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LEAD USERS: A SOURCE OF NOVEL PRODUCT CONCEPTS*

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Accurate marketing research depends on accurate user judgments regarding their needs. However, for very novel products or in product categories characterized by rapid change—such as "high technology" products—most potential users will not have the real-world experience needed to problem solve and provide accurate data to inquiring market researchers. In this paper I explore the problem and propose a solution: Marketing research analyses which focus on what I term the "lead users" of a product or process.

Lead users are users whose present strong needs will become general in a marketplace months or years in the future. Since lead users are familiar with conditions which lie in the future for most others, they can serve as a need-forecasting laboratory for marketing research. Moreover, since lead users often attempt to fill the need they experience, they can provide new product concept and design data as well.

In this paper I explore how lead users can be systematically identified, and how lead user perceptions and preferences can be incorporated into industrial and consumer marketing research analyses of emerging needs for new products, processes and services.
(MARKETING—NEW PRODUCTS; RESEARCH AND DEVELOPMENT; INNOVATION MANAGEMENT)

1. Introduction

Accurate understanding of user need has been shown near-essential to the development of commercially successful new products (Rothwell et al. 1974, Achilladelis et al. 1971). Unfortunately, current market research analyses are typically not reliable in the instance of very novel products or in product categories characterized by rapid change, such as "high technology" products. In this paper I explore the problem and propose a solution: marketing research analyses which focus on what I term the "lead users" of a product or process.

Lead users are users whose present strong needs will become general in a marketplace months or years in the future. Since lead users are familiar with conditions which lie in the future for most others, they can serve as a need-forecasting laboratory for marketing research. Moreover, since lead users often attempt to fill the need they experience, they can provide new product concept and design data as well. How lead users can be systematically identified, and how their perceptions and preferences incorporated into industrial and consumer marketing research analyses of emerging needs for new products, processes and services is examined below.

2. Marketing Research Constrained by User Experience

Users selected to provide input data to consumer and industrial market analyses have an important limitation: Their insights into new product (and process and service) needs and potential solutions are constrained by their own real-world experience. Users steeped in the present are thus unlikely to generate novel product concepts which conflict with the familiar.

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The notion that familiarity with existing product attributes and uses interferes with an individual's ability to conceive of novel attributes and uses is strongly supported by research into problem solving (Table 1). We see that experimental subjects familiar with a complicated problem-solving strategy are unlikely to devise a simpler one when this is appropriate (Luchins 1942). Also, and germane to our present discussion, we see that subjects who use an object or see it used in a familiar way are strongly blocked from using that object in a novel way (Duncker 1945, Birch and Rabinowitz 1951, Adamson 1952). Furthermore, the more recently objects or problem-solving strategies have been used in a familiar way, the more difficult subjects find it to employ them in a novel way (Adamson and Taylor 1954). Finally, we see that the same effect is displayed in the real world, where the success of a research group in solving a new problem is shown to depend on whether solutions it has used in the past will fit that new problem (Allen and Marquis 1964). These studies thus suggest that typical users of existing products—the type of user-evaluators customarily chosen in market research—are poorly situated with regard to the difficult problem-solving tasks associated with assessing unfamiliar product and process needs.

As illustration, consider the difficult problem-solving steps which potential users must go through when asked to evaluate their need for a proposed new product. Since individual industrial and consumer products are only components in larger usage patterns which may involve many products, and since a change in one component can change perceptions of and needs for some or all other products in that pattern, users must first identify their existing multiproduct usage patterns in which the new product might play a role. Then they must evaluate the new product's potential contribution to these. (For example, a change in the operating characteristics of a computer may allow a user to solve new problem types if he makes related changes in software and perhaps in other, related products and practices. Similarly, a consumer's switch to microwave cooking may well induce related changes in food recipes, kitchen practices, and kitchen utensils.) Next, users must invent or select the new (to them) usage patterns which the proposed new product makes possible for the first time, and evaluate the utility of the product in these. Finally, since substitutes exist for many multiproduct usage patterns (e.g., many forms of problem analysis are available in addition to the novel ones made possible by a new computer) the user must estimate how the new possibilities presented by the proposed new product will compete (or fail to compete) with existing options. This problem-solving task is clearly a very difficult one, particularly for typical users of existing products whose familiarity with existing products and uses interferes with their ability to conceive of novel products and uses when invited to do so.

The constraint of users to the familiar pertains even in the instance of sophisticated consumer marketing research techniques such as multiattribute mapping of product perceptions and preferences (Silk and Urban 1978, Shocker and Srinivasan 1979, Roberts and Urban 1985). "Multiattribute" (multidimensional) marketing research methods, for example, describe a consumer's perception of new and existing products in terms of a number of attributes (dimensions). If and as a complete list of attributes is available for a given product category, a consumer's perception of any particular product in the category can be expressed in terms of the amount of each attribute the consumer perceives it to contain, and the difference between any two products in the category can be expressed as the difference in their attribute profiles. Similarly, consumer preferences for existing and proposed products in a category can in principle be built up from consumer perceptions of the importance and desirability of each of the component product attributes.

Although these methods frame user perceptions and preferences in terms of attributes, they do not offer a means of going beyond the experience of the users interviewed. First, for reasons discussed above, user subjects are not well positioned to accurately evaluate novel product attributes or "amounts" of familiar product attributes which lie outside the range of their real-world experience. Second, and more specific to these techniques, there is no mechanism to induce users to identify all product attributes potentially relevant to a product category, especially attributes which are currently not present in any extant category member. To illustrate this point, consider two types of such methods, similarity-dissimilarity ranking and focus groups.

In similarity-dissimilarity ranking, data regarding the perceptual dimensions by which consumers characterize a product category are generated by inviting a sample of consumers to compare products in that category and assess their similarity-dissimilarity. In some variants of the method, the consumer specifies the ways in which the products are similar or different. In others, the consumer simply provides similarity and difference rankings, and the market analyst determines—via his personal knowledge of the product type in question, its function, the marketplace, the consumer, etc. —the important perceptual dimensions which "must" be motivating the consumer rankings obtained.

The similarity-dissimilarity method clearly depends heavily on an analyst's qualitative ability to interpret the data and correctly identify all the critical dimensions. Moreover, by its nature, this method can only explore perceptions derived from attributes which exist in or are associated with the products being compared. Thus, if a group of consumer evaluators is invited to compare a set of cameras and none has a particular feature—say, instant developing—then the possible utility of this feature would not be incorporated in the perceptual dimensions generated. That is, the method would have been blind to the possible value of instant developing prior to Edwin Land's invention of the Polaroid camera.

In focus group methods, market analysts assemble a group of consumers familiar with a product category for a qualitative discussion of perhaps two hours' duration. The topic for the focus group, which is set by an analyst, may be relatively narrow (e.g., "35 mm amateur cameras") or somewhat broader (e.g., "the photographic experience as you see it"). The ensuing discussion is recorded, transcribed, and later reviewed by the analyst whose task it is to identify the important product attributes which have implicitly or explicitly surfaced during the conversation. Clearly, as with similarity-dissimilarity ranking, the utility of information derived from focus group methods depends heavily on the analyst's ability to accurately and completely abstract from the interview data the attributes which consumers feel important in products.

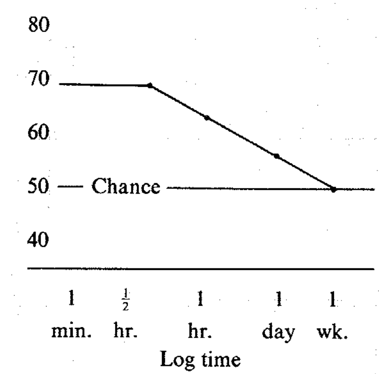
In principle, however, the focus group technique need not be limited to only identifying attributes already present in existing products, even if the discussion is nominally focused on these. For example, a topic which extends the boundaries of discussion beyond a given product to a larger framework could identify attributes not present in any extant product in a category under study. If discussion of the broad topic mentioned earlier, "the photographic experience as you see it," brought out consumer dissatisfaction with the time lag between picture taking and receipt of the finished photograph, the analyst would be in possession of information which could induce him to identify an attribute not present in any camera prior to Land's invention, instant film development, as a novel and potentially important attribute.

But how likely is it that an analyst will take this creative step? And, more generally, how likely is it that either method discussed above, similarity-dissimilarity ranking or focus groups, will be used to identify attributes not present in extant products of the type being studied, much less a complete list of all relevant attributes? Neither method contains an effective mechanism to encourage this outcome, and discussions with practitioners indicate that in present-day practice, identification of any novel attribute is unlikely.

TABLE 1

The Effect of Prior Experience on Users' Ability to Generate or Evaluate Novel Product Possibilities

Study	Nature of Research	Impact of Prior Experience on Ability to Solve Problems
Luchins (1942)	Two groups of subjects ($n =$) were given a series of problems involving water jars, e.g.: 'If you have jars of capacity A, B and C how can you pour water from one to the other so as to arrive at amount D?' Subject group 1 was given 5 problems solvable by formula, $B - A - 2C = D$. Next, both groups were given problems solvable by that formula *or* by a simpler one (e.g. $B - C = D$).	81% of experimental subjects who had previously learned a complex solution to a problem type applied it to cases where a simple solution would do. No control group subjects did so ($p =$ NA[a]).
Duncker (1945)	The ability to use familiar objects in an unfamiliar way was tested by creating 5 problems which could only be solved by that means. (For example, one problem could be solved only if subjects bent a paper clip provided them and used it as a hook.) Subjects were divided into two groups. One group of problem solvers saw the crucial objects being used in a familiar way (e.g. the paper clip holding papers), the other did not (e.g. the paper clip was simply lying on a table unused).	Subjects were much more likely to solve problems requiring the use of familiar objects (e.g. paper clips) in unfamiliar ways (e.g. bent into hooks) if they had not been shown the familiar use just prior to their problem-solving attempt. Duncker called this effect "functional fixedness" ($n = 14$; $p =$ NA[a]).
Birch and Rabinowitz (1951)	Replication of Duncker, above	Duncker's findings confirmed ($n = 25$; $p < 0.05$)
Adamson (1952)	Replication of Duncker, above	Duncker's findings confirmed ($n = 57$; $p < 0.01$)

Adamson and Taylor (1954)	The variation of "functional fixedness" with time was observed by the following procedure. First, subjects were allowed to use a familiar object in a familiar way. Next, varying amounts of time were allowed to elapse before subjects were invited to solve a problem by using the object in an *unfamiliar* way.	If a subject uses an object in a familiar way, he is partially blocked from using it in a novel way. ($n = 32$; $p < 0.02$) This blocking effect decreases over time (see graph). Functional fixedness as a function of log time 
Allen and Marquis (1964)	Government agencies often buy R & D services via a "Request for Proposal" (RFP) which states the problem to be solved. Interested bidders respond with Proposals which outline their planned solutions to the problem and its component tasks. In this research, relative success of eight bidders' approaches to the component tasks contained in 2 RFPs was judged by the Agency buying the research ($n = 26$). Success was then compared to prior research experience of bidding laboratories.	Bidders were significantly more likely to propose a successful task approach if they had prior experience with that approach only, rather than prior experience with inappropriate approaches only.

[a] This relatively early study showed a strong effect but did not provide a significance calculation—or present data in a form which would allow one to be determined without ambiguity.

Finally, both of these methods conventionally focus on familiar product categories. This restriction, necessary to limit the number of attributes which "completely describe" a product type to a manageable number, also tends to limit consumer perceptions to attributes which fit products within the frame of existing product categories. Modes of transportation, for example, logically shade off into communication products as partial substitutes ("I can drive over to talk to him—or I can phone"), into housing and entertainment products ("We can buy a summer house—or go camping in my recreational vehicle"), indeed, into many other of life's activities. But since a complete description of life cannot be compressed into 25 attribute scales, the analysis is constrained to a narrower—usually conventional and familiar—product category or topic. This has the effect of rendering any promising and novel cross-category new product attributes less visible to the methods I have discussed.

In sum, then, we see that marketing researchers face serious difficulties if they attempt to determine new product needs falling outside of the real-world experience of the users they analyze.

3. Lead Users' Experience Is Needed for Marketing Research in Fast-Moving Fields

In many product categories, the constraint of users to the familiar does not lessen the ability of marketing research to evaluate needs for new products by analyzing typical users. In the relatively slow-moving world of many consumer products, new cereals and new car models do not often differ radically from their immediate predecessors. Therefore, even the "new" is reasonably familiar, and the typical user can thus play a valuable role in the development of new products.

In contrast, in high technology industries, the world moves so rapidly that the related real-world experience of ordinary users is often rendered obsolete by the time a product is developed or during the time of its projected commercial lifetime. For such industries I propose that "lead users" who *do* have real-life experience with novel product or process concepts of interest are essential to accurate marketing research. Although the insights of lead users are as constrained to the familiar as those of other users, lead users are familiar with conditions which lie in the future for most—and so are in a position to provide accurate data on needs related to such future conditions.

I define "lead users" of a novel or enhanced product, process or service as those displaying two characteristics with respect to it:

—Lead users face needs that will be general in a marketplace—but face them months or years before the bulk of that marketplace encounters them, *and*

—Lead users are positioned to benefit significantly by obtaining a solution to those needs.

These two lead user characteristics are shown schematically in Figure 1. Two specific examples of lead users: Firms who today need and could obtain significant benefit from a type of office automation which the general market will need tomorrow are lead users of office automation; a semiconductor producer with a current strong need for a process innovation which many semiconductor producers will need in two-years' time is a lead user with respect to that process.

Users whose present needs foreshadow general demand exist because important new technologies, products, tastes, and other factors related to new product opportunities typically diffuse through a society, often over many years, rather than impact all members simultaneously (Rogers and Shoemaker 1971). Thus, when Mansfield (1968) explored the rate of diffusion of twelve very important industrial goods innovating into major firms in the bituminous coal, iron and steel, brewing, and railroad industries, he

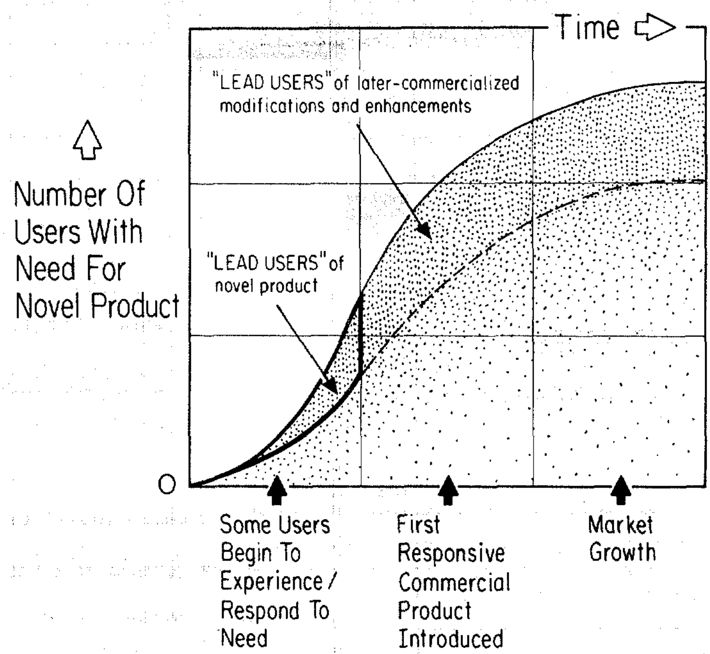


FIGURE 1. A Schematic of Lead Users' Position in the Life Cycle of a Novel Product, Process or Service. Lead Users (1) Encounter the Need Early and (2) Expect High Benefit from a Responsive Solution. (Higher Expected Benefit Indicated by Deeper Shading.)

found that in 75 percent of the cases it took over 20 years for complete diffusion of these innovations to major firms. Accordingly, some users of these innovations could be found far in advance of the general market.

Users of new products and processes have been shown to differ on the level of benefit they can obtain from these (Mansfield 1968). The greater the benefit a given user can obtain from a needed novel product or process, the greater his effort to obtain a solution will be. (This link between innovation activity and expectation of economic benefit was first empirically established by Jacob Schmookler (1966), who conducted a careful study of the correlation between changes in sales volumes of some capital goods and appropriately lagged changes in rates of patent applications in categories related to those goods.) I therefore reason that users able to obtain the highest net benefit from the solution to a given new product (or process or service) need will be the ones who have devoted the most resources to understanding it. And it follows that this subset of users should have the richest real-world understanding of the need to share with inquiring market researchers.

4. Utilizing Lead Users in Marketing Research

How then can lead users be incorporated into marketing research? I suggest a four-step process:

(1) Identify an important market or technical trend;

(2) Identify lead users who lead that trend in terms of (a) experience and (b) intensity of need;

(3) Analyze lead user need data;

(4) Project lead user data onto the general market of interest.

I consider how each of these steps might be approached below with regard to industrial and consumer products.

4.1. *Identifying an Important Trend*

Lead users are defined as being in advance of the market with respect to a given important dimension which is changing over time. Therefore, before one can identify lead users in a given product category of interest, one must identify the underlying trend on which these users have a leading position.

Identification of important trends affecting promising markets is already commonly performed by many firms as a necessary component of their corporate strategy. Methods used range from the intuitive judgments of experts, perhaps formalized in a technique such as the "Delphi" method, to simple trend extrapolation to more complex correlational or econometric models. (See Chambers, Mullick, and Smith (1971), for a useful practitioner's overview. See Martino (1972) for the special case of forecasting trends in technology.) Despite the existence of formal trend assessment methods, however, trend identification and assessment remains something of an art. Thus, analysts typically must judge which of many important trends in a market they will focus on, or must combine several into a suitable index variable.

In the case of industrial goods, trend identification and assessment can often be both informal and accurate. Since potential buyers typically measure the value of proposed new industrial products in economic terms, important underlying trends related to product value are often inescapably clear to those in the industry. For example, it is clear to those in the semiconductor and computer fields that computer memory and microprocessor chips are getting more capable and less expensive for a given capability every year. It is also clear that, for technical reasons, this trend is also likely to continue for a number of years. Finally, it is clear that this trend has very important cost/performance implications for firms which incorporate these semiconductors in computers or myriad other increasingly "intelligent" products.

In the case of consumer goods, accurate trend identification is often more difficult because there is often no underlying stable basis for comparison such as that played by economic value for industrial goods. Therefore, while consumer perceptions of trends and their subjective assessment of the importance of these can be determined straightforwardly by survey at any given point in time, these perceptions may not be consistent over time. (For example, we cannot expect to predict the trend in consumer interest in auto fuel economy as a function of fuel cost as accurately as we could predict industrial buyer interest in fuel economy on that basis.)

In sum, reliable methods for formal prediction of trends over time which will have an important effect on a given product area are not yet well developed. In some product areas, however, notably in industrial goods, the needed data on important trends are clear to those with expertise, and in these instances the poor state of formal methods is not an impediment to incorporating analyses of lead users into marketing research.

4.2. *Identifying Lead Users*

Once a firm has identified one or more significant trends which appear associated with promising new product opportunities, the market researcher can begin to search for lead users, users (1) who are at the leading edge of each identified trend in terms of related new product and process needs and (2) who expect to obtain a relatively high net benefit from solutions to those needs. Let us consider practical means for identifying lead users in the instance of industrial goods and consumer goods in turn.

The first task, identifying users at the leading edge of a given trend, is usually straightforward in the case of industrial goods because a given firm's position on a range of trends is usually well known to industry experts. Thus, in many instances, industrial good manufacturers have only a few or a few score major potential customers for a given product type and often know the characteristics of each user quite well. As illustration, recall the important trend toward cheaper, more capable computer memory and microprocessor semiconductor chips. Manufacturers of semiconductor process equipment would recognize that cheaper, more capable semiconductors are achieved in major part by the packing of circuit elements ever more densely on chip surfaces by semiconductor makers (equipment users), a trend involving significant new user needs for semiconductor process equipment. They would also know that many users at the leading edge of the need for density trend are makers of VLSI memories, with makers of other types of semiconductors such as linear ICs lying further back on the curve. Therefore, VLSI memory manufacturers can be flagged as potential lead users of process equipment with regard to this trend.

The second task is identifying the subset of those user firms positioned at the forefront of the trend under study who are also able to obtain relatively high "net benefit" from adopting a solution to trend-related needs. In the case of industrial goods, net benefit is typically measured in economic terms. And when this is so, the net benefit (B) which a user firm expects to obtain from a solution to a given need can be stated as: $B = (V)(R) - C - D$ where (V) is the dollar "volume" of product sales or processing activity to which the user plans to apply his solution; (R) is the increased rate of profit per dollar of this volume resulting from application of that solution; (C) is the user's anticipated costs in developing and/or adopting the solution; and (D) is the net benefit which the user would have obtained from old practices, equipment, etc., displaced by the novel solution. (Industrial firms typically make the calculation described above when they assess the return on investment they may anticipate from investing in a new product, process or service. I will not describe specific methods of making such calculations here. General methods can be found in accounting texts. A discussion of net benefit calculations useful in the specific instance of innovations will be found in von Hippel (1982).)

An additional, very practical method for identifying lead users involves identifying those users who are actively innovating to solve problems present at the leading edge of a trend. Thus, the semiconductor process equipment makers mentioned in our earlier example could seek those few VLSI memory manufacturers (equipment users) who are actively developing processes for the manufacture of denser chips. A user conducting such R&D is probably a lead user because innovation is expensive, and the user engaged in it surely expects to reap high net benefit from a problem solution. Identifying lead users by seeking innovating users can be very economical, because the identity of users conducting R&D on a given problem area is often common knowledge to industry participants.

In the case of consumer goods, lead users with respect to specified trends can readily be identified by appropriately designed surveys. For example, if the trend toward increasing consumption of "health foods" is selected, a survey of consumer food preferences could identify those on the leading edge of that trend. The lead users among this group could then be identified by additional questions concerning the value respondents place on improvements in the healthfulness of food. (Such a screening question might be: "How much extra would you be willing to pay for X food free of Y additive?") Those found to place a significantly higher value than most on such improvements, e.g., x standard deviations above the mean, are the users who anticipate obtaining the highest net benefit from a solution to the need. They are therefore lead users with respect to this trend.

Finally, three important complexities with regard to identifying lead users should be noted. First, key lead users should not necessarily be sought within the usual customer base of the manufacturer performing the market research. They may be customers of a competitor—or totally outside of the industry he serves. For example, if a manufacturer of composite materials used in autos identifies an important trend toward lighter, higher strength materials, he may find the lead users at the front of this trend are aerospace firms rather than auto firms, because aerospace firms may be willing to pay more than auto firms for improvements on these attributes. Often, consumer products manufacturers will find valuable lead users among users of analogous industrial goods, because the benefit which an industrial user can expect from a given advance often far outstrips that which an individual consumer could expect. Thus, a manufacturer seeking to develop centralized controllers for home heating, lighting and security systems might well seek lead users among firms seeking to use controllers of similar function in commercial buildings. (Note that one must always be aware of both similarities and differences between the lead users one is assessing and the user population one intends to serve. This point will be developed in §4.4.)

The second complexity with respect to identifying lead users is that one need not be restricted to identifying lead users who can illumine the *entire* novel product, process or service which one wishes to develop. One may also seek out those who are lead users with respect to only a few of its attributes—or indeed of a single attribute, defined as narrowly as one likes. Thus, to elaborate on the example begun above, a manufacturer of centralized controllers of home systems might seek lead users with respect to the energy management aspects of such a controller among firms using controllers of analogous function in commercial or industrial applications where a great deal of energy is used and/or energy costs are high. At the same time, he might seek lead users with respect to the security system attributes of such a home controller system among a totally different set of users—perhaps individuals or firms who feel at high risk for burglary and have very valuable goods to protect.

The third and final complexity regarding the identification of lead users which I will mention has the following source: Users driven by expectations of high net benefit to develop a solution to a need might well have solved *their* problem and no longer feel that need. Therefore a survey seeking to identify lead users on the basis of high unmet need might not identify these particular users. This can be a significant loss, since lead users who perceive that they have successfully developed a responsive solution to the need at issue clearly have valuable data for market researchers. In practice, however, I find that in the instance of industrial products, users at the leading edge of an important (moving) trend have to innovate again and again to maintain a level of satisfaction with their current practice, and so will seldom express expectations of low net benefit from additional improvements over their present practice. In the instance of consumer products, the problem can be addressed via additional survey questions specifically inquiring about possible consumer-developed solutions to the needs under study.

4.3. *Analyzing Lead User Data*

Data derived from lead users and their real-life experience with novel attributes and/or product concepts of commercial interest can be incorporated in market research analyses using standard market research methods. However, the analyst might wish to be on the lookout for somewhat more user-developed product solutions and more substantive need statements in lead user data than he is used to finding in analyses of other user populations. Recall that, since problem-solving activity has been shown to be motivated by expectations of economic benefit, and since lead users have been defined in part as users positioned to obtain high net benefit from a solution to their needs, it is reasonable that lead users may have made some investment in solving the need at issue. Sometimes lead user problem-solving activity takes the form of applying existing commercial products or components in ways not anticipated by their manufacturers. Sometimes lead users may have developed complete new products responsive to their need.

Product development by users receiving relatively high returns from such activity has been empirically documented (von Hippel 1982). In some product areas (e.g., semiconductor process machinery (von Hippel 1977) and scientific instruments (von Hippel 1976)), moreover, users have developed *most* of the commercially successful product innovations. To illustrate, the results of several studies of the functional locus of innovation are summarized in Table 2. (The absence of actual product development by users in a given area (e.g., engineering plastics (Berger 1975) and conductor

TABLE 2

Data Regarding the Role of Users in Product Development

Study	Nature of Innovations and Sample Selection Criteria	*n*	Innovative Product Developed by:[a] User	Mfg.	Other
Knight (1963)	Computer innovations 1944–1962:				
	—systems reaching new performance high	143	25%	75%	
	—systems with radical structural innovations	18	33%	67%	
Enos (1962)	Major petroleum processing innovations	7	43%	14%	43%[b]
Freeman (1968)	Chemical processes and process equipment available for license, 1967	810	70%	30%	
Berger (1975)	All engineering polymers developed in U.S. after 1955 with $> 10^6$ pounds produced in 1975	6	0%	100%	
Boyden (1976)	Chemical additives for plastics—all plasticizers and UV stabilizers developed post World War II for use with 4 major polymers	16	0%	100%	
Lionetta (1977)	All pultrusion processing machinery innovations first introduced commercially 1940–1976 which offered users a major increment in functional utility[c]	13	85%	15%	
von Hippel (1976)	Scientific instrument innovations:				
	—first of type (e.g., first NMR)	4	100%	0%	
	—major functional improvements	44	82%	18%	
	—minor functional improvements	63	70%	30%	
von Hippel (1977)	Semiconductor and electronic subassembly manufacturing equipment:				
	—first of type used in commercial production	7	100%	0%	
	—major functional improvements	22	63%	21%	16%[d]
	—minor functional improvements	20	59%	29%	12%[d]
VanderWerf (1982)	Wirestripping and connector attachment equipment	20	11%	33%	56%[e]

[a] NA data excluded from percentage computations.
[b] Attributed to independent inventors/invention development companies.
[c] Figures shown are based on reanalysis of Lionetta's (1977) data.
[d] Attributed to joint user-manufacturer innovation projects.
[e] Attributed to connector suppliers.

attachment equipment (VanderWerf 1982)) does not mean that lead users with their rich insights are absent here; it simply means that the distribution of economic benefits flowing from product development in that area makes product development by manufacturers or other nonuser groups so attractive that nonusers preempt user product development activity (von Hippel 1982).)

Users develop both industrial and consumer products. An example of each will help convey the flavor:

> IBM designed and built the first printed circuit card component insertion machine of the X-Y Table type to be used in commercial production. (IBM needed the machine to insert components into printed circuit cards which were in turn incorporated into computers.) After building and testing the design in-house, IBM sent engineering drawings of their design to a local machine builder along with an order for eight units. The machine builder completed this and subsequent orders satisfactorily and, two years later, applied to IBM for permission to build essentially the same machine for sale on the open market. IBM agreed and the machine builder became the first commercial manufacturer of X-Y Table component insertion machines. (The above episode marked that firm's first entry into the component insertion equipment business. They are a major factor in the business today.) (von Hippel 1977)

> In the early 1970's, store owners and salesmen in southern California began to notice that youngsters were fixing up their bikes to look like motorcycles, complete with imitation tailpipes and "chopper-type" handlebars. Sporting crash helmets and Honda motorcycle T-shirts, the youngsters raced their fancy 20-inchers on dirt tracks.
>
> Obviously on to a good thing, the manufacturers came out with a whole new line of "motocross" models. By 1974 the motorcycle-style units accounted for 8 percent of all 20-inch bicycles shipped. Two years later half of the 3.7 million new juvenile bikes sold were of the motocross model . . . . (*New York Times* 1978)

Of course, completely developed new products are not the only useful "solution data" available from lead users. All need statements implicitly or explicitly contain more or less information about possible solutions to the need at issue. Consider the following sequence of need statements which deal with a consumer product:

*I am unhappy . . .

*about my children's clothes . . .

*which are often not fully clean even when just washed.

*I find that X type stains on Y type clothes are especially hard to remove.

*If I mix my powdered detergent into a paste and apply it to the stain before washing, I find it helps get things clean.

Each succeeding statement clearly provides a valuable increment of data useful for defining a new product need and devising a responsive solution. On the basis of the last statement we see that liquid detergent could be invented. We also are able to learn that the user is approaching the problem as a "stain removal" problem rather than "keep the kids away from X staining agent" problem. And, probably, the user is ranking this choice after having experimented with both approaches. In essence, such *experience* with the need/problem is what makes lead user's data so valuable.

4.4. *Projecting Lead User Data onto the General Market of Interest*

The needs of today's lead users are typically not precisely the same as the needs of the users who will make up a major share of tomorrow's predicted market. Indeed, the literature on diffusion suggests that, in general, the early adopters of a novel product or practice differ in significant ways from the bulk of the users who follow them (Rogers and Shoemaker 1971). Thus, analysts will need to assess how lead user data apply to the more typical user in a target market rather than simply assume such data straightforwardly transferable.

In the instance of industrial goods, the translation problem is typically not serious. As we pointed out earlier, industrial products are typically evaluated on economic grounds whereby users calculate the relative costs and benefits of the proposed product. When an objective economic analysis is possible, all users—not just lead users—will make similar calculations and thus provide a common basis for market projections.

In the instance of consumer goods, and in the instance of industrial goods for which the costs and benefits of the proposed product for the user do not form the basis for product preferences, a test of the applicability of lead user needs and concepts to the future general market is not so simple. One approach involves prototyping the novel product and asking a sample of typical users to use it. Such users would then be in a position to provide accurate product evaluation data to market research (a) if presenting the user with the product created conditions for him similar to the conditions a future user would face, and (b) if the user were given enough time to fully explore the new product and fully adapt his usage patterns to it. If a new product were being tested in this manner in a field where little else was expected to change by the time of product introduction—say, a new detergent for the home laundry—conditions (a) and (b) could probably be effectively met. However, in rapidly moving fields in which the proposed new product will interact with many other not-yet-developed products in unforeseen ways, new approaches may be needed.

5. Summary

In this paper I have defined lead users, and explored the valuable insights they can offer regarding needs—and, often, prototype solutions—for novel products, processes and services. I have also presented four general steps by which one may identify and analyze lead users in any given instance. Practitioners may wish to use the method in its present early form, while researchers may wish to explore, test and refine it. Both are possible, and we make suggestions regarding each below.

I suggest that interested practitioners have no hesitation about experimenting with the general methodology described here. Lead users are often accessible enough to allow successful identification of interesting data regarding desirable new products and/or product modifications with little effort—given that the practitioner has a good knowledge of the customers and application area he is analyzing. As evidence, during the past two years Professor Glen Urban and I have helped approximately 100 MIT Master's students to undertake short projects involving the identification of lead users in areas they were familiar with. With very little coaching, almost all have succeeded. (Examples: lead users of sports equipment have been identified and studied in sports ranging from rock climbing to trail biking to street hockey. Other projects have dealt with lead users of various types of industrial process equipment and various types of computer hardware and software.) Therefore, I urge practitioners to "learn by doing," and conduct a rough initial test for their own interest and satisfaction. If the results are positive, I hope they will be motivated to do still more.

Researchers who wish to systematically explore the value of lead user methods will find many possible approaches. I propose that initial empirical studies of the value of lead user data be focused on industrial goods rather than consumer goods. (As was noted earlier, lead users of industrial goods can typically be identified more reliably than lead users of most consumer goods given today's state of the art.) The value of lead user data under real-world conditions can be assessed via a longitudinal study design which tests the predictive accuracy of data collected earlier from lead users against the actual future general market as it evolves. A less ambitious effort could focus on industrial products and compare the economic performance of novel product concepts proposed by lead versus typical users.

Researchers who wish to improve lead user methods will find much needs to be done in both industrial and consumer goods arenas. For example, the means for identifying lead users and analyzing their needs obviously must be improved and extended. Also, organizational schemes for routinely acquiring lead user data (special interface groups, special incentives which will induce lead users to interact on a continuing basis, etc.) need to be developed and tested. Valuable research on all these topics appears to be exciting and well within reach.[1]

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