendance of everyone to avoid errors and obsolete functions, by interdisciplinary proceedings and by a developed information system [Pleschak 1996].

2.5 Consolidation to Integrated Innovation Capability

Following picture relates the above-named definitions:

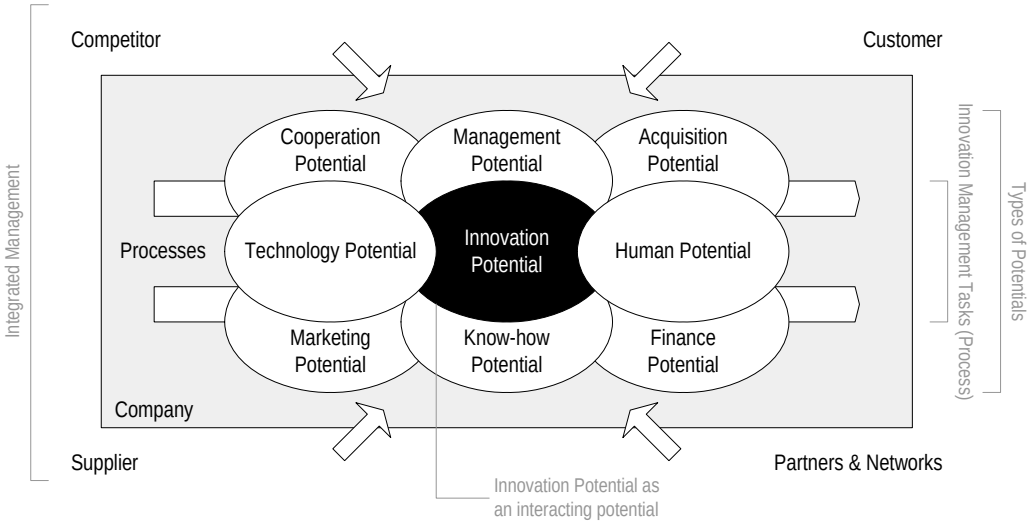

Figure 1. Correlation of innovation capability (innovation potential) to the business environment (based on Tschirky)

3. Concept of an instrument to improve the ability to innovate

The background of this contributionprovides the project i-Puls[1] with the goal to measure and to improve innovation capability of several swiss small and medium-sized businesses (SMB). To enable this goal an instrument shall be developd which the participating consulting companies may adopt in their services. Until now the project bases on the approach by Meier [Meier, Fadel et al. 2004] on which a questionnaire was attached. The questionnaire was used in several companies to measure and to improve the innovation capability. The consultants in the project find faults in the conceptual frame of the questionnaire. A main aspect is that the concept overbalances enablers like methods and tools and underweights human factors like the innovative culture. Another point is that the approach doesn't connect the innovative company with its business environment to map out an innovation strategy. These inputs from shall be integrated in a new concept and as well in the instrument.

The ability to innovate may be viewed as an intern strength of a company to act successfully in the market. The interaction of a company with its environment implicates to adjust the innovation capability of a company to its market needs – thus the opportunities and threats of the external factors shall be included as well in the model. This systemic approach may be viewed as a landscape. The landscape is classified in two major parts: Situated in the middle the innovative company itself and peripheral the company's business environment.

[1] Project i-Puls „Measurement and Development of Innovation Capability" supported by the Federal Office for Professional Education and Technology KTI/CTI

3.1 Business Environment

To link the external opportunities with the internal strength the five forces model of Porter is drawn on this model to provide a basis to map out an innovation strategy. The five forces model of Porter defines following five factors that influence the market situation and of course the innovative company: Customer, supplier, competitors, the rivalry between competitors and possible future substitutes. The power of the forces determine the potential profit of a business sector and the weaker the forces the better the opportunity for above average performance. The most distinct force determines the profitability of a sector and therefore very important for mapping out an (innovation)-strategy [Porter 2004].
Besides these elements the element partners & network are situated in the business environment as a multiplicator of potentials. In the following chapters these elements are described more in detail.

Supplier

In a strategic view, if the bargaining power of the supplier increases, the price of supplied products will increase and the prospective profit thus will be reduced. This scenario is possible if e.g. the products the supplier provides are unique or if the supplier accomplished to impose costs if the customer changes the supplier. The strategic challenge is to change the situation like gaining a stronger position with e.g. finding new suppliers or buy a big amount of products [Porter 2004].
In a cooperative point of view the interfaces between company and supplier should be designed optimally due to gain market information (work-flow) and an optimal collaboration e.g. integration of the supplier into processes of the innovation process [Hauschildt 2004].

Customer

In a strategic view the customer will capitalise its bargaining power. In this case this will reduce the margin. A strategic scenario between customer and supplier is already written in the chapter *Supplier* above [Porter 2004].
In a view of cooperation the question is how the innovative company should gain new customers and informations about the market. In this context approaches like the use of lead users as checkout or reference customers. The customer needs should be integrated into company tasks to design products which fit needs [Hauschildt 2004]. This demands a Market Intelligence.

Competitor

The market entry of new customers or product substitutes necessitate adequate reaction in the market, which inevitably use resources of the company and thus reduce company's profit. Prophylactic strategy may be to increase the amount of products and marketing and to enhance the distribution channel. A barrier of market entry is e.g. the economy of scale, the loyalty of customers to a brand, the access to distribution channels. An entry of new competitors may be enabled by new market situations like e.g. a run-out of a patent [Porter 2004].
In view of cooperation the establishment of research networks, the use of technology transfer systems and joint ventures may lay the foundation of increased corporate interaction for innovation. For this kind of collaboration the term "co-opetition" is used [Hauschildt 2004].

Partners & Network

The three elements supplier, customer and competitor deduced from the five forces model may as well be distinguished as partners in a cooperative point of view (as describd in the chapters). In this context the main purposes for a cooperation are on the one hand to complement material (finances, infrastructure, technologies) or immaterial (know-how, skills, technologies) resources and on the other to gain market information and to acquire new customers [Hauschildt 2004].

3.2 The Innovative Company

According to the statement of the project partners of the project i-Puls, the two main capabilities "cultural capability" and the "procedural capability" are located balanced with the same weight in the

center (Figure 2) – these two capabilities enable to generate ideas and to proceed the idea into a successful product. To align the company strategically, the generated ideas are selected and propelled in an innovation process according to the criterias resulting from the innovation strategy - as an original document of volition situated in the leadership level - due to the business environment. The resource level contains the resources as follows: Physical persons (detached from its know-how and abilities), technologies, financial and material resources. These resources are provided to support the process of generating ideas and realising new products.
The leadership and resource level form the conditions in which the cultural and the procedural capability have to agitate to subserve the company's goals (described in the (innovation-)strategy).
A similar dual perspective is described by the approach Continous Innovation Capability by Boer. To meet the customer demands the company should possess on the one hand an operational effectiveness to satisfy the today's customer in term of function, price, time, quantity and place and on the other a strategic flexibility to enable tomorrow's customer needs. The strategic flexibility should enable the development new configurations of products, market approaches, processes, technologies, competencies, organisation and management systems. The operational effectiveness is based on exploitation capabilities and the strategic flexibility on exploration capabilities [Boer 2005].

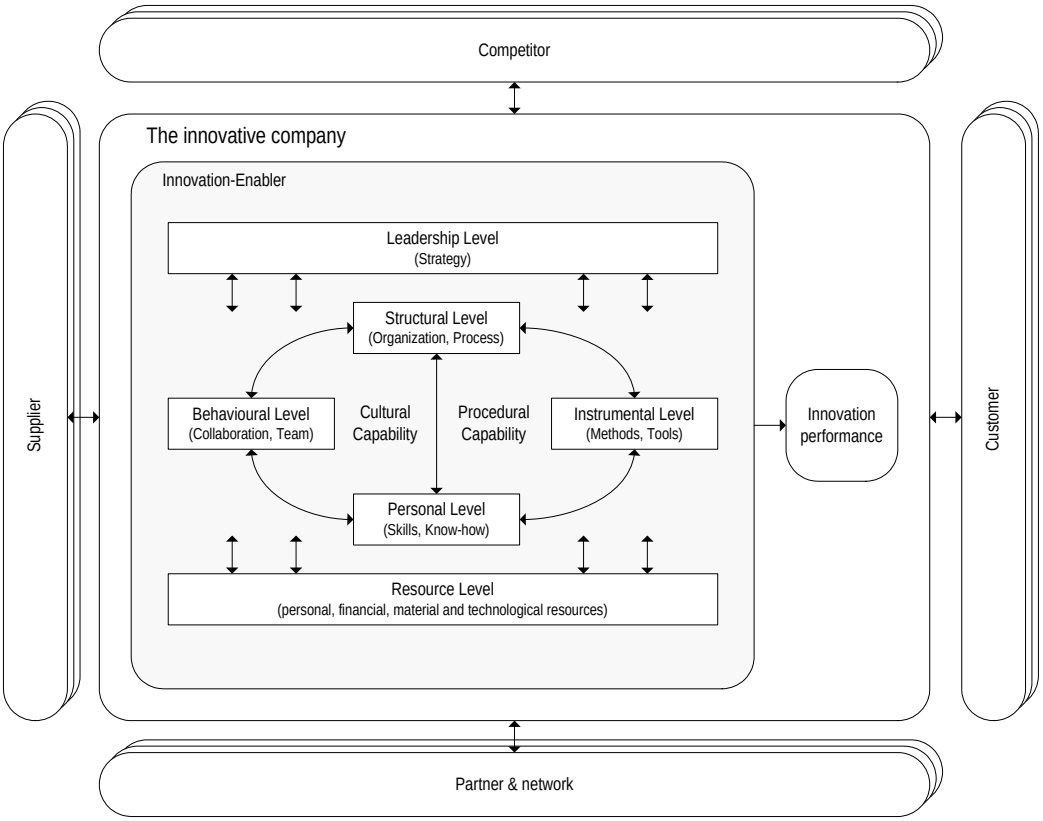

Figure2. Inovation Capability Landscape

Leadership Level

The leadership level contains the innovation strategy, which set the long term goal of the company's innovative activities. The survey of the "Chief Executive" attests, that 40% of the CEOs consider a clearly defined innovation strategy as one of the main factors to process an idea into an innovation. The lack of an innovation strategy as well desiderates the prioritisation of innovation projects. In the

model the leadership level interacts between business environment and the innovative company. It considers the fit to the market (supplier, customer, competitor), the core competencies, and correlates the (product-)innovation strategy to the corporate strategy [Bircher 2005].

Personal Level

According to Peter Drucker the employees are the most valuable resources of every company and the leader's character as the most important means of guidance – character quotes example and character will be imitated. To relate to innovation a company needs intrapreneurs - entrepreneurial thinking and initiative employees - the entrepreneur in the enterprise. The intrapreneur is characterised as a high-potential and highly motivated employee [Born 2005].
So the personal level references on the indivual in the company and its interactions due to its individual talents. This level is differentiated between the stage of maturity of the individual capability and know-how and the stage of maturity of the individual motivation.
The company's challenge concerning innovation is how to develop intern persons or how to acquire extern persons to achieve a continous flow of ideas and process the ideas gradually into an innovation. To meet this challenge the concept represents the cultural and the procedural capabilities. The cultural capability describes the company's capability to develop a culture which supports the process of ideation (new ideas) as the front end of the innovation process (idea into innovation); in a way that the right employees get in contact and interact in a way to subserve the innovative goals. The procedural capability specifys the employees capability to use the instruments and tools to support the innovation process.
The troika personal, structural and behavioural level (→ cultural capability) represents the employees who in which way over processes or the form of organization interact. The connection over the organization induce the interactions among employees and as well the interaction between the management and the employees. Aspects are highlighted like how to overcome opposition against innovation, how management supports innovative activities, how management quotes example for innovation, how much resources are investigated in innovative activities or how much risk management takes.
The troika personal, structural and the instrumental level describes the procedural capability where the employees support processes in the innovation process with instruments (methods, tools). Aspects like continuing education in methods and tools are important to support the innovation process.

Behavioural Level

The cultural capability may partly be described as the dimension behaviour, specific the collaboration and the way of contact among each employee. In the level of behaviour aspects like way of communicating, willingness to responsibility, style of leadership (e.g. participatory), incentive system or acceptance of risk are described.

Structural Level

The structural level describes the form of organisation and the shape of the innovation process. Concerning the innovation process the question is how to move ideas into products and introduce them into the market, including processes for generating ideas, conceptualizing, embodiment, technology support, production, and launching the product. Concerning the form of organisation the question is which form of organisation supports the most the innovation process and how flexible personal resources may be relocated. As well the size of an organisation shall be answered in this level. As an excursus according to Gladwell [Gladwell 2000] groups of 150 are an organized mechanism that makes it far easier for new ideas and information moving around the organization to tip; to go from one person or one part of the group to the entire group all at once.

Instrumental Level

The specific working procedures that improve the effectiveness and efficiency of a company's approach to innovation and communication like software, hardware and equipment to facilitate firstly the design of the products and secondly the management of product information.

Resource Level

The personal, financial, material and technological resources that enable a company's innovation process and the resources that are spent to improve the cultural capability of a company.

Innovation performance

This element represents the output generated out of the resources spent in the innovation process (e.g. number of new products launched, time to market).

3.3 Design the instrument

The concept itself isn't an instrument yet a company may use to measure and to improve its innovation capability - but may provide a basis for an instrument. The instrument shall be designed in form of a questionnaire to which companies may apply continuously to locate call for action and to transform current state into target state. Thus to each element several questions are attached.
Several questionnaires are now under construction. A first short assessment which doesn't take much time to alert a company on its innovation capability and on its call for action. A second assessment to assess the current state of innovation capability from the view of different employees. And a third assessment to assess the current state and define a target state of innovation capability.
The short assessment mainly focuses on management ratios and is separated in output factors (innovation performance) and input factors (e.g. resources, processes). The second assessment is designed as a checklist questionnaire to definy the current state. And the third questionnaire is based on the Capability Maturity Model Integration (CMMI). CMMI is a method to evaluate and measure the maturity of the processes in organizations on a scale of 1 to 5 – this method is adapted to measure the innovation capability and to set the target state of maturity level [Meier, Fadel et al. 2004].
The proceeding in the assessment is shown in the following graphic. The assessment may start in provision of information I or as well II. Below the roles are listed which participate in the assessment.

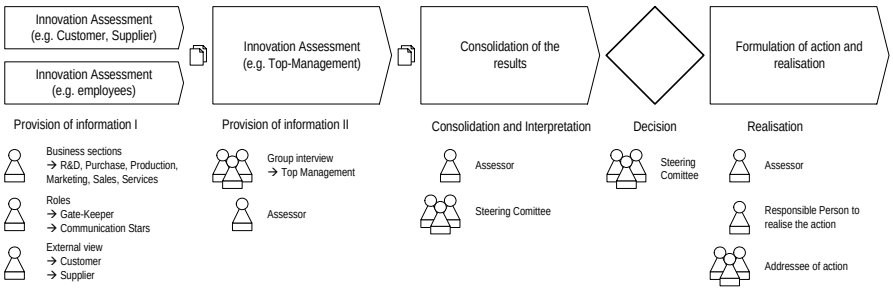

Figure 3. Proceeding of the assessment

4. Conclusion

This concept is a try to catch up the character of innovation capability in its most important facets. Its specialty is the concept which weights cultural (cultural capability) soft factors as high as more hard factors like processes (procedural capability) and sets them in a systemic way relevant to its business environment. Thus the actions to improve the innovation capability may be aligned to its context. As a further idea the life cycle of a company may be as a well another contextual factor which doesn't exist yet in the concept. Because relevant to a company's lifecycle the strategy may vary thus another goal regarding innovation is set.
Measurement of innovation capability may be viewed as a benchmark among different companies. The variation of innovation goals referencing to it's contextual factors has to be considered in the assessment of the innovation capability. The company's optimal innovation capability is thus highly dependent to its business environment. To formulate the right questions in the right profundity to assess the integrated innovation capability will be a challenging further step.

Acknowledgement

This paper is dedicated in memoriam of Prof. Dr. Markus Meier. Markus Meier was Professor of Mechanical Engineering, head of the Center for Product Design and a member of the Department of Mechanical and Process Engineering at the Swiss Federal Institute of Technology Zurich from 1996 to 2005.

References

Bircher, M. (2005). Die integrale Produktinnovation ein Ansatz zur Unterstützung von Innovationsprojekten. Zürich, ETH.

Boer, H., Kuhn, J. et al. (2005). Continuous Innovation Coping with dualities - an integration perspective.

Born, H. (2005). Peter Drucker. Weltwoche. 46.

Carden, S. D., Mendonca, L. T. et al. (2005). What global executives think about growth and risk. In: McKinsey Quarterly 2.

Gladwell, M. (2000). Tipping Point wie kleine Dinge Grosses bewirken können. 2. Aufl. Berlin, Berlin-Verlag.

Hauschildt, J. (2004). Innovationsmanagement. 3., völlig überarb. und erw. Aufl. München, Vahlen.

Meier, M., Fadel, G. et al. (2004). The Impact Model for Innovation Success and its Assessment. Zürich.

Pleschak, F., Sabisch, H. (1996). Innovationsmanagement. Stuttgart, Schäffer-Poeschel.

Porter, M. E. (2004). Wie die Kräfte des Wettbewerbs Strategien beeinflussen. In: Harvard Business Manager.

Tschirky, H., Koruna, S. (1998). Technologie-Management. Zürich, Verlag Industrielle Organisation.

Christian Buergin
ETH Zurich, Department of Mechanical and Process Engineering
8092 Zurich, Switzerland
Tel.: +41 44 632 49 68
Fax.: +41 44 632 11 81
Email: christian.buergin@imes.mavt.ethz.ch