Developing New Product Concepts Via the Lead User Method: A Case Study in a "Low Tech" Field",

Cornelius Herstatt* and Eric von Hippel**

WP#3249-91-BPS February 1991

Publication Information: Herstatt, Cornelius, and Eric von Hippel (1992), "From Experience: Developing New Product Concepts Via the Lead User Method: A Case Study in a "Low Tech" Field", Journal of Product Innovation Management, 1992;9: 213-221.

* Swiss Federal Institute of Technology, Zurich, Switzerland
** MIT Sloan School of Management, Cambridge, MA USA

Lead User Workshops for New Product Concept Development: A Case Study

Cornelius Herstatt and Eric von Hippel

ABSTRACT

The Lead User market research method is built around the idea that the richest understanding of new product and service needs is held by just a few "Lead Users." They can be identified and drawn into a process of joint development of new product or service concepts with manufacturer personnel. In this article we report on a successful application of a Lead User market research method carried out by Cornelius Herstatt at Hilti AG, a major European manufacturer of products and materials used in construction.

In the application described, new product concepts were developed in a three-day workshop sponsored by Hilti and attended by both Lead Users and Hilti development and manufacturing personnel. The Lead User method was found to be almost twice as fast as traditional ways of identifying promising new product concepts and less costly as well. It was also judged to provide better outcomes by Hilti, the firm participating in the case.

Introduction

"Lead Users" of a novel or enhanced product, process, or service have been defined (von Hippel 1986, 1988) as those who display two characteristics with respect to it:

- They face needs that will be general in a marketplace - but face them months or years before the bulk of that marketplace encounters them, and

- They expect to benefit significantly by obtaining a solution to those needs.

Each of the two Lead User characteristics is important from the point of view of obtaining rich market researcher information on new product and service opportunities. The first is important because, as studies of problem-solving have shown, users who have real-world experience with a need can provide the most accurate data regarding it. And when needs are evolving rapidly, as is the case in many high technology product categories, only users at the front of the trend will have experience with "tomorrow's needs today." The second Lead User characteristic is important because, as has been shown by studies of industrial product and process innovations (Mansfield 1968), those who expect a high benefit from a solution to a need tend to experiment with solutions on their own - and so can provide the richest need and solution data to inquiring market researchers. Note that a Lead User is ahead of all the categories of adopter listed on a traditional innovation diffusion curve such as that developed by Rogers and Shoemaker (1971). Lead Users of each new or modified product or service concept exist before any firm has developed a version for sale in the market.

New product concept development with Lead Users is a very new approach, and implementation techniques are still evolving rapidly. Previously published studies have involved the development of concepts for very complex products and services (e.g., Urban and von Hippel 1988). In such cases initial meetings between Lead Users and product designers have been used to develop only functional concepts for desirable new products and services. In the case we describe here, the product involved was relatively simple, and it proved possible to design a complete product - up through the stage of preliminary engineering drawings - during the course of a three-day Lead User workshop. In this article, we will include practical detail on the steps we used to implement the Lead User method in general, and the Lead User Workshop in particular, in the hope that these will prove useful to others who may wish to try applications of their own.

The Case Study

The company participating in this study Hilti AG, a leading manufacturer of components, equipment, and materials used in construction, such as fastening systems, drilling and cutting equipment, and specialty chemicals. Hilti is headquartered in Liechtenstein, has major production facilities in Europe, the United States, and Japan, and sells world-wide. The worldwide sales of Hilti are over 1 billion US dollars per year.

The product line we elected to concentrate on in our Lead User workshop case study was "pipe hangers" - a relatively "low-tech" type of fastening system often used in commercial and industrial buildings. Pipe hangers are assemblages of steel supports and pipe clamps and other hardware components that are used to securely fasten pipes to the walls and/or ceilings of buildings. Sometimes pipe hangers can be quite simple and support only a single pipe. Frequently, however, they are relatively complicated structures that simultaneously support and align a number of pipes of different sizes and types.

Figure 1: A Conventional Pipe Hanger Configured to Support Several Pipes

A Lead User market research study involves four major steps, which are spelled out in detail elsewhere (von Hippel 1986,1988; Urban and von Hippel 1988). In brief summary, these are as follows: (1) Specify the characteristics a Lead User will have in the product/market segment of interest; (2) Identify a sample of Lead Users who fit these Lead User criteria; (3) Bring the sample of Lead Users together with company engineering and marketing personnel to engage in group problem-solving; (4) Test whether concepts found valuable by Lead Users will also be valued by the more typical users in the target market. In the paragraphs that follow we will describe how each of the four steps in a Lead User study were carried out in this case.

Step 1: Specification of Lead User Indicators

Recall that Lead Users of a product, process, or service are defined as those who display two characteristics with respect to it: (1) They have needs that are advanced with respect to an important marketplace trend(s); (2) They expect to benefit significantly by obtaining a solution to those needs. In order to identify lead users of pipe hanging hardware, a first step was to identify important trends and users with relatively high benefit expectations related to these.

(A) Identification of Trends

Identification of important trends in the evolution of user needs in pipe-hanging hardware began with a survey of experts. A brief analysis of the target market showed that people with expert knowledge in the relevant field would be found among "layout engineers," the specialists in charge of planning complex pipe networks in commercial and industrial buildings. (Layout engineers also are key decisionmakers with respect to determining which components will be bought and used for the pipe networks they design.)

Expert advisors for this study were found in construction departments of technical universities, professional engineering organizations, and municipal departments responsible for approving the design of pipe networks. Some of these were already known to the Hilti R&D department; others were identified via

recommendations. Ultimately, the panel of experts who provided information for this study consisted of eight leading layout engineers in Switzerland, Germany, and Austria: two researchers from the construction departments of the Swiss Federal Institute of Technology and the University of Darmstadt (Germany); one engineer from the professional organization in Bonn (Germany); and one engineer each from the municipal building departments in Bern (Switzerland) and Berlin (Germany).

The trends identified as most important by the experts surveyed regarding pipe hanger systems were as follows:

Trend 1: There is an increasing need for pipe hanger systems that are extremely easy to put together - so easy that instruction booklets will not be needed: Such systems should have significantly fewer components than at present. They should adapt to a wide range of application conditions, and should be based on a simple, consistent construction principle.

Reason for trend: Education levels among installers are going down in many countries.

Trend 2: There is a need for rapidly actuated, positive, interlocking fasteners to connect pipe hanger elements together securely, and to attach the completed hangers securely to building walls and ceilings.

Reason for trend: Safety standards in many countries are becoming more stringent. Some of the multiple screws and bolts now used to assemble hangers (see Figure 1) may be inadvertently overlooked by installers - with consequent risk of field failure.

Trend 3: There is a need for pipe hangers made from lighter, noncorrodible materials. Pipe hangers should therefore increasingly be made of plastics rather than of the steel elements that are used almost exclusively today.

Reason for trend: Pipe-hanging systems made of steel are heavy and therefore difficult and dangerous to hang under some field conditions. In addition, steel is subject to corrosion and failure in wet environments or environments where chemicals are present.

Solutions that offered improvements with respect to these (somewhat overlapping) trends were expected to result in significant benefits for the users of pipe hangers. The skills required of installers would be reduced; user firms would have fewer components to stock; the speed and safety of installation would be greatly increased; the risk of field failures would be reduced.

(B) Identification of High Benefit Expectations

Expectations of innovation-related benefit on the part of users can be identified by survey, and this approach has been successfully applied elsewhere (von Hippel 1986, 1988)). However, as mentioned earlier, innovation-related activity by users can also serve as a proxy for expectations of benefit, and this is the approach used here.

Users showing innovation activity were identified by conducting telephone interviews with a sample of 74 interviewees. Since, as will be described in the next section, the same sample was screened to simultaneously identify users having both Lead User characteristics: (1) being ahead with respect to identified trends and (2) having high expected benefit, we will defer a detailed discussion of methods and findings with respect to user innovation activity until we describe how step two was carried out in this study.

Here, we simply note that users engaged in innovating were determined by questions such as: "Do you / did you ever build and install pipe-hanger hardware of your own design? Do you / did you ever modify commercially available pipe hanger hardware to better suit your needs?" We also note that a high fraction of users interviewed (36%) were in fact found to display this characteristic.

Step 2: Identification of Lead Users

Once the trends and the user benefit characteristics were specified that would be used to identify lead users, the next step was to identify a Lead User sample. In this study, the step was begun by identifying a random sample of companies that install pipe hangers. Such companies are specialists in installing pipe networks in commercial and industrial buildings - for example, industrial plumbing firms. Installation of pipe hangers is a subtask in the larger task of pipe installation. The tradesmen who actually install pipe hangers comprised the group in which Lead Users would be identified. (Installers of pipe hangers have only a moderate-level technical education. In the countries from which our user sample

was drawn - Switzerland, Germany, and Austria, these installers have completed eight years of general schooling, and then have taken a two- or three-year vocational training program in their particular trade. Finally, they have passed a municipal examination and received a license to practice.)

Hilti's German, Austrian, and Swiss sales divisions (selected because of their geographical accessibility) were asked to provide the names of companies that they thought were buyers of pipe-hanger systems made either by Hilti itself or by competitors. In this request no mention was made of either customer innovativeness or customer size. The three sales divisions eventually responded with the names of 120 firms they thought met the criteria.

Next, attempts were made to contact all 120 user firms for a telephone survey. Ultimately, 74 of these were in fact successfully contacted and judged suitable for and willing to undertake more detailed interviews (20 of the 120 were excluded because they could not be reached after 5 telephone calls. An additional 16 were excluded because they were found not to be currently using the product type at issue. A final 10 were not included simply because they were not willing to participate in an interview).

In the instance of the 74 firms who were willing to participate in a telephone interview, interviewers sought to identify the most expert person on the products under investigation. To do this, the first contact at each firm was asked: "Whom do you regard the most expert person on pipe-hanger systems in your company, and can we talk to that person?" In 64 of the 74 cases, the interviewers were referred to expert "fitters" - employees who actually install pipe-hanging systems in the field. In the remaining 10 cases they were referred to direct supervisors of fitters, all of whom had moved into supervisory positions only after extensive experience in the field.

Interviews were next conducted with all of these 74 individuals. The interviews were aimed at identifying a subset of users in the total user sample who had both of the two Lead User characteristics: (1) being ahead on the trends identified by the experts and (2) expecting high benefit from innovations along these dimensions.

The proxy used for "ahead on identified trends" was simply: (1) did the interviewees agree that advances along the trends that had been specified by the expert panel were in fact needed and important; and (2) could the interviewees describe at least some technically interesting ideas regarding these trends. As we noted in our discussion of step one in a Lead User study, the proxy used for user

innovation benefit expectations was: had the users developed or modified pipe hangers in ways that they felt represented improvements with respect to the identified trends.

As a result of the interviews just described, 22 lead users of pipe hanging hardware were identified. Table 1 summarizes the findings on this matter and, as a matter of interest, compares these with data drawn from the Urban and von Hippel study of PC-CAD users (1988). In both studies, there was a high overlap among users displaying the two Lead User characteristics.

	Sample of Pipe Hanger Users	Sample of PC-CAD Users*
Users at front of selected trend(s)	30% (22)	28% (38)
Users who built own prototype products	36% (27)	25% (34)

*Data Source: Urban and von Hippel (1988).

Table 1: Percent of sample found to have Lead User characteristics in two studies

It is interesting to note that, as is shown in Table 1, fully 27 (36%) of our random sample of users of pipe-hanging systems had designed, built, and installed hangers of their own devising in one or more cases. This compares very favorably with the 25% of innovating users found in the technically sophisticated field of PC-CAD.

Step 3: Lead User Product Concept Development

A group of 22 Lead Users of pipe hangers had now been identified. The next task was to bring some of these Lead Users and expert Hilti personnel together in a concept generation workshop.

Selection of Lead User Concept Group

Two additional tests were applied to the sample of 22 Lead Users to identify those best suited to join with engineers from the manufacturer and other experts in a three-day concept generation workshop. These additional tests consisted simply of the judgment of the person who had interviewed the user on two matters: Did

the interviewer judge that the user could describe his experiences and ideas clearly?; Did the user seem to have a strong personal interest in the development of improved pipe hanger systems? Fourteen of the 22 Lead Users met these additional tests and were invited to join the workshop.

Twelve of the 14 Lead Users contacted - 10 pipe fitters plus 2 supervisors of fitters - agreed to join the product concept development workshop. Interestingly, the two that did not were users who had patented their own pipe hanger system designs. These two were unwilling to present their ideas in a workshop, most probably because of their concerns about the diffusion of their technical know-how.

All users who joined the workshop formally agreed that any inventions or ideas developed during the sessions would be the property of Hilti. As compensation, every participant was offered a small honorarium (about $150 US). Interestingly, most of the participants did not accept the honorarium; they felt sufficiently rewarded by simply attending and contributing to the planned workshop.

Three-Day Product Concept Generation Workshop

The goal of the product concept generation workshop, sponsored by Hilti, was to develop the conceptual basis for a novel pipe hanger system with characteristics identified in the technical trend analysis described earlier. In order to most effectively meet this goal and in order to efficiently transfer the workshop findings to Hilti, the Lead Users at the workshop were joined by two of the expert layout engineers who had participated in the trend analysis segment of our study. Invitees from Hilti consisted of the marketing manager, the product manager, and three engineers who worked on the design of pipe-fastening systems.

The workshop was organized as follows:

- On Day 1, the entire group conducted a review of important trends and problems in pipe-hanging systems. Next, five relatively independent problem areas were defined by the group, and a subgroup was established to work on each. (The five subgroup topics were: [1] methods of attaching pipe hangers to ceilings or walls; [2] design of support elements extending between the wall attachment and pipe clamp itself; [3] the design of the pipe clamps; [4] design of the methods of attaching various system components to each other in the field; and [5] methods of conveniently

adjusting the length of supporting members at the field site.) Membership in the subgroups was at the option of workshop participants, and shifts in membership were made from time to time to avoid the possible danger of premature fixation on individual problem-solving ideas championed by individual users. Each of the subgroups was assisted by technicians from Hilti or by external layout engineers.

- On Day 2, the five subgroups worked on their problem areas in the morning, and in the afternoon all took a break from the specific problems at hand and participated in some general problem-solving and creativity exercises such as role-playing and team-building exercises. The purpose of these was both to lessen pressure on participants and to make them more comfortable with each other. And, after a short while, the workshop was in fact characterized by very strong group cohesion and intensive, cordial interaction.

- On Day 3, the subgroup ideas were presented to the entire group for evaluation and suggestions. As an aid to this evaluation effort, each of the subgroup ideas was evaluated on three criteria: originality (how revolutionary and novel is the solution from a technical point of view?); feasibility (how quickly can the solution be realized employing currently available technology); and comprehensiveness of solution (does the idea represent a single solution or does it resolve several user problems simultaneously?) Next, membership in the subgroups was changed, work on the most promising concepts was continued, and informal engineering drawings were produced by participants. Finally, the most promising concepts were discussed and modified by the entire group, and then merged into one joint concept.

Results of Product Concept Generation Workshop

At the conclusion of the workshop, the single pipe hanger system design selected by the total group as incorporating the best of all the elements discussed in the subgroups, and this was the system recommended to Hilti.

After the workshop, the technical and economic feasibility of the new product concept proposed by the Lead Users was evaluated further by Hilti personnel. At the conclusion of this work, it was decided that the Lead Users had

indeed developed a very valuable new pipe hanger system. In the judgment of company experts it was well in advance of the offerings of competitors.

Step 4: Testing Whether Lead User Concepts Appeal to Typical Users

The fourth and final step in the Lead User market research method involves testing whether routine users in a marketplace find the product or service concept developed by Lead Users to be attractive. Because Hilti's internal evaluation showed the potential commercial value of the Lead User concept to be very high, they were not willing to present it to a random sample of typical users for evaluation, but instead decided to simply test the Lead User product concept on a sample of 12 "routine" users.

The companies selected for this routine user sample were drawn from the original group of 74 interviewed companies. The selection criteria were that the telephone interview data showed them not to be Lead Users, and also that they must have had a long, close relationship with Hilti. (The latter requirement was added because the company wished to have confidence that these users would be willing to honor a request to keep the details of the new system secret.) The interviewees selected were buyers as well as users: They had the dominant role in the purchasing decisions of their own companies with respect to pipe hangers.

These 12 user-evaluators were asked to review the proposed pipe hanger system in detail, noting particular strengths and weaknesses. Their response was very positive. Ten of the 12 preferred the Lead User product concept over existing, commercially available solutions. All except one of the 10 expressed willingness to buy such a pipe hanger system when it became available, and estimated that they would be willing to pay a 20% higher price for it relative to existing systems.

Comparison of Lead User Method with Method Ordinarily Used by Hilti

The case study was, as reported above, very successful. In addition, Hilti personnel informally judged that the Lead User method, beginning with a technological trend identification and ending with a novel product concept, was significantly faster and cheaper than the more conventional marketing research methods they normally used. Unfortunately, data needed to test this judgment carefully did not exist in the firm. However, it was possible to compare the time and costs expended in this first Lead User study by Hilti with the time and costs

expended on a project that they had recently conducted, and that they judged to be of very similar scope and complexity.

Concept Generation Method Employed	Time and Cost Expenditure for Concept Generation, Evaluation, and Acceptance By Hilti	
	Time	Cost
Lead User Method	9 months	$51,000
Conventional Method	16 months	$100,000

Table 2: An Anecdotal Time and Cost Comparison Between Two Product Concept Generation Efforts at Hilti

The new product concept generation process Hilti conventionally used took a total (elapsed time) of 16 months from start to final agreement on the specifications of the product to be developed, and cost $100,000. The work began with marketing personnel collecting and evaluating data on needs and problems from customers (5 months; $56,000); then marketing explained to engineering what it had found, and these two groups jointly developed tentative product specifications (2 months; $5,000). Next, engineering went off on its own to develop technical approaches to meeting the agreed-upon specifications (4 months; $23,000). Then, engineering got together with marketing to evaluate and adjust these (3 months; $10,000). Finally, both engineering and marketing wrote up a formal product specification and submitted it to management for formal approval (2 months; $5,000).

In contrast, the Lead User method took a total (elapsed time) of 9 months and cost $51,000 from the start of work to final agreement on the specifications of the product to be developed. In this instance, the major steps were all conducted by a project group headed by the manager of the pipe hanger product line. The group membership consisted of two development engineers, and two experts in marketing. One of the marketing specialists was responsible for pipe hangers specifically, and one was a market research methods expert from Hilti's central market research group. The steps carried out by this group (and described in detail

earlier in the article) were survey of experts (2 months; $9,000); telephone survey (2 weeks; $8,000); Lead User product conception generation workshop (3 days; $24,000); internal evaluation of Lead User concept (3 months; $4,000); concept test on typical user group (2 months; $4,000); writing of formal product specification submission to management for formal approval (2 months; $2,400).

In sum, the Lead User method consumed only 56% of the time used for the project put forward by Hilti as comparable. In our estimation and that of Hilti personnel, the reason for the time saving appeared to lie mainly in the systematic, parallel involvement of engineers, market specialists, and highly qualified users - in contrast to the serial involvement of these groups used in the earlier method. Because of this, time-consuming feedback loops or reconsiderations, often produced by misinterpretations or information filtering in the serial method, were avoided.

The cost of the Lead User process was also found to be significantly lower than product concept generation methods previously used by Hilti (approximately 50%). An informal evaluation of the reasons for this, conducted with Hilti personnel, suggests that the cost saving had two principal causes. First, the costs for customer surveys were lower in the Lead User method. (In the Lead User project, only 12 selected users were involved in joint, face-to-face discussions. In the conventional project approximately 130 interviews with a randomly selected group of users, each involving face-to-face visits by Hilti personnel, were carried out in three different countries.) Second, the solutions provided by the Lead User group required less work on the part of manufacturer technical departments than did the ideas developed through more conventional market research methods. (In the Lead User project, product development engineers from Hilti's technical departments had direct user contact and had been involved in concept development from the start. They therefore had richer data regarding user needs in the Lead User project than they did in the conventional project.)

Discussion

In this case study, the Lead User workshop for the development of new product concepts worked well. A significant fraction of all users sampled were found to have Lead User characteristics. A group selected from among these proved very effective in working with company personnel on new product concept development, and did in fact develop a new system judged to be very valuable by both the manufacturer and a group of non-Lead Users. Also, and importantly,

study participants found participation to be both useful and enjoyable. (Bailetti and Guild (1991) explicitly measured the responses of design engineers to visits with Lead Users, and also found that participants judged this experience to be very valuable.)

An additional, unanticipated result of the Lead User workshop was an observed improvement of teamwork within the manufacturer, manifested in a significant improvement in the level of cooperation between the technical and marketing groups in the company. One reason for this was apparently that the teamwork built into the Lead User method had a carry-over effect. Also, since product and performance requirements of innovative users were immediately translated into language meaningful to both engineers and market researchers, a shared language was created that made further cooperation easier.

Although the Lead User method in general, and the workshop in particular, worked well in this case study, the reader should note that it is still a very new method. Details of method application will appropriately differ from study to study - and we are all still learning.

References

Bailetti, Antonio J., and Guild, Paul D. "Designers' Impressions of Direct Contact Between Product Designers and Champions of Innovation." Journal of Product Innovation Management 8, no. 2 (June 1991):91-103.

Mansfield, Edwin. Industrial Research and Technological Innovation: An Econometric Analysis. New York: W.W. Norton & Company, 1968.

Rogers, Everett M., with F. Floyd Shoemaker. Communication of Innovations: A Cross-Cultural Approach. New York: Free Press, 1971.

Urban, Glen L., and von Hippel, Eric. "Lead User Analyses for the Development of New Industrial Products." Management Science 34, no. 5(May 1988):569-82.

von Hippel, Eric. "Lead Users: A Source of Novel Product Concepts." Management Science 32, no.7 (July 1986):791-805.

von Hippel, Eric. The Sources of Innovation. New York: Oxford University Press, 1988.