Conference Paper

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Development of an Internet-Based Evaluation Tool

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Publication Date:
2003

Permanent Link:
https://doi.org/10.3929/ethz-a-006721034

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ASSESSMENT OF THE INNOVATION CAPABILITY OF SMES – DEVELOPMENT OF AN INTERNET-BASED EVALUATION TOOL

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ABSTRACT
Due to increasing globalization and technological change, the importance of the capability to develop new products and bring them successfully onto the market – in the following referred to as innovation capability – increases not only for large enterprises but also for SMEs (Small and Medium Enterprises).

In this paper, we firstly develop a model of SMEs’ innovation capability, divided into the five dimensions: innovation structure, innovation strategy, innovation resources, innovation activities, and innovation culture. Secondly, we explore if SMEs want external support to enhance their innovation capability and if yes, how this support could be provided. Thirdly, findings of the pilot study and the innovation capability model are implemented into an evaluation tool as a first step of external supporting activities. With the help of this tool, a database of the innovation capability of SMEs will be created to allow benchmarking and studies of innovation management in SMEs.

INTRODUCTION: INNOVATION CAPABILITY AS A COMPETITIVE ADVANTAGE
The capability to develop new products and bring them successfully onto the market is generally accepted as a source for competitive advantage. Due to increasing globalization and technological change, the importance of innovation increases not only for large enterprises but also for SMEs (Small and Medium Enterprises) as well. Nevertheless, partially due to limited resources, success factors, methods, or good practices in innovation management which are routinely used by large enterprises are mostly unknown to SMEs. In addition, some SMEs are not even aware of deficiencies and the potential to improve their innovation capability.
In the following section, we firstly develop a model of SMEs’ innovation capability. The model integrates success factors for innovation management identified in literature, divided into the five dimensions: innovation structure, innovation strategy, innovation resources, innovation activities, and innovation culture.

Secondly, we explore if SMEs see a need for external support to enhance their innovation capability and if yes, how this support could be provided. For this purpose, 21 general managers of SMEs were interviewed using a semi-standardized questionnaire. The interviews revealed the need for affordable and scalable consulting services.

Thirdly, findings of the pilot study and the innovation capability model were implemented into an evaluation tool as a first step of external supporting activities. The evaluation tool enables managers of SMEs to assess their innovation capability and identify strengths and weaknesses. Furthermore, it provides suggestions for improvement.

Development of the Innovation Capability Model

The evaluation of the innovation capability of any enterprise can be started with an input/output analysis with:

**Innovation Input:**
- R&D ratio,
- Expenses for new products,
- Expenses for breakthrough innovations and new technologies,

**Innovation Output:**
- Number of new patents,
- Percentage of new products,
- Average age of products,
- Success rate of innovation projects.

Based on input/output analysis and figures some estimation can be derived about the innovation capability of the enterprise. The analysis can be supported by comparative figures of similar enterprises (same industry, similar company size etc.). However, no conclusion in terms of the reasons for a weak or strong innovation capability can be drawn from these figures. Therefore, our reference framework for the further analysis

Figure 1: Innovation capability model
additionally includes a model of the internal factors influencing the innovation capability of a firm (see Figure 1). The perception that the innovation capability is considerably affected by the fulfillment of specific aspects is a fundamental prerequisite for this model. Our model focuses in particular on industrial SMEs.

For this purpose, we undertook an extensive literature review considering literature on SMEs and innovation management (e.g. [1]-[25]). Additionally, we considered assessment procedures related to innovation capability (e.g. [26]-[36]). Thus, an extensive collection of design elements, as well as concrete instructions for SMEs was compiled. To structure our innovation capability model (Figure 1) we took over several elements of the St. Galler Management Model [37]. Each of the five dimensions (innovation structure, innovation strategy, innovation resources, innovation activities, and innovation culture) contains a list of elements (see Table 1). The performance of each of the five dimensions affects the performance of the others – represented by the circular arrows in Figure 1.

With this model a basis was created to support SMEs in assessing and improving their innovation capability. In a next step, it had to be examined whether and in which form such support is necessary and desired.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Elements</th>
</tr>
</thead>
</table>
| Innovation structure| - Existence of innovation process  
                        - Process quality of innovation process  
                        - Fit of organizational structure and innovation management (departments and projects)  
                        - Multidisciplinary project teams  
                        - Knowledge management  
                        - Communication and information structure  
                        - Network with external partners |
| Innovation strategy| - Existence of innovation strategy  
                        - Relevance of innovation strategy  
                        - Procedure to revise innovation strategy  
                        - Scope of innovation strategy  
                        - Strategic controlling |
| Innovation resources| - Competencies of employees  
                          - Training for employees  
                          - Triage of employees  
                          - Free resources for innovation  
                          - Financing of innovation |
| Innovation activities| - Number of innovation projects  
                          - Selection of innovation projects  
                          - Use of innovation methods  
                          - Project controlling  
                          - Idea management  
                          - Integration of suggestions (customer, suppliers etc.)  
                          - Usage of external knowledge and competencies  
                          - Marketing activities  
                          - Preparation of market launch |
| Innovation culture | - Response to change  
                        - Response to failures  
                        - Social competencies and team behavior  
                        - Leadership  
                        - Communication style |

Table 1: Dimensions and elements of the innovation capability model
PILOT STUDY: SMES’ NEED OF EXTERNAL SUPPORT

In a pilot study, we explored if SMEs see a need for external support to increase their innovation capability, and if yes, how this support should be configured. For this purpose, we randomly selected 126 firms from four sectors: mechanical engineering, electrical engineering, medical engineering, and data processing [38]. The four sectors were chosen to cover the range from traditional SMEs to entrepreneurial firms. 21 firms agreed to participate in our study [39]. The general managers of these firms were interviewed with a semi-standardized questionnaire.

Company size ranged from having 15 to 500 employees. All 21 firms developed at least one new product or service during the last three years before our study. The degree of newness of these new products was for most part incremental, radical innovations were rarely developed. None of the firms had a standardized, systematic innovation process.

13 of the 21 firms see a need for external support to increase their innovation capability. Only four firms strictly reject external support with regard to innovation management. In the following, for the most part only the responses from respondents interested in external support are evaluated to assess in detail, how this support should look like.

Respondents were asked, what scope external support should have (see Figure 2). All respondents suggest an assessment of the innovation capability combined with suggestions for improvements. Half of the respondents would proceed and draw on external support for the implementation of suggested improvements. The majority of SMEs of our study reject a certification of the innovation capability.

<table>
<thead>
<tr>
<th></th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of innovation capability</td>
<td>3</td>
</tr>
<tr>
<td>Suggestions for improvement</td>
<td>10</td>
</tr>
<tr>
<td>Implementation</td>
<td>1</td>
</tr>
<tr>
<td>Certification of innovation capability</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 2: Scope of external support (N=14)

Next, respondents were asked, how information should be collected to assess the innovation capability of their firms. As Figure 3 shows, the SMEs of our sample prefer either check lists, interviews, or a combination of both. Only two SMEs consider the analysis of business documents. One respondent requires an individual data collecting process. However, the majority regards a semi-standardized or standardized data collection as sufficient.
In addition to the appropriate method of data collection, we asked respondents for areas that firms regard as important in terms of innovation capability (see Figure 4). Three main areas for improvement were identified: project management and organization, technology strategies, and market and competitive strategy.

After clarifying the scope of external support for the improvement of the innovation capability, we further studied who could provide this support and what SMEs are willing to invest in order to improve their innovation capability. As Figure 5 shows, the SMEs of our study suggest universities or consultancies as external partners.

![Figure 3: Data collection (N=15)](image1)

![Figure 4: Main areas for improvement (N=15, multiple answers possible)](image2)

![Figure 5: Preferred external partners (N=14, multiple answers possible)](image3)
The respondents of our sample had difficulties to quantify the time and money they would be willing to invest in the assessment of their innovation capability. However, it became apparent that the general managers we interviewed prefer a two-step approach to reduce their financial risk. In a first step, an inexpensive assessment of the innovation capability should be made and general suggestions for improvement should be given. This could be organized in a workshop or – to lower costs – in the form of a standardized questionnaire. Thereafter, respondents would want to decide if they proceed with a second step. This second step would include an in-depth analysis tailored for the respective SME and the development of more concrete suggestions for improvement. For the first step, respondents would be willing to pay 500 to 1'500 Euros. For the second step, they would invest round about 5'000 to 25'000 Euros. Altogether, the improvement of the innovation capability should not take longer than half a year.

To ensure the acceptance of the assessment method we are going to develop in the next section, respondents were asked which threats and opportunities they see in an assessment of their innovation capability. Figure 6 shows that two thirds of the respondents expect shorter development times, reduced development costs, and higher innovation quality. These opportunities should be communicated to SMEs to raise their interest in participating in an assessment. Besides direct impacts on efficiency and effectiveness, respondents expect indirect positive impacts like a higher transparency of their innovation process.

<table>
<thead>
<tr>
<th>Opportunity is expected</th>
<th>Opportunity is not expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of development time</td>
<td>9</td>
</tr>
<tr>
<td>Reduction of development costs</td>
<td>9</td>
</tr>
<tr>
<td>Improvement of innovation quality</td>
<td>9</td>
</tr>
<tr>
<td>Reduction of failure rate</td>
<td>8</td>
</tr>
<tr>
<td>Improvement of internal communication</td>
<td>6</td>
</tr>
<tr>
<td>Higher transparency of innovation process</td>
<td>10</td>
</tr>
<tr>
<td>General change in the firm</td>
<td>9</td>
</tr>
</tbody>
</table>

Figure 6: Opportunities (N=12–15)

Respondents expect more opportunities than threats from an assessment of their innovation capability (see Figure 6 and 7). With regard to threats, respondents worry about high implementation costs. In addition, they question if their employees would accept and implement suggestions for improvement. This supports the need for a two-step approach to reduce financial risks for the SMEs. A standardized assessment of the innovation capability could eventually be followed by an in-depth consulting. With regard to secrecy, the general managers of our sample do not fear diffusion of secret information.
To summarize, the pilot study reveals the need for external support to enhance SMEs’ innovation capability. This support could be provided by universities. The results suggest a two-step approach, with a standardized assessment as a first inexpensive step. SMEs expect reduced development time and costs and higher innovation quality from an assessment of their innovation capability. The next section combines the theoretical model of SMEs’ innovation capability with SMEs’ needs identified in the pilot study.

DEVELOPMENT OF THE ASSESSMENT TOOL
Translation of capability elements into a questionnaire
To support a standardized assessment of SMEs’ innovation capability, the innovation capability model was translated into a questionnaire (see Table 2).

<table>
<thead>
<tr>
<th>Threat is expected</th>
<th>Threat is not expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation too expensive</td>
<td>7 4</td>
</tr>
<tr>
<td>Reduction of flexibility</td>
<td>7 6</td>
</tr>
<tr>
<td>Rejection from employees</td>
<td>8 5</td>
</tr>
<tr>
<td>Violation of secrecy</td>
<td>3 9</td>
</tr>
</tbody>
</table>

Figure 7: Threats (N=11–13)

Table 2: Part of the innovation capability assessment questionnaire
Each element was represented by one question. For each question, five possible answers were given, which represent the different levels of the elements’ support of the innovation capability. To put the answers across to managers of SMEs, concrete ideas of successful practices are formulated in the answers. Table 2 gives some examples. The average score of each dimension (see Figure 8) as well as the answers of each question reveal strengths and weaknesses and therefore potential for improvement in the innovation system.

Figure 8: Overview of dimension scores

**Pre-test of the questionnaire**
To make sure the questionnaire is understandable and useable for SMEs, the questionnaire was tested with seven representatives of four enterprises. The interpretation of the interviewees was examined and the wording of several questions was adjusted. The questionnaire was found to be helpful. The interviewees stated that even the process of answering the questionnaire gave insights into weaknesses and potential for improvement of their innovation system.

**Status**
The complete questionnaire, as well as an instruction on how to use it is available on [www.innovation.ethz.ch](http://www.innovation.ethz.ch). During the next months, an on-line questionnaire will be offered at the same address. This provides an opportunity to electronically evaluate data and draw diagrams. Furthermore, anonymized data – agreement of the enterprises presupposed – can be collected in a data base. The resulting database of assessed SMEs does not only help SMEs to benchmark their innovation capability, it is also a valuable database for research on innovation management. The data base of all participating SMEs can be used as a valuable source for studies of success factors, strengths and weaknesses, actual needs and practices of SMEs in innovation management.

For the SMEs, the results are the basis for further consulting services custom-tailored to the specific needs of the particular SME. After weaknesses and potentials for improvement are identified by the self-assessment, eventually additional external support is needed. The amount of consulting support can be limited by a well directed internal preparation.
CONCLUSIONS

Innovation capability has a growing importance for SMEs. Based on a literature review, a comprehensive model of the innovation capability of industrial SMEs was developed.

The results of our pilot study reveal the need of an assessment of the innovation capability of SMEs. Therefore a questionnaire was deduced from the model. With this questionnaire, SMEs are able to conduct a self-assessment of their innovation ability and to identify weaknesses and improvement potentials in their innovation system. The data assessed will be collected in a database and used for future in-depth studies of innovation management in SMEs.

REFERENCES

[27] http://www.vdivide-it.de/innoundaltern/results.htm


[38] The KOMPASS data base was used to identify SMEs with 11 to 500 employees located in Northern Germany.

[39] The sample consists of six medical engineering firms and five firms from each of the other sectors.