Need Assessment in Practice – Methods, Experiences and Trends

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1. Introduction

The intensive concern with customer needs and problems is one of the key contributors to the success of innovation management. During the seventies, numerous procedures were developed, in theory as well as in practice. These procedures entered literature as so called "need-assessment" approaches (see e. g. Holt, Geschka, Peterlongo 1984). However, the application of these procedures to different industrial sectors and types of firms as well as the benefit achieved for innovation in practice, remained unexplored to a great extent till the nineties, except for a few documented experiences and case studies (see e. g. Herstatt 1998). Geschka and Herstatt carried out the first empirical study in Switzerland in 1990/91. This study was confined to the Swiss mechanical industry and the results were published in "Die Unternehmung" 3/91 (Geschka, Herstatt 1991). An identical survey was repeated in 1998 within the scope of a research project together with the Institute of International Innovation Management of the University of Bern (*). The scope was extended to the chemical industry and the electrical industry. Some results from the first study were confirmed. Nevertheless, differences were noticed as well, especially with regard to the use of several methods to record innovation needs, it was also found that different industries have different preferences with respect to methods due to specifics of the branch. In this paper, we describe the results of the current study, go into the differences between both studies, and discuss these and the possible rationals in the interviewed companies.

2. Summary of the study in 1991

The objective of the first study was to answer the following questions:

- Are users systematically and methodically involved in the development of ideas for product innovations (product improvements and new products) in the investigated industries?
- Which methods and instruments are used to achieve this?
- How are these methods and instruments judged with regard to their suitability for the development and use of ideas for product innovations and the respective expenditure?

To answer these questions, 1050 questionnaires were sent to Swiss mechanical firms with more than ten employees (full survey). 159 fully completed questionnaires were returned (15%). The medium-sized firms were represented strongly with 57 %, which closely corresponds to the structure of this branch of industry. The rest was split up between 28 % of small firms and 15 % of large-scale enterprises. Regarding further details as classification of the firms, composition of the interviewees, development of hypothesises as well as specifics of the analysis we refer to the first study.

In the first study, the own research & development department was mentioned as the most important source for new products as well as for product improvements. An interesting finding was, that the importance of this source was considered equal for new and improved product. This phenomenon was explained with growing product ranges and more differentiated customer needs, which involve the R&D department more and more into product and range care.
As second important source, customer proposals were mentioned (30 %). Still 6 % of the firms gave customer complaints as a reason to search for new products. This result surprised us then, as the consequent step from a complaint to a new product was not expected. It was however not surprising finding out, complaints are the drivers for product improvements in 18

% of the cases. Combining customer complaints and proposals, 36 % of the ideas for new products came out of the user area (46 % for improved products). A further also important source was the observation of competition (16 %).
At least 78 % of the interviewees answered the question, if they systematically involve users in the development of (new) product ideas with "yes". One answer to the question how enterprises involve users was given 102 times and therefore remarkable: using direct contacts to the customer, including the sales force and service department. Only 12 enterprises stated to interview customers on a regular base, and only one enterprise mentioned to use customer workshops to generate new product ideas. An interesting result was, that neither the intensity nor the kind of customer involvement in the innovation process was significantly depending on the size of the firm. At those time we assumed that bigger organizations were more active in this area than smaller ones.

The question, why customers were not used for the generation of ideas for product innovations, where answered by 22 % of the firms as follows:

- customers are not qualified enough (17 times mentioned);
- customers or users respectively do not want to be involved in the innovation process of the manufacturer;
- the active involvement of customers/users requires too much effort (10 times mentioned).

In addition, we checked a given catalog of methods how to record innovation needs (see also figure 1) regarding the dimensions frequency of use in practice, assumed time consumption (as an indicator for costs), internal feasibility, as well as usability/convertabilty of the ideas into new or improved products/outputs.
In this connection, it turned out that in the investigated industry:

- the evaluation of "sales and after-sales service reports", the most frequently used method, was also the most positively rated regarding usefulness;
- certain methods were hardly used at all; these were the following procedures "literature survey" out of the customer sector, "evaluation of patent applications" of the buyer sector, "user panels", "institutionalized complaint management", "creativity sessions" with customers, "customer related function and value analysis", as well as occasionally "occupation of customer employees" in the own firm;
- certain methods were often used despite the time spent felt quite long, like evaluation of "sales and after-sales service reports", evaluation of "customer inquiries" and "customer proposals" as well as "joint product and prototype tests" together with users;
- especially one procedure, the "joint product development" together with users/customers was hardly used at all (rank 12), despite the fact that it was expected to be very useful (rank 6);

In a ranking defined by the interviewees with regard to frequency of use, the evaluation of "sales and after-sales service reports", followed by "observation of users", evaluation of "customer inquiries", "joint product and prototype tests", and "customer proposals" were the most outstanding ones from the 17 checked procedures.
The order of precedence for the criteria cost/benefit relationship strengthened this impression, i. e. it was almost the same (see figure 1).

Rank	Order of precedence with regard to the	Order of precedence with regard to the

	frequency of use	cost/benefit relationship
1	sales and after-sales service reports (4)	sales and after-sales service reports (4)
2	observation of users (7)	customer inquiries (5)
3	customer inquiries (5)	observation of users (7)
4	product and prototype tests (14)	product and prototype tests (14)
5	customer proposals (6)	customer proposals (6)
6	customer complaints (3)	joint product development (15)
7	interviews with customers (8)	interviews with customers (8)
8	problem analysis (9)	customer complaints (3)
9	creativity sessions (12)	problem analysis (9)
10	complaint management (11)	creativity sessions (12)
11	function and value analysis (13)	literature survey (1)
12	joint product development (15)	complaint management (11)
13	literature survey (1)	function and value analysis (13)
14	occupation of customer employees (17)	occupation of own empl. at the customer (16)
15	occupation of own empl. at the customer (16)	user panels (10)
16	user panels (10)	occupation of customer employees (17)
17	evaluation of patent applications	evaluation of patent applications (2)

Figure 1. Ranking of the investigated methods and instruments with regard to frequency of use and cost/benefit relationship (code numbers of the investigated methods are listed in brackets, empl. = employees)

3. The study in 1998

In 1998, a written interview was done in the Swiss industry on the same concept as the investigation in 1990/91; this survey covered the mechanical, electrical, and chemical industry. This extension was made for two reasons: first, in the meantime, the three selected industries have proven to be very innovative branches of the Swiss industry; second, by choosing two additional industrial sectors, differences between them regarding coverage of innovation needs could be identified.

3.1 Objective and methods

The objective of the research is identical with the objective of the study in 1990/91. In addition, a comparison between the results was supposed to show changes in the use or evaluation of methods, e. g. with regard to preferences for single methods or procedures.

> To answer these questions above,1133 questionnaires were sent out. In the mechanical and electrical industry the spot check covered 37 % of all firms with more than ten employees in the German-speaking part of Switzerland. The spot check in the chemical industry covered approximately 26 % of the total. In this sector, a lower limit of ten employees was chosen to avoid small firms to be overrepresented. 217 out of the 1133 questionnaires were returned. Out of these questionnaires, 185 could be evaluated which corresponds to a return rate of 17 %.

3.2 Results for all industrial sectors

The evaluation of the fulfilled questionnaires regarding the size of the firms for all three industrial sectors, showed that 46 % were small firms, 48 % medium-sized, and 6 % large-scale enterprises.

> As distinguishing factor for the sizes of the firms, the number of employees was chosen again (small firm 1-50 employees, medium-sized firms 51-1000 empl., large-scale enterprises more than 1000 empl.). With regard to the way of distribution 64 % of the firms sell their products directly, i. e. without involving the trade, whereas 30 % distribute their products indirectly, i. e. over the trade. Only 5 % of the interviewed firms used direct as well as indirect distribution channels. Thus, the majority used the direct distribution.

3.2.1 Sources used for product innovations

The question, where most of the ideas for product innovations (divided into product improvements and development of new products) come from, resulted in the following distribution shown in figure 2:

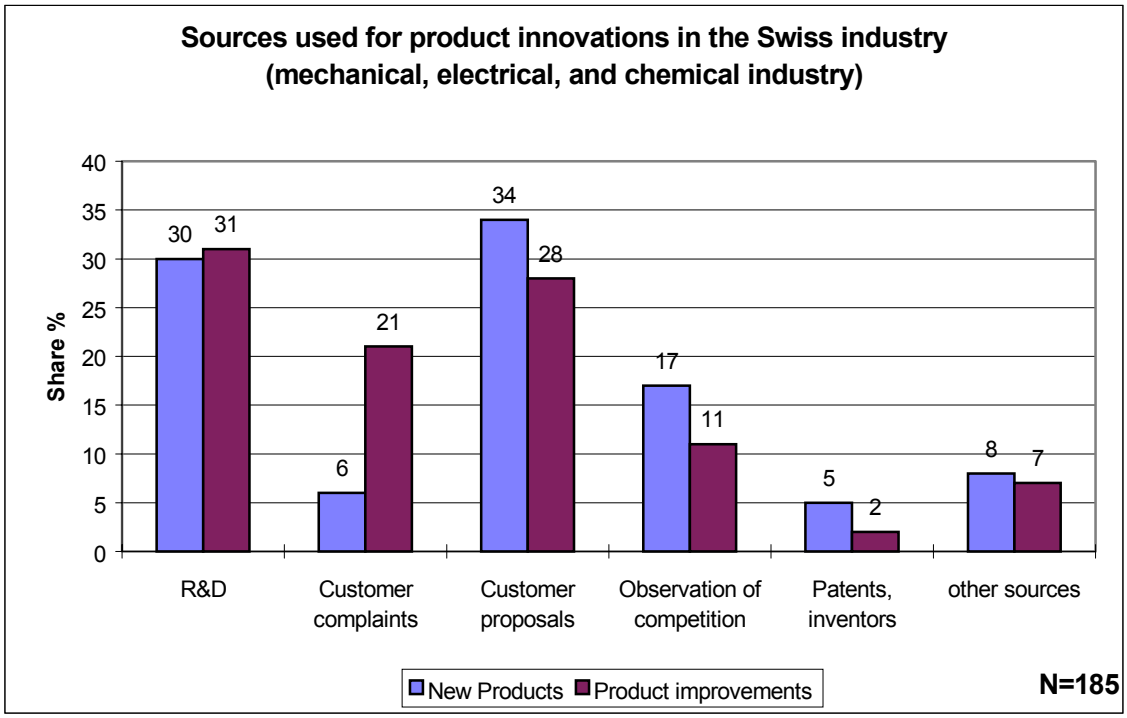

Figure 2: Sources used for product innovations in the Swiss mechanical, electrical, and chemical industry

The most important source for planning new products were *customer proposals*. The second important source was the own *R&D department*. Compared to the first investigation, the proposals from customers have gained importance and replaced the R&D department as primary source for innovation. In this connection, the different and compared to the first investigation extended sample has to be taken into consideration.

For product improvements, on the other hand, the own *R&D department* was stated as most important source. *Customers proposals* followed at number two.

Customer complaints were taken into consideration for product improvements to 21 % and for the planning of new products to 6 %, which is plausible and approximately corresponds to the

results of the first investigation. The *observation of competition* is with 17 % more important for the planning of new products than for product improvements (11%). Combining the sources *customer complaints* and *customer proposals*, 40 % of the ideas for new products were initiated from the customers or users. For product improvements the percentage was even higher, approximately 49 %. Both values confirm the first investigation, and a higher importance of the input from the customers to product innovations can be concluded.

76 % of the firms answered the question if customers/users are systematically involved in the gathering of ideas for product innovations with "yes". However, even today only a few firms have a budget for the action steps related to the coverage of innovation needs.

3.2.2. Methods and instruments used in practice

In addition, the methods 1 to 17 were checked regarding the dimensions *frequency of use*, *assumed time consumption/costs*, *user friendliness*, and *usability of the ideas* as well as *convertabiliy of the ideas into new products*.

Figure 3 shows the results for the three industrial sectors (mechanical, electrical, and chemical industry). The respective *mean values*, the *modus*, i. e. the most often naming, and the *standard deviation* which represents the spreading around the mean value are given.

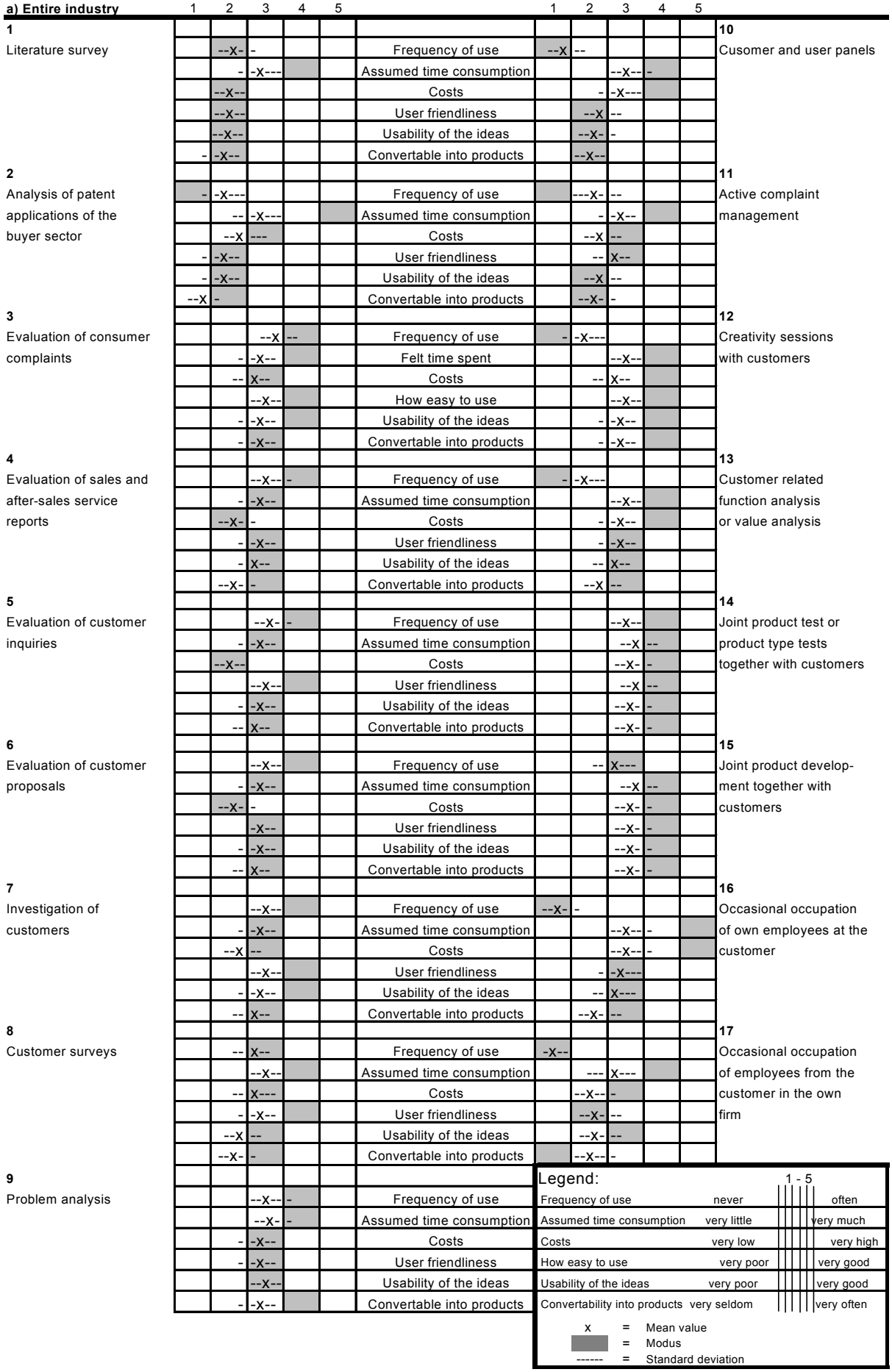

Figure 3: Use and evaluation of the different methods

The analysis of the results showed again that for all investigated industrial sectors:

- certain methods are not used at all (methods no. 2, 10, 11, 12, 13, 16, and 17). This is due to the fact that firms do not see a big benefit in using these methods (methods no. 2, 10, 11) or, on the other hand, because the costs or the time consumption related to the methods are assessed as too high (methods no. 12, 13, 16, and 17); this corresponds to the results of the first study;
- certain methods are often intensively used, despite the time consumption assumed as high, because firms expect a high benefit (methods no. 3, 7, 9, 14, and 15);
- one method (no. 12 "creativity sessions with customers") is hardly used at all, despite the fact that the benefit is judged positively. Reasons are the related costs, and the time consumption rated as high. Another possible reason is the lack of methodical know-how;
- method no. 4 "evaluation of sales and after-sales service reports" is still used intensively today, however, less often as during the first study. The usability of the ideas is rated positively as well (mean 3.3; modus 4).
- Further methods more often used today compared to the other investigated methods, are the methods no. 5, 6, 7, and 14. Method no. 14 has the highest value for the usability of the ideas (mean 3.8, modus 4) of these four methods.

Furthermore, the interviewees were asked to rank the methods most often used today and in addition give an order of precedence with regard to the price/benefit relationship (figure 4).

Rank	Order of precedence with regard to the frequency of use	Order of precedence with regard to the cost/value relationship
1	customer inquiries (5)	joint product development (15)
2	customer complaints (3)	product and prototype tests (14)
3	sales and after-sales service reports (4)	sales and after-sales service reports (4)
4	product and prototype tests (14)	customer inquiries (5)
5	joint product development (15)	customer complaints (3)
6	customer proposals (6)	customer proposals (6)
7	observation of users (7)	observation of users (7)
8	problem analysis (9)	interviews with users (8)
9	creativity sessions (12)	creativity sessions (12)
10	interviews with users (8)	problem analysis (9)
11	complaint management (11)	function and benefit analysis (13)
12	function and benefit analysis (13)	complaint management (11)
13	literature survey(1)	occupation of own empl. At the customer (16)
14	user panels (10)	user panels (10)
15	occupation of own empl. At the customer (16)	literature survey (1)
16	evaluation of patent applications (2)	occupation of customer employees (17)
17	occupation of customer employees (17)	evaluation of patent applications (2)

Figure 4: Comparison of the ranking of the used methods with regard to frequency of use and cost/benefit relationship

It is remarkable, that compared to the investigation from 1990/91, the method no. 15 "joint product development" together with customers has become significantly more important regarding the frequency of use (from rank 12 to rank 5) as well as cost/benefit relationship (from rank 6 to rank 1).

3.2.3 Generating groups with comparable methods

In a further step we tried to find out which of the used methods are assessed as comparable by the interviewed firms. For this purpose a factor analysis was carried out as follows:

a) To each of the two independent dimensions (productivity and complexity) three characteristics are assigned:

Complexity:
- Assumed time consumption
- Costs (c)
- User friendliness

Productivity:
- Frequency of use
- Usability of ideas
- Convertability into products

b) The characteristics were rated on a scale from 1 (very poor) to 5 (very good). The means were calculated for both factors.

c) The couples of values for each method were plotted into a two-dimensional diagram. In this way rough groups of methods were formed, which are rated similar with regard to the relation complexity/productivity (see figure 5).

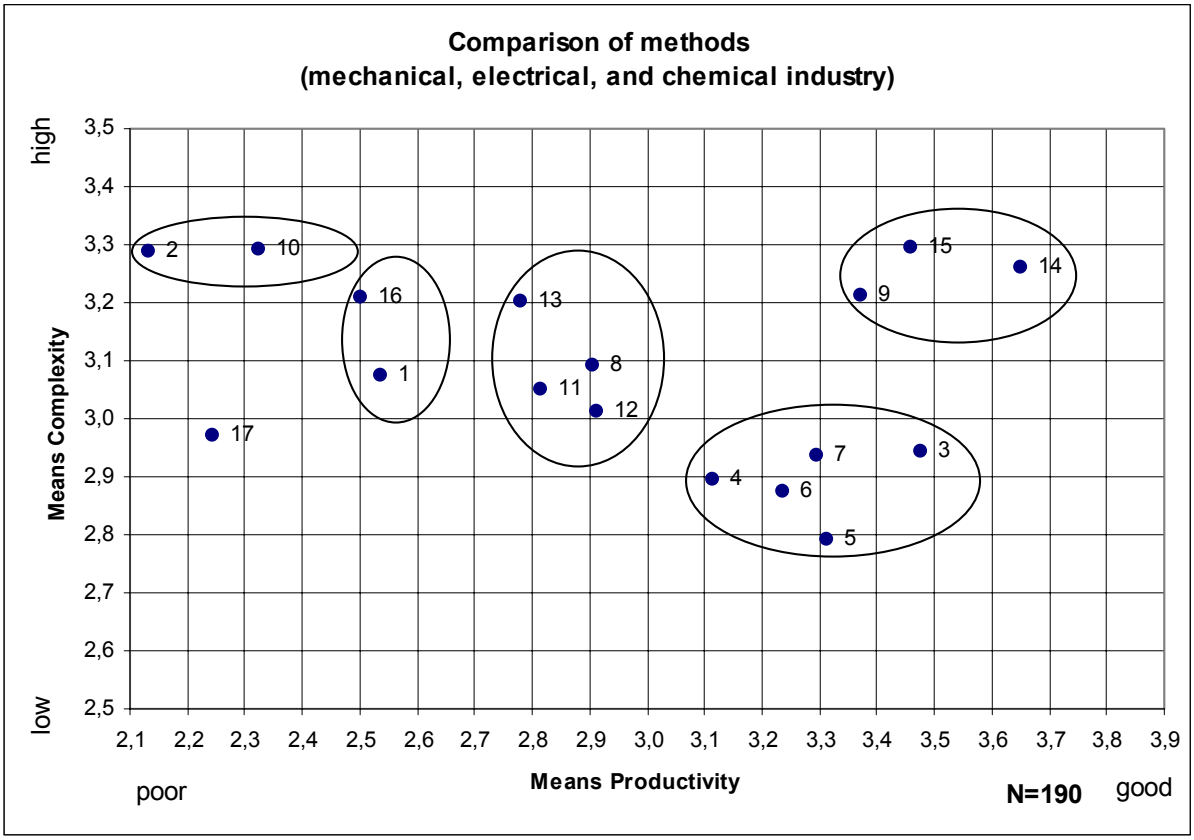

Figure 5: Comparison of methods by using a factorial analysis in the three industrial sectors (Similarities in the perception of the methods are encircled)

From this analysis it can be concluded that "customer related problem analysis", "joint product and prototype tests" and "joint product development" together with customers are judged

as superior with regard to the usability of this methods as well as the complexity related to them.

4. Results for the mechanical industry

4.1 Results from the written standard interview

Three significant differences were discovered compared to the preceding study in 1990:

1. Method no. 15 " joint product development" together with customers achieved number one regarding the "frequency of use" as well as the "cost/benefit ratio". This method was rated very poor in the former study: rank 12 for the "frequency of use" and 6 for the "cost/benefit ratio" .
2. Method no. 1 "literature survey" is judged as much more complex today compared to the study in 1990.
3. Method no. 2 "evaluation of patent applications" is also considered as much more complex today compared to 1990.

4.2 Results of complementary interviews and explanations

An additional interview was carried out six weeks later to gain further insight into the changed preferences and rating of the methods. A further goal of this secind interview round was to understand deviations from the results in the other indstries. This second interview was confined to the mechanical industry only. The written interviews were complemented with telephone calls or partially completely done by telephone.

Following conclusion can be drawn out of the additional interview:

Method No. 15 "joint product development" together with customers:

- The comprehension for an approach driven by real consumer needs has increased significantly during the last eight years. Costs, the need to shorten innovation time, and the philosophy and methods of quality management (especially the customer-based approach) have significantly driven this trend.
- The firms realized, that customer needs can best be integrated into new products by involving the customers directly into product development. First experiences with innovative strategies are available for special branches (e. g. Belz 1998 or Herstatt/von Hippel 1998).
- The joint product development together with customers is equivalent to an early concept testing by the customers. Thus products are developed that meet the demand and the risk of failure is reduced.
- On the other hand, there are some reservations to the early cooperation with customers, in a stage, where the product concept is not yet mature. The following difficulties/hurdles are observed in practice:
  - The participating customers demand exclusive rights or other preferences compared to other potential customers;
  - Delays of the project execution due to cooperation and communication are expected;

- Furthermore, it is feared that the wrong customers are selected and therefore the innovation success is endangered;
- In addition, it is feared that selecting certain customers for a long period of time can cause addiction;
- A further hurdle to the early cooperation with customers is the danger of know-how transfer from participating customers to competitors.

Method no. 1: „literature survey“:

- Today, the effort to evaluate literature is much higher due to additional sources and data banks (internet). Huge amounts of data have to be handled and stored. Therefore, the complexity of this method is judged to have increased.
- Apart from the increased amount of information, it is often not specific enough, inconsistent, not up-to-date, sometimes not objective, and the reliability cannot always be checked.
- Today, the internet is used more often for literature survey. On the other hand, extensive searches are often needed, which can only be done by specialists due to the high complexity.

Method no. 2: “evaluation of patent applications” of the buyer sector:

- The access to patent information has become much easier due to special data banks and telecommunication possibilities (access to specialized data banks). On the other hand the search and evaluation complexity has increased.
- There are still translation issues; especially Japanese patents are difficult to understand, even if they are filed in English.
- The availability and the speed of institutions for patent analysis seem to be sufficient in Switzerland, nevertheless, EDP and data bank surveys often require a high effort, which is more than firms can handle timing wise as well as in content.
- Furthermore, patent surveys cannot give a broad overview over innovation needs, as many aspects are not patented or not relevant for patents.

5. Results for the electrical and chemical industry

5.1 Chemical industry

The sample of the chemical industry includes only 19 firms. In average, the firms are significantly larger than the firms of the mechanical industry.

The chemical industry is based on science. Many innovations are push-through innovations; research enables new or improved effects or applications. This traditional approach and the well established R&D departments still seem to be the key driver for innovations in Swiss chemical firms today. The internal R&D department is the most important source for innovation, for new products as well as for product improvements.

The method “joint product development” together with customers, which was number one regarding frequency of use for the mechanical industry, is ranked only as number 10 or 9 respectively in the chemical industry. This discrepancy can be explained by the fact that user of

chemical products are usually not chemical firms themselves, and do not have any chemical competency. The customers can provide desires and requirements but they cannot directly take part in product development. For the mechanical industry the situation differs: The users predominantly use the mechanical facilities for production, can therefore profit from their experience with production processes, and give concrete input for the design of a new facility or improved elements. Furthermore, the "heads" of production are often mechanical engineers; therefore the "joint product development" with customers takes part in one discipline; the partners use the same language. Therefore, this efficient method is successfully used in the mechanical industry, whereas it is of limited value for the chemical industry due to it's specialties.

The method "customer proposals" reveals the same picture: A user of chemical products without chemical knowledge cannot deliver concrete proposals for new chemicals. This is why this method is rated 16 in the chemical industry regarding frequency of use, whereas it ranks no. 5 in the mechanical industry.

The most customer-based method used in the chemical industry is "sales and after-sales reports". It is number one regarding frequency of use as well as cost/benefit relationship. This method is at number two for the mechanical industry. As the "joint product development" together with customers is of no use for the chemical industry, the "sales and after-sales reports" consequently move up to number one.

The methods "literature survey" and "evaluation of patent applications" of the user industry are also judged differently in the mechanical and chemical industry: Both methods are more frequently used by chemical firms (ranks 3 and 4 or 6 and 8 respectively). This result can be explained by the tradition in the chemical industry too. Since many years, the chemical industry has better access to literature data banks than any other industry, and it is used to apply this source of information. The same is true for patent surveys. This method is less well established in the mechanical industry, and therefore seldom used and also judged worse regarding its value.

5.2 Electrical industry

With 77 firms, the electrical industry is the second largest sample of the investigation; 97 questionnaires from the mechanical industry could be evaluated. In average, the firms are smaller than the chemical firms, but bigger than the firms in the mechanical industry.

The electronic industry is similarly to the chemical industry based on science. The results of the study are therefore more similar to the chemical than the mechanical industry. The "joint product development" together with customers is only rated no. 8 regarding the frequency of use and no. 6 regarding the price/benefit relationship. The "customer proposals" are even judged worse (rank 13 and 13).

The user of electronic products also often lacks the knowledge about technological function and operation of these products, and can therefore not contribute directly to product development. As in the chemical industry, the "sales and after-sales reports" is the most useful and frequently used method (rank 4 and 1).

The methods "literature survey" and "evaluation of patent applications" of users have a higher importance in the electrical industry compared to the mechanical industry too. This results

can be explained by the scientific foundation of the electrical industry (ranks 2 and 4 resp. 5 and 7).

Another striking difference between the electrical industry and the other two industries is that "customer requests" are seldom used and judged negatively regarding their value (rank 16 and 12).

6. Interpretation and findings for the innovation management

The results of the investigation show that customer-based thinking has further intensified during the last 8 years in Switzerland. With regard to the various methods and procedures, differences were found in the three investigated industrial sectors.

It seems that especially mechanical firms seek direct contact with customers to get hints for innovations. In the former study in 1990/91 the "joint product development" together with customers was judged positively but seldom used. Today, this method is number one in the mechanical industry, regarding the frequency of use as well as the cost/benefit relationship, whereas is was at number 12 in 1990/91. In exchange, the "sales and after-sales reports" dropped from number 1 to 3. These reports are still important, however, the firms realized that to get in direct contact with customers is even more important. It seems that both methods are applied. After analyzing"sales and after-sales reports" direct contacts to customers are established and joint product developments undertaken.

Another interesting fact is, that analyzing published information (patents, literature) is still important in the chemical and electrical industry, in contrast to the mechanical industry, where this method is to a large extent neglected. On the other hand, these two industries rather seldom carry out "joint product development" together with customers, as the user often does not have the professional, industry specific competence.

The three investigated industrial sectors show significantly differing results. This results among other things from branch specifics. Explanations are given, nevertheless, to gain further insight into the differences between the branches, further branch specific studies have to be done.

Nevertheless, most of the firms have realized that they have to strive for direct contact with the customer. Related costs were accepted, fears of contact overcome. The method "joint product development" together with customers is a general procedure and not a precise method with a recipe how to act. After the dominance of this method is realized, further studies should treat the concrete procedure, difficulties and uncertainties. Based on these studies support and tools can be developed for practical use.

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