

EVALUATION OF ENTERPRISE'S INNOVATION ACTIVITY

Prof. Dr.-Ing. Udo Lindemann, Dipl.-Ing. Christoph Baumberger, Dipl.-Ing. Daniel Karl Fuchs, Dipl.-Ing. Bernd Jokele, Dr.-Ing. Frank J. Schumann

Abstract

In many situations the question about the evaluation of an innovation arises. Here a product as well as the supporting process itself is considered during the analysis. Within the elaborated model an evaluation system for innovation of an enterprise is introduced. During the analysis of the current situation the model is characterized by an objective quantifiable component, as through a documentation of the subjective view. In addition the model allows an adaptation of the basic pattern for different areas of application. During the application of the evaluation model enterprises or departments can be positioned relatively to each other. With that the basis for a transparent process is given and the possibility of defined optimisations can be supported.

1 Problem description

Since change and progress accelerate, competition gets fiercer, cost pressure increases and product tender converges but customer claims in terms of economical and functional value rises as well companies have to undertake continuous innovation activities to remain on the forefront of competition. Either by creating innovative, unique products to differ from the competition or by process improvement which lead to cost advantages and price differentiation – only in this way economic efficiency, corporate success and long-term growth can be ensured. Unfortunately innovation activities, i.e. any R&D effort, feature some attributes which differ considerably from other management and value-added processes within organisations. The intention and the outcome of an innovation activity as well as the eventual reward often cannot be clarified entirely in the first place. Beyond it innovations are characterised by exceptional complexity, high risk of failure and uncertainty as well as emerging opposition caused by the interrelated organisational changes.

Apparently the initial point, the process of innovation and the eventual (market) success cannot be completely comprehended and predetermined by research or methodology. On the other hand innovation activities require substantial expenditures in advance and long-term financial investment on expense of the enterprise. Thus innovation activities account for some of the most prevalent management problems within organisations. Enterprises now have profound interest in overseeing innovations in an adequate and effective way, thus involving all participating parties, creating appropriate organisational conditions, reducing risks and oppositions and eventually realising and launching innovations successfully to the market. In general these issues are covered by the field of innovation management.

The following paper shall contribute to analyse and support regarding activities. At this a framework for description and evaluation will be introduced, which includes the innovation management issues portrayed above and thus makes them manageable indeed.

2 State of research

Due to the importance and urgency of continuous innovation within companies there was undertaken comprehensive research on conditions, influences and success factors of innovation management in recent years (e.g. [1], [2], [5], [6], [7], [8], [9], [10], [11], [12]). The research mainly focus on organisational conditions as well as the process management and on innovation methods. It involves microeconomics and social sciences as well as engineering disciplines. On the basis of empirical success factor studies there were developed some good evaluation tools by consulting firms and research institutes as well e.g. the "Innovation guide" by the Deutsches Zentrum für Luft- und Raumfahrt, [2]. However in the opinion of the authors the existing approaches does not provide an extensive solution for evaluating the over-all performance of an organisation but concentrate primarily on product evaluation or process analysis. On the other hand there is a broadly accepted and applied evaluation approach by the European Foundation of Quality Management assessing the excellence of corporate management by concentrating on the quality of management, processes and products [4].

In a similar manner the authors attempt to develop an approach which allows to map and evaluate the innovation management system, the embedded processes and the eventual innovative results of an organisational unit. By understanding innovation as an integral executive and managerial function within any economic enterprise the authors want to provide a system for supporting innovation processes in companies and for exposing inconsistencies, lacks and possibilities for improvement in a lasting way.

3 Innovation model compound

The model in hand for evaluating the innovation performance of an enterprise was developed with regard to the extensive innovation management literature (esp. [7], [11]). The suggested so-called "Trias-model" (trilogy model) consists out of three aspects:

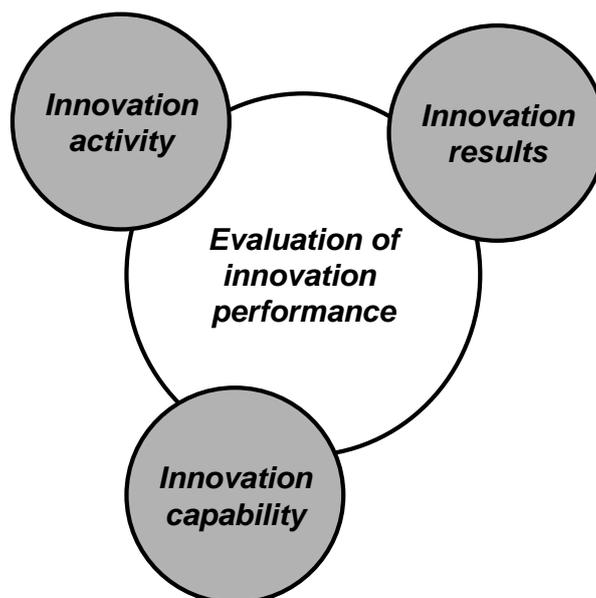


Figure 1: Evaluation of innovation performance

The meanings of the different aspects are described in the following paragraphs:

- The aspect of **innovation capability** expresses to which degree an enterprise is enabled to innovate in principle and how the organisational background is distinct. Thus innovation capability expresses the potential to develop new products, procedures etc.. The aspect includes the existence and configuration of all individual and organisational prerequisites as well as how the company and its members face and exceed existent limits when creating innovations. In detail subjects like sufficient resources, appropriate competences and employee training in combination with communication and cooperation skills are treated.
- However, the "Trias model" considers management processes too. This aspect is declared as **innovation activity** and describes the problem solving process within the enterprise. According to that, the innovation is preordained by the interactivity of processes and decisions. Here abilities and skills will be employed to produce a product/result or to promote an idea. Thus innovation activity is the link between the qualification to achieve something (innovation capability) and a corresponding result (innovation results).
- Finally within the aspect of **innovation results** is shown which outcomes an enterprise ultimately achieves within its innovation system. But not only the actual and direct results of the innovation process are treated. Rather all technical, economic, individual, and system-wide social effects are considered at this.
- The three aspects are summarized as **innovation performance**. Through that an integral statement about the performance of the innovation system of a company can be made (cp. figure above).

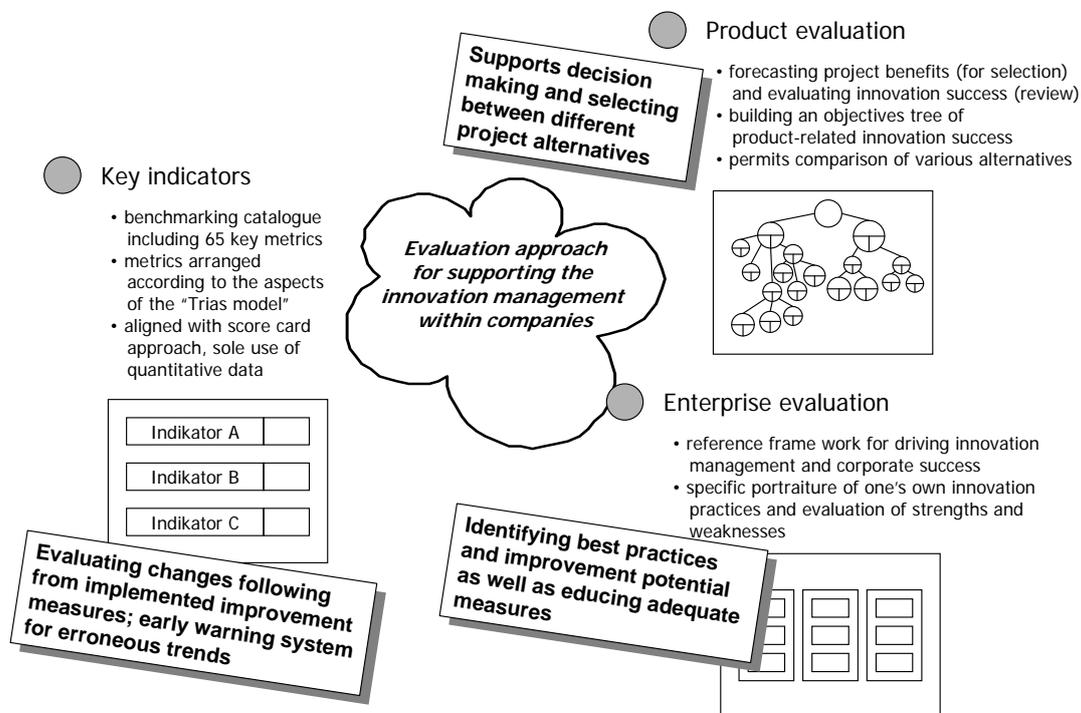


Figure 2: Evaluation approach for supporting innovation management within companies

Elaborating that approach the authors defined further criterions to describe the particular aspects and appointed different evaluation approaches. On that account the designed evaluation system consists out of three modules, which in each case has different designation and function in assessing innovation-related areas.

In detail this evaluation modules are:

1. The module **product evaluation** is based on the concept of the utility analysis, [3], [9]. The focus is the project selection during the planning phase before the actual product development begins. Otherwise it is also conceivable for subsequent evaluation or comparison with competitive products.
2. The module **key indicators** is associated with the Score Card concept and applies metrics and ratios. Its implementation leads to a controlling instrument for the innovation management system of an enterprise.
3. The module **enterprise evaluation** is based on the EFQM concept. It is to be regarded as the main result of the work at hand. It helps to reflect the current situation concerning the innovation management of an enterprise thoroughly. In so doing the internal practices of innovation management will be revealed and compared to other companies (or departments). Finally best practices can be identified and improvement potentials are made transparent.

The particular modules will be described in detail hereafter.

3.1 Module product evaluation

The module of **product evaluation** facilitates the decision making concerning project alternatives or product ideas, e.g. for selection, [9] . Furthermore a retrospective evaluation of a developed product can be undertaken e.g. for comparing products with a benchmark, competitive products or allocated targets. Thus the evaluation module helps either to evaluate (existing) products or to select between upcoming projects.

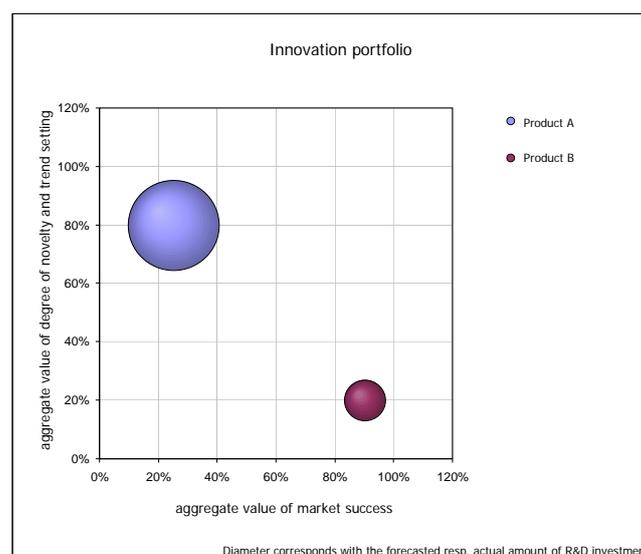


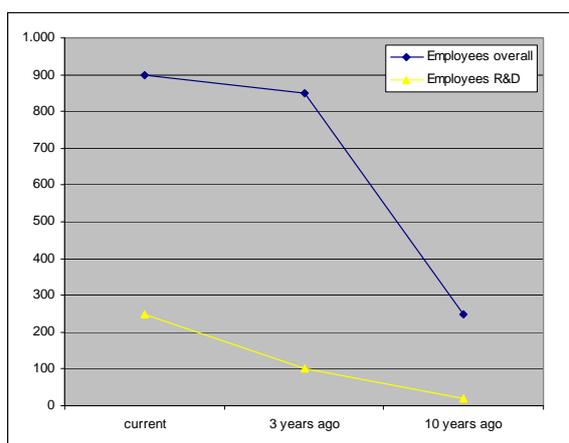
Figure 3: Innovation portfolio

- Concept and criterion derivation: The implemented evaluation procedure is similar to the utility analysis, [3], [9]. According to the aspect of innovation results in the aforementioned "Trias model" an objective system is defined consisting of technical and economical criteria. The level of innovation success then is measured according to the novelty of the development, the degree of trend setting as well as the market success.
- Application of the module: A rough valuation is made possible using four-stage, ordinal scales. I.e. four characteristic, mainly qualitative descriptions are attached to each criterion. For receiving a specific evaluation upper and lower bound as well as the actual expectations must be defined by the examinant. The actual expectation then is scored on that four-stage scale. An exemplary evaluation result and its illustration is given in the figure above.

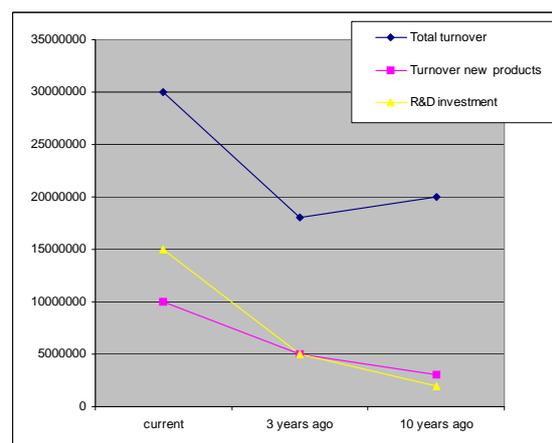
3.2 Module key indicators

The module of **key indicators** follows the concept of a score card. A catalogue with 65 metrics allows surveying the actual status of the innovation system of an enterprise. The regular application of the system makes it possible to control general trends connected to the innovation management system. Moreover the effects of implemented improvement measures can be estimated. In case of significant deterioration of selected indicators convenient steps can be taken early enough. In addition the comparison with other departments or enterprises is possible.

- Concept and criterion derivation: The evaluation approach was intended as a measuring instrument for the executive board of innovation intensive departments. This module includes all aspects of the suggested innovation model. A selection of the most common factors were assigned from the literature (esp. [1], [6], [7], [10]) and allocated to the three aspects of the "Trias model", e.g. the number of employees in research and development (innovation capability), the number of prescribed milestones in the innovation process (innovation activity) as well as the ratio of new developed products in the total turnover (innovation result).



Innovation capability: Total and R&D employees (current, 3 and 10 years ago)



Innovation results: Total turnover and turnover of new products compared with R&D investment (current, 3 and 10 years ago)

Figure 4: Innovation capability and results

- Application of the module: Since the criterions of this module mainly are of quantitative, easily measurable manner a separated conception does not appear necessary. The values usually can be received directly from existing annual reports or employee questionnaires and should be displayed over time or in comparison to other companies. According to the score card concept the dates shall be not reduced to a single number, but represented in an overall view exemplified in the figure above . Apparently conclusions can only be drawn from retrospective comparison with other departments, former situations or desired values. Alike that counts for the main problem of the present evaluation approach: Decision makers must be aware of the specific influence of certain criteria to draw right conclusions and define appropriate measures. I.e. that means that the influence of the number of employees onto the innovation efficiency should be made clear as well as how this is connected to the turnover of new products (cp. figure above).

3.3 Module enterprise evaluation

Finally the module of enterprise evaluation shall be introduced. It allows to survey the practices and procedures of an enterprise in the area of innovation management. Here the advantages and disadvantages in the internal innovation practice can be uncovered. One of the prevalent objectives of this module is to gather information that allows a significant statement on the current status of the enterprise.

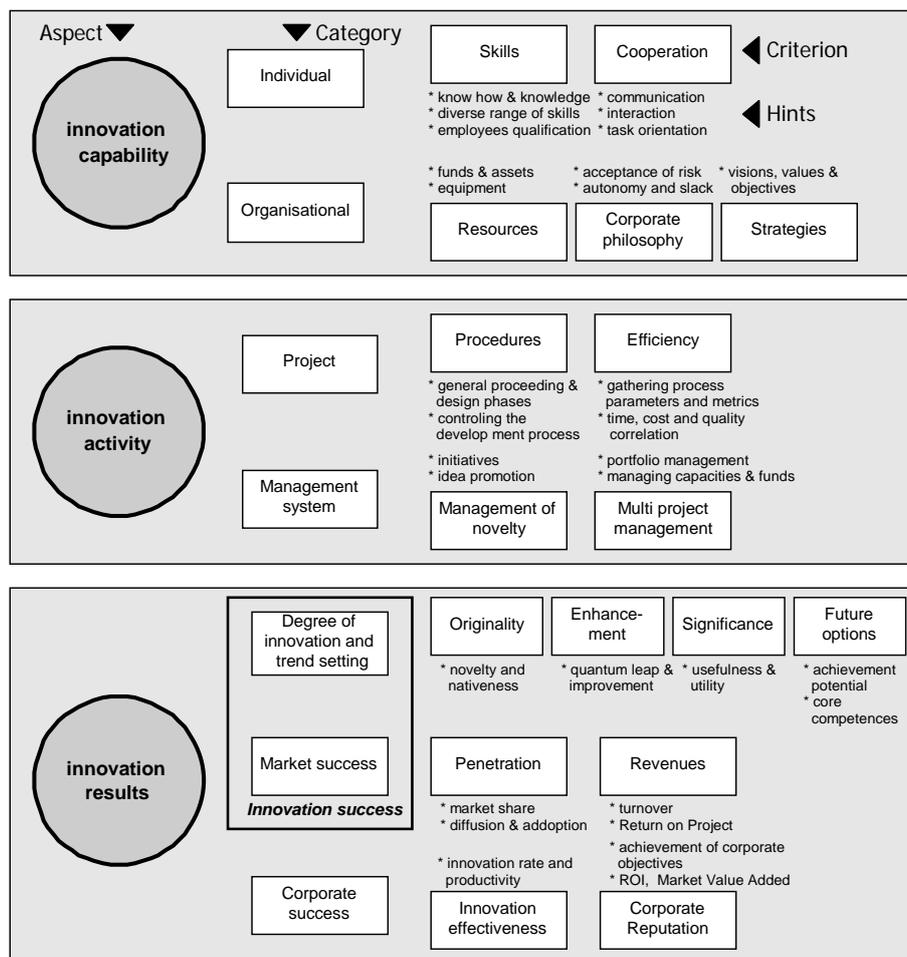


Figure 5: Enterprise evaluation

Competitor's practices or an ideal can be used as reference. The idea of the EFQM approach in combination with the presented "Trias model" allows to reveal opportunities for improvement, enhance organisational potential and finally leads to a higher level of innovation performance.

- Concept and criterion derivation:** Basically the configuration of the evaluation module is orientated on an elaborated "Trias model" but features fundamental characteristics of the EQM approach as well, e.g. the lists of possible areas to address below each criterion which are intended to further exemplify the meaning of the criteria. According to the "Trias model" the three aspects "innovation capability" (structural conditions and general potential of the innovation department), "innovation activity" (execution of the innovation process with respective decision-making) and "innovation results" (appearance and effects of innovative products) are prefixed on the first level. Attached to that is a tree-like structure containing categories, general criterions and specific hints (cp. figure above as well): The categories help to arrange the criterions in form and content. The criterions themselves are valid for different enterprises and describe the particular spheres of corporate innovation management in further detail. Still due to their universal character there is another structural level including various hints which clarify the specific meaning of each criterion and helps a company to classify its own performance. Apparently the model esp. the hints are not completely elaborated yet. But in so doing the model shall kept open and flexible for future modulation and corporate customisation.

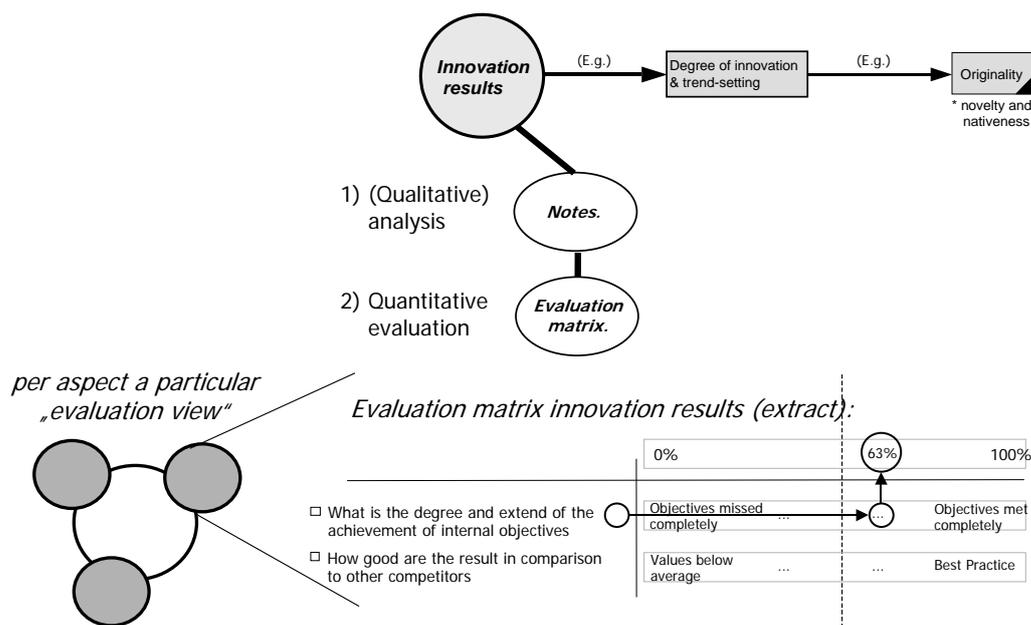


Figure 6: Evaluation matrix innovation results

- Application of the module:** Of course the introduced evaluation criteria now have to be specified anyhow. The authors of the present approach suggest two steps at this (cp. figure below). Starting point of the evaluation is the survey in accordance with the above-mentioned criterions and hints as appropriate for the particular characteristics of the evaluating enterprise. In the first step the hints shall be specified either in a verbal, qualitative mode or on the basis of quantitative figures (using measurements or estimations). In the second step this "real" values will be scored with a specially designed transformation matrix as is shown in the figure below. In doing so both qualitative and quantitative data of completely different kind shall be considered in the evaluation. The different scores will be summarised and finally one receives a rate

that reveals the degree of excellence of the several spheres of the innovation management system within a company.

4 Conclusions

In the paper at hand the authors introduced an evaluation model for surveying and improving the performance of the innovation management system within economic enterprises. By building up a simplified system model, adding more detailed evaluation criteria and proposing different modes of evaluation procedures a comprehensive tool was provided for evaluating innovation-related organisational structures, processes as well as resulting products. In opposition to existing tools the authors tend on creating an integrated assessment instrument which comprehends all of the just mentioned fields of innovation management within companies. In doing so practices within a company can be viewed under a holistic perspective, which helps to remain competitive on the innovative edge and improve company's success in a lasting way.

5 References

- [1] Bürgel, H.D.; Haller, C.; Binder, M.: F&E – Management; München: Vahlen 1996.
- [2] Cooper, R.G.; Deutsches Zentrum für Luft- und Raumfahrt (DLR): New Product Leadership: Systematic Innovation Success; Köln: DLR InnoGuide Center 2001.
- [3] Daenzer, W.: Systems Engineering; Zürich: Industrielle Organisation 1997.
- [4] European Foundation for Quality Management (EFQM): EFQM-Modell für Excellence; Brüssel: EFQM Publ. 1999.
- [5] Gausemeier, J.; Ebbesmeyer, P.; Kallmeyer, F.: Produktinnovation; München: Hanser 2001.
- [6] Gerpott, T.: Strategisches Technologie- und Innovationsmanagement; Stuttgart: Schaeffer-Poeschel 1999.
- [7] Hauschildt, J.: Innovationsmanagement; München: Vahlen 1997.
- [8] Hippel, E. v.: The sources of innovation; New York: Oxford University Press 1995.
- [9] Pahl, G.; Beitz, W.: Engineering Design; Berlin: Springer 2001.
- [10] Sabisch, H.: Produktinnovation; Stuttgart: Poeschel 1991.
- [11] Trott, P.: Innovation Management And New Product Development; London: Financial Times; Pitman Publ. 1998.
- [12] Utterback, J.M.: Mastering the Dynamics of Innovation; Boston: Harvard Business School Press 1994.

Dr. U. Lindemann, G. Ch. Baumberger, D. K. Fuchs, B. Jokele,
Institute of Product Development, Technische Universität München
Boltzmannstr. 15, 85748 Garching, Germany

Mail: [lindemann](mailto:lindemann@pe.mw.tum.de), [baumberger](mailto:baumberger@pe.mw.tum.de), [fuchs](mailto:fuchs@pe.mw.tum.de), jokele@pe.mw.tum.de; HP: www.pe.mw.tum.de

Dr. Frank J. Schumann
Siemens AG, Corporate Technology, Production Processes Product Definition
Otto-Hahn-Ring 6, 81730 Munich, Germany

Mail: frank.jens.schumann@siemens.com; HP: www.ct.siemens.de