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**Working Paper**

## Innovation search fields with Lead Users

Working Paper, No. 9e

**Provided in Cooperation with:**

Hamburg University of Technology (TUHH), Institute for Technology and Innovation Management

*Suggested Citation:* Herstatt, Cornelius; Lüthje, Christian; Lettl, Christopher (2001) : Innovation search fields with Lead Users, Working Paper, No. 9e, Hamburg University of Technology (TUHH), Institute for Technology and Innovation Management (TIM), Hamburg, <http://nbn-resolving.de/urn:nbn:de:gbv:830-opus-1593>

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## **Innovationsfelder mit Lead Usern erschließen**

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Mai 2001  
Arbeitspapier Nr. 9

## **Innovation search fields with Lead Users**

*“Close orientation with the market is essential for innovation success!” Although both academics and market research practitioners would generally agree with this statement, alignment with the needs of the customer often results in conservative innovation strategies. Due to their focus on what is currently on offer in the marketplace, customers primarily demand small, step-wise developments - so-called incremental innovations. This dilemma can be overcome through with the help of particularly advanced customers (Lead Users).*

*The Lead User method aids companies in capitalizing on the innovative potential of these highly qualified customers. A case study with the German firm, Johnson & Johnson Medical GmbH, demonstrated that Breakthrough Innovations are achievable this way.*

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**Cornelius Herstatt, Christian Lüthje, Christopher Lettl**

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### **Introduction**

In order to ensure their long-term growth, companies require a balanced portfolio of both incremental and more significant innovations. In the ideal situation, the continuous improvement of the existing product/service range would provide the financial support for the ongoing development of the more significant innovations.

In successful companies, the development of incremental innovation projects belongs to the day-to-day routine work. Management possesses an arsenal of methodologies, with which these projects can be systematically planned, steered and controlled. Traditional market research therefore offers many possibilities to determine the needs of the customer and to test the developed concepts in the target markets prior to market launch.

It is however a very different situation for so-called “breakthrough” innovation projects. In such cases, the results from market research studies continually evoke disappointment. It appears it is impossible to determine the demands of tomorrow’s markets from such conceptual methodologies. This may be due to certain methodologies providing customers with only limited opportunity to articulate innovative ideas. It can however also be due to the typical customer involved in market research studies. It is rare that sample testing of the current market leads to the identification of potential starting points for innovations due to the average customer not being capable of looking beyond what is currently on offer in the marketplace.

Leading companies such as 3M, HILTI, Nortel Networks or Kelloggs are increasingly working with Lead Users in the early phases of innovation projects. Lead Users are especially well-qualified, advanced users who are both sufficiently well motivated and qualified to make significant contributions to the development of new products or services (von Hippel 1988). Their identification and involvement is supported through the so-called “Lead User Methodology” that was conceived by MIT Professor Eric von Hippel and used successfully in many innovation applications.

The methodology of this approach and its implementation in commercial innovation practice forms the basis of this paper. After a short description of Lead Users, we will show that innovative customers exist in numerous product fields. Following this, the process steps of the Lead User Method will be outlined. Additionally, the functionality and effectiveness of the methodology will be shown through its application. In the second half of this paper a current case study is treated in which innovation concepts for surgical hygiene and sterile products are developed through the involvement of Lead Users.

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## What are Lead Users?

With the help of a representative choice of existing customers, market research endeavors to obtain dependable and *aussagekräftige* suggestions for the development of innovations. Often this results in disappointment as only a few innovative outcomes are reported from these kinds of studies. These studies often primarily result in individual ideas for smaller, incremental improvements of the existing product program and only rarely in applications for significant new innovations. Companies that depend exclusively on the results of such studies run the risk that their products will become outdated and over the long term lose market share.

Most of the customers involved appear to be unable to remove themselves from the current market range and to imagine the needs of the future that foreshadow market development. Their experience with the current market products on offer prevents them from thinking creatively about future possibilities (“functional fixedness”).

Based upon this, it appears to make sense to not align non-incremental innovation projects with representative customer groups but rather to make use of cooperations with Lead Users (von Hippel 1988). These customers are identifiable predominately through two characteristics:

1. Lead Users anticipate the future needs of the market and do so significantly earlier than the majority of other customers.
2. Lead Users profit strongly from innovations that solve their problems or enable new opportunities.

The first characteristic is the basis for the **qualification** of the Lead User to possess the ability to make valuable contributions to the development of new products. Through their prominent role in the recognition of new challenges and application problems, manufacturers can use them as predictors of the needs of the “market-of-tomorrow”. As opposed to representative customers, Lead Users have to imagine themselves in the future application. They are able to achieve this from their day-to-day experience and dissatisfaction with current market offers. The second Lead User characteristic is the **motivation** for innovation. The expected benefits associated with an innovation can become so strong that the Lead User becomes the innovator themselves if they are not satisfied by the manufacturer. This “forced” entrance into innovation can occur quite often due to manufacturers either not being aware of or not appreciating the importance of the emerging needs of smaller customer groups.

## Lead Users exist!

The existence of Lead Users can be seen in numerous examples of innovations that are initiated by user of the products and services and often without the manufacturer’s involvement in the implementation (see Box 1). These User innovations occur in both consumer and in industrial goods markets.

A well-known example of an innovation that stemmed from a consumer is “TipEx”, invented at the end of the 1950’s by a secretary. The invention was later taken over by 3M and implemented on an industrial scale. The sport’s drink “Gatorade” was developed by the trainer of a college football team. In general, the recreation and sport markets are rich in User innovations. Newly developed sports usually stem from the participants themselves. In an investigation of innovations in skate boarding, snow boarding and surfing it was shown that practically all of the basic product development was carried out by the participants and not sports article manufacturers (Shah 2000). In a study in the area of outdoor and trekking products, a high level of innovative product users was also confirmed (Lüthje 2000).

In some industrial goods markets users are also responsible for important innovations. For example, it was shown with semi-conductor and capacitor manufacturing that the significant advances in technology were made by the semi-conductor manufacturers themselves and not from the developers of the respective process technologies (von Hippel 1977). Similar results were found for other process technologies such as CAD and CAM systems. Innovative product users were likewise found in the medical field. Clinics and doctors in many different fields are responsible for many new developments (Shaw 1985). Herstatt proved the existence of Lead Users for the fastening industry in construction (Herstatt 1994).

Even in the dynamic IT industry there are numerous examples of innovations to be found that develop from the users. The operating system “Linux” or the server software “Apache” are two prominent examples of the “Open Sources Movement”. These projects were initiated by individual software users - Linus Torvalds in the case of Linux or Rob McCool at Apache - and accepted later from important user groups. These “User Communities” improve and test the programs and decide independently over the recording of new program codes in the

software. Even today when the marketing of the products is partly taken over by companies (e.g. Red Hat Inc., VA Linux Systems), the manufacturers are rarely involved in the development of the software.

### Box 1

#### Are innovative users exceptions?

Existing research shows that innovation activities are not limited to a small section of users in a market. It can be shown that the percentage of users in different industries who improve prototypes or develop completely new products is considerable. The numbers vary between 10% and nearly 40%. When manufacturers make concerted efforts to search for users who have already developed solutions for their needs, a rich source of innovative ideas can be the reward.

Studie	Produktbereich	Stichprobe (n)	% der User, die Prototypen entwickelt haben
Urban/ von Hippel (1988)	PC-CAD für Design von Leiterplatten (USA)	136	23%
Herstatt/ von Hippel (1992)	Rohraufhängungen (Schweitz)	74	36%
Morrison/ Roberts/ von Hippel (1999)	OPAC Bibliothekssysteme (Australien)	102	18%
Lüthje (2000)	Trekking- und Outdoorprodukte (Deutschland)	159	9,8%
Lüthje (2001)	Operationsinstrumente (Deutschland)	261	22%

The numerous examples of User Innovations in different industries and product fields begs the question as to what role manufacturers can take in this situation. Only if Lead Users are identified and included in innovation projects does it allow manufacturers the chance to profit from the immense potential of the users.

#### Targeting Lead Users and their involvement in innovation projects

In the 1980's MIT's Professor Eric von Hippel developed a system to search for advanced customers. The so-called Lead User methodology has since, on the basis of numerous applications, been detailed and developed further. The methodology consists of a four-phase process that begins with the delineation of a search field and ends with the development of a product idea (see Diagram 1). Applications of the methodology by leading manufacturers until now (see Box I) have lasted periods of between four and nine months.

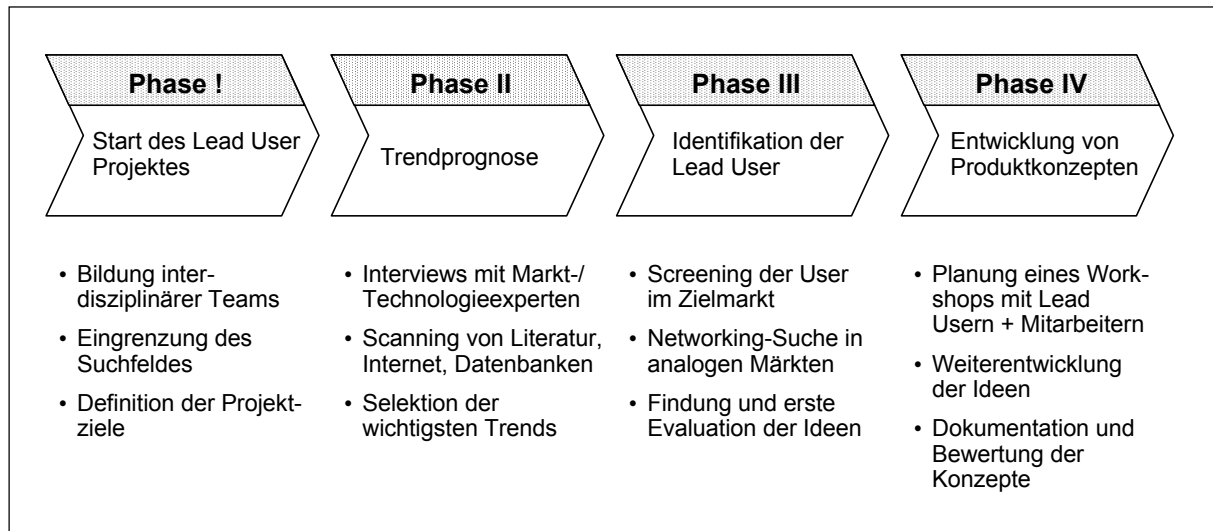


Diagram 1: Process steps for the Lead User Methodology

#### Phase I: Start des Lead User Project

A Lead User project is too demanding for it to run within a company's functional area alongside routine duties. The creation of a dedicated, interdisciplinary team consisting of people from marketing, sales, R&D and production is required. The team can encompass three to six members where a minimum of 50% of their work time should be available for the project.

The project team begins with delineation, as accurately as possible, of the search field i.e. a market, product field or service area in which innovative ideas could be found. Goal formulation then follows with the determination of the basic demands required to satisfy the development (desired degree of innovation). Both internal and external influences on the project should be considered at this stage.

#### Phase II: Trend prognosis

The identification of critical trends and developments in the search field is important in order to confirm that the Lead Users detect market needs earlier than other customers. These include technology and market trends relating to each search field as well as the predicting of economic, legal and business developments. When such trends are known, Lead Users who lead these trends can be searched for.

There are many different sources of information available for trend analysis. In addition to the analysis of secondary source information (e.g. academic publications, data banks, internet), presentations by experts have proved to be especially valuable. The choice of experts should include a wide variety of expert knowledge in order that important developments are not missed (e.g. concurrent technologies, newly created markets). Often just a few interviews with subject matter experts allow a good overview of important developments of the investigated markets. At this point the first concrete indications of suitable Lead Users appear as often the interviewed experts are a good starting point for identification these advanced customers.

#### Phase III: Identification of Lead Users

In order to ascertain who the Lead Users are, the project team must first determine the indicators that will allow for their correct identification. Amongst other considerations, it is important that the Users actually do lead the trends that were chosen as being important in the previous phase. Further indicators that have proved worthwhile in previous applications of the methodology are; the dissatisfaction with the current market offerings, high understanding of problems in the search field in question and the ability to developed their own product improvements.

The process of searching for the Lead Users is in itself a creative one that must be tailored to the specific conditions of the relevant search field. It is possible to follow three basic process types for this search:

*Screening Approach:* For a large number of product users "screening" for the presence of the previously identified indicators can be carried out for Lead Users. As well as the information freely available about

companies from customer data banks, customer complaints or externally produced reports, telephone interviews can also be used. This approach is practical when the number of customers in the market is overseable and a complete screening of all users possible.

*Networking Approach:* This approach involves a small number of customers who are asked if they know of other product users who have new needs or are innovatively active. These kinds of recommendations usually lead very quickly to interesting Lead Users. A significant advantage of this methodology lies in that the team is often exposed to analogous fields in which similar challenges are present as in the search field in question. An example for this is the Lead User project for “medical imaging” for the recognition of small tumors. The search process here didn’t just involve leading radiologists but also experts from the military field as Lead Users. The identification of minute details by the military (e.g. weapons) on satellite images is achieved through pattern-recognition software that is capable of very good results when the resolution is particularly poor. The idea of using a pattern-recognition system for “medical imaging” was completely new as previously the focus had always been on improving resolution.

#### *Phase IV: Development of Product Concepts*

With the identification of Lead User groups, the project team has often already collected some ideas for innovations, albeit vague ones. The Lead Users are then brought together in a workshop that typically lasts two to three days in order to develop the ideas further and to combine them. The workshop serves as an efficient discussion platform where the product users as well as some of the company staff should also be involved.

Depending on the search field, the issue of Intellectual Property Rights will probably need to be addressed. It is sensible, as a minimum, for the parties involved to sign a confidentiality agreement and also to determine the rights of ownership and use. From experience, Lead Users are generally prepared to absolve the rights to ideas without any significant form of compensation.

The workshop revolves around the development of problems associated with existing market offerings and the challenges of future solutions. The results of these discussions, aided by creativity and workshop techniques, serve as the basis for the subsequent development of concrete innovation ideas in teams of three to five people. Throughout these processes, the ideas are fleshed out such that by the end they form a basic sketch, concept outline or model.

After completion of the workshop, the ideas are subjected to a preliminary evaluation via their presentation to the respective decision maker from within the organization. The team members act as product champions during this process. When the decision is made for the further development of a concept, the normal development and evaluation processes that the organization uses to pursue innovation ideas are applied. The Lead User methodology is therefore no substitute for traditional innovation management and market research techniques.

#### **Box 2**

##### **Lead User applications**

This basic process for the identification and involvement of advanced customers has proven itself in numerous practical cases. The Lead User methodology can be successfully applied in industrial goods sector as well as for the end user market. The bandwidth of the technological level of the projects in question spans from “low-tech” through to “high tech” fields.

##### **Building and Construction Industry: HILTI AG**

The German company HILTI AG began working with the Lead User methodology as far back as the 1980’s. The first application was carried out in the search field of the fastening of pipes (water, air conditioning, sanitary) and air duct in buildings. The trend analysis, carried out together with planning engineers, resulted in a high demand for a flexible and manageable fastening system that allowed a significant reduction in the time required for assembly. With the aid of the “screening approach”, fourteen Lead Users were chosen from a group of over 150. The selected Lead Users all fulfilled the criteria outlined previously. Due to the available systems not fulfilling their requirements, some of these users had constructed their own products from different manufacturers’ individual components. An innovative concept for a fastening system resulted from the workshop that was afterwards shortly patented. The products developed from this concept formed the basis for a new business area, “technical assembly” and are a firm part of the successful HILTI marketing program.

##### **Medical Products Industry: 3M**

Lead User projects begun being used at 3M in the mid-90's and since then there have been 7 such projects undertaken in different product divisions. One recently completed project in 3M medical division involved the search field of protection against infection during operations. Increasing hygienic demands, a higher resistance against antibiotics and increasing cost pressures were identified as being relevant factors in the search field. With help of the "networking approach", doctors within the target market, working under extreme conditions (e.g. surgeons in developing countries) were selected. As well as this, users from analogous fields were also involved such as microbiologists or make-up artists. The latter aided in the development of materials that can adhere reliably and comfortably to the human skin. The result of this project was improved protective coverings, a microbial-treated incisions foil and a radical new approach to individual infection control that allows hygienic measures to be tailored to the specific needs of the patient.

#### **IT Industry: Nortel Networks**

The IT firm Nortel Networks has recently successfully applied the Lead User methodology to their operations. An initial project was begun in the "wireless internet" search field. The project was primarily concerned with GSM-based tracking systems for different applications. The trend analysis carried out showed a strong demand for systems that could be used in mobile applications. Lead Users were sought in fields where the position of objects and the transfer of data played significant roles. In this way, contact was made with so-called "storm chasers" who locate and track tornados. Another group consisted of "animal trackers" who often must determine the position of wild animals from a traveling vehicle. The Lead User workshop produced concrete applications for mobile tracking systems that allow the transfer of multiple forms of data. Included in this, is a concept for the mobile controlling of an "intelligent" house. This system allows, amongst other things, the control of particular appliances in a house as soon as the user leaves the work place (e.g. switching on a heater or pre-heating an oven).

#### **Using Lead Users to create new product lines: Application of the methodology at Johnson & Johnson Medical GmbH Deutschland\* (referred to as J&J)**

A recent Lead User project was carried out by the German subsidiary of Johnson & Johnson Medical. The management staff of surgical hygiene products, including disposable articles used during surgery such as gowns, masks and garments, saw the Lead User methodology as a promising approach for the development of ideas for completely new products. The project started in mid-2000.

##### *Phase I: Start of the Lead User Project*

The key decision maker at J&J chose the patient coverings and the protective clothing of operation personnel as the search fields for which innovative ideas should be sought. This product area is in the mature phase of the product life cycle. Significant differences between competing products are today not really present, so that choice is based primarily on the price. It is likely that the price competition increases further due to the increasing cost pressures being experienced by hospitals and clinics. With this in mind, it was hoped that the application of the Lead User methodology allows the generation of new ideas for innovations that would capture J&J significant market share.

The project team was composed of staff from marketing, sales and product management. The author of this paper served as the facilitator of the process.

##### *Phase II: Trend prognosis*

In order to determine future trends in the search field, discussions with experts from a variety of areas were held:

1. The largest expert group consisted of users from the target market i.e. from surgeons and leading OP nurses. Those questioned included surgeons who were leaders in their fields and had implemented new technology in their surgery ("technology leaders"). Also included were "extreme users". This group consisted of doctors who worked under particularly difficult conditions such as in the tropics (poor hygiene controls, poor product availability) or burns surgeons (long operations with large, moist wounds).
2. In addition to the actual product users, other experts from the target market were involved in the discussions (second expert group). This included hygiene experts, buyers in clinics or logistics personnel from hospitals.
3. The third group was made up from experts in analogous application fields, primarily from semi-conductor production. This is due to the conditions required in the "clean rooms" of chip factories being similar to operation rooms (free from dust or particles).

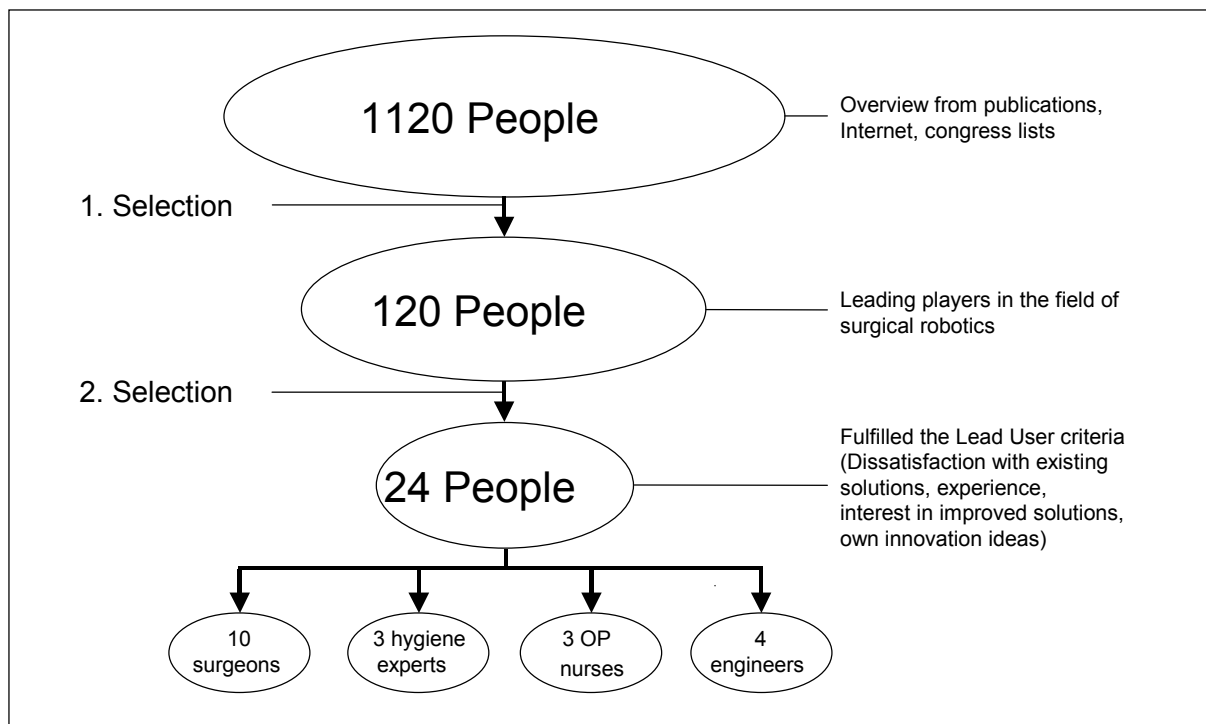


From these expert discussions alone resulted a magnitude of ideas for the improvement of the coverings and protective clothings. This outcome, due to the incremental nature of those ideas, whilst not the key aim of this project, was however considered to be a useful byproduct by J&J. The discussions also resulted in a deeper understanding about developments that would play an important role in this search field for the future. The bandwidth ranged from economical trends (the need for the reduction in hospital inventory), to medicinal developments (the increase of particular infections) to concrete technological trends (new surgical techniques). In light of this great range, focusing on one idea was required.

The project team decided to pursue the technological trend of “surgical robotics”. In some surgical fields (hip and knee prosthetics, minimally invasive heart surgery, brain surgery) surgical robots are already applied. They support the surgeon in the tasks that require the highest precision possible such as with exact drilling of bones. Therefore associated with the increasing use of this technology are completely new demands for the protection against infection in OP that in turn allow the possibility for offering new hygiene products. It is here that a great chance for innovations was seen. For this project, hip and knee prosthetics were chosen from the aforementioned application field. Due to the robotic systems developed for this field, “CASPAR” and “ROBODOC”, already having wide distribution, any product improvement in these systems, at least in the middle term, promised a high market potential.

### *Phase III: Identification of Lead Uses*

Lead Users were sought after in surgeons that primarily operate in hip surgery. Within this field users were identified who worked at the forefront of technology, identified serious hygienic problems, reported making use of improvements made in this field and even possibly made their own attempts to solve these problems. At this point an exhaustive screening process was applied. Through research of relevant publications and in the internet, as well as attending conferences and interviews with experts, over 130 people were identified who play a critical role in robotic surgery today. These people were contacted via telephone or visited in their clinic and questioned. Furthermore, those selected were asked to name any other people that were leaders and active in an innovative way in robotics or similar fields. These people were also contacted (“networking approach”). The systematic selection process of Lead User is outlines in Diagram 2.



*Diagram 2: Selection process for identifying Lead Users*

During the selection process, a group of 20 people were identified who matched the Lead User criteria. The members of this group stemmed from four fields displaying varying competencies; the surgeons as users of robotic systems, the OP personnel as the people responsible for hygienic conditions in OP (e.g. covering of the

robot and patient), the clinical engineers as being responsible for the technical maintenance and the clinical hygiene experts for infection-related questions.

#### *Phase IV: Development of the product concept*

From these 20 Lead Users, 18 were present for the subsequent 2-day Lead User workshop. This healthy number of participants reflected the high degree of involvement of the group in the development of the product concept. The group of Lead Users was complemented by three robot-manufacturing representatives, three employees from J&J and through the author of this paper as a moderator. An initial priority of the workshop was the agreement of the participants to surrender any user rights to J&J.

The group started the workshop with the aim of developing concrete concepts for innovative hygiene products in the field of robot-assisted surgery. Initially the participants involved themselves with hygiene problems in current OP applications with surgical robots ("as-is" analysis) and the evaluation of future ones (trend prognosis). This process lasted a half-day and resulted in the workshop's search field being divided systematically into unique and clear sub-fields. From these four concrete fields, the participants chose those that needed to be solved with the highest priority. In order to develop these further, four sub-groups were formed consisting of 5 to 6 participants and a moderator. In the remaining one and a half days, the group worked intensively on developing innovative solutions and in doing so produced numerous sketches and simple models from a variety of materials. The makeup of the groups varied throughout depending upon the interest of the participants. The work of sub-groups was shared between all groups via presentations and discussions.

At the end of the second workshop day, four complete and detailed concepts developed from the numerous individual ideas and solutions. One was the development of a new type of foil to cover the surgical robot that could remove the current sterility and handling problems. The second sub-group suggested a total solution for the stifling of the mist that is produced during the operations (moisture as well as bone and blood particles). The third solution consisted of a new, integrated system for the sterile storage of the patient's leg during a hip replacement surgery. The fourth group developed a process for the cleaning of the surgical robot after the completion of the procedure.

In a subsequent evaluation of the developed concepts by the participants of the workshop, the results of the first three groups performed outstandingly with respect to the criteria of originality, problem solving capacity and its ability to be realized. It should not be forgotten however that the participants of the workshop were made up of leading surgeons, OP nurses, engineers and hygiene experts. The evaluation of the ideas was based on a broad as well as a deep knowledge in the field of robot-assisted surgery.

The workshop provided J&J with the beginnings for the development of new product lines. All four of the concepts included products that were not currently in the J&J product program. Some of the product ideas are still not available from any manufacturer in the market, making them world firsts.

#### **Leaving the well-trodden path with the Lead User methodology**

The deliberate alignment with the customer and the desire to make compatible, significant and innovative jumps belong to the greatest challenges of innovation management. Companies that are able to do both increase the probability that their new products and services will perform successfully in the market. As shown here, leading companies like HILTI AG or 3M depend upon the intensive cooperation with Lead Users who are ahead of their time in both their needs and demands from products.

The effectiveness of the Lead User methodology has been proved in numerous applications. A current investigation within 3M, who have the greatest experience with Lead Users to date, supports this emphatically. In a comparison between Lead User projects and traditionally carried out development processes, the degree of innovation, turnover, market share, ability to be realized and strategic importance all were measured as being significantly superior in the Lead User projects. From these Lead User projects, new product lines resulted that without exception were responsible for a large proportion of the turnover. It has been shown that concepts developed with Lead Users have, on average, the potential to produce turnovers eight times higher than ideas produced via traditional innovation projects (Morrison et al. 2001).

The Lead User application at J&J described above resulted not just in the possibility for the further development of the existing market offer but also the chance for the expansion of their program as well as the development of completely new product lines. Beginning with conventional patient coverings and OP garments, a mature field with few possibilities to develop decisive competitive advantage, the starting points for significant innovations were developed.

With all the positive results, it should not be forgotten that the Lead User methodology is no substitute for the proven methods of innovation management and market research. It leads companies primarily to new ways to develop innovative products and services. As a result it produces “market-fit” ideas for innovations that must be advanced further with the traditional methods for the development and evaluation of concepts and prototypes.

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\* We would like to thank Dr. Ulja Schmidt, Dieter Roloff and Jeroen Bauer from the Johnson & Johnson Medical GmbH for the successful collaboration.