# HAS A CUSTOMER ALREADY DEVELOPED YOUR NEXT PRODUCT?

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# Has a customer already developed your next product?

"Find a need and fill it" is the accepted strategy for developing a successful new product - a strategy which research into the innovation process has proven correct. But what is a "need" - and where do you most successfully look? We have studied the need information which triggered the manufacture of several hundred innovative and successful new products, and have developed some answers which should be of use to managers interested in new products. The key findings we will discuss:

- Information about the need for a new product is often found bundled together with valuable product design data. This data may be missed by even experienced market researchers looking for "needs only" - with the result that a manufacturing firm has to invest in re-developing what it could have gotten for free. Sensitivity to the amount of product design data usually present in your "new" product need information can pay out handsomely.
- Information about new product needs in some industries prove to come consistently from the same type of source in case after case. Once this source is identified, management can do a great deal to use it more efficiently.

Managers who choose to use our findings and to apply the methods proposed in this article should be able to say as a result, "In our industry, need information leading to successful new products typically also provides us with X amount of the product design data, gratis, and comes from Y source - and we can organize to pick up and process this type of information more efficiently."

## 2.0 Product Design Data Contained in Need Information

The conventional wisdom is that customers provide the needs, while manufacturing firms develop the solution to the needs. But, if one thinks about it, one sees that any information about a need provides information about what a product responsive to the need should look like as well. Consider the following statements of a need. Each succeeding phrase adds more data about what a responsive product should look like to the need statement presented first:

I need higher profits

... which I can get by raising output

... which I can best do by getting rid of the bottleneck in process step D

... This can best be done by designing and installing new equipment

... with the following operating characteristics

... and the following design

Clearly, the amount of work a manufacturer must do to convert the first need statement - "I need higher profits" - into a responsive new product is high. He must employ skilled analysts able to study the business of the potential customer and conceptualize a new product opportunity which will impact the customer's felt need for higher profits, etc. On the other hand, a manufacturer who receives need information containing the maximum amount of product design data shown need only have his manufacturing people poised by the telephone (Who may be expected to ring is a matter we will cover in a later section), ready to follow customer instructions.

Many people find it difficult to get the flavor of product design data contained in information about needs since the concept is novel,

so an example from our research data may be helpful. Consider the following case of a product innovation for which a product user did most of the innovation work and provided a great deal of product design data to the manufacturer along with information about his need for a new product:

In the late 1950's, 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, in 1959, sent engineering drawings of their design to a local machine builder along with an order for 8 units. The machine builder completed this and subsequent orders satisfactorily and later (1962) 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 extant. (The above episode marked that firm's first entry into the component insertion equipment business. They are a major factor in the business today.)

Does the pattern in the example seem familiar? If you're in process equipment manufacture or instrument manufacture it should. We have found that 60% to 80% of the innovative products* commercialized in those industries were invented, prototyped and used in the field by innovative users before they were offered commercially by equipment or instrument manufacturing firms. In such instances, the manufacturer

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*By innovative products, we mean those which offered users in their judgment a significant functional advantage over previously available products. "Me-too" products are excluded. See von Hippel [1] and [2] for details.

who takes advantage of user efforts needed only to contribute product engineering work to obtain a first-to-market product innovation. (We call this type of innovation pattern a user dominated one and have preliminary data that shows it plays a major role in many product areas - from computer software to food products. [Remember Pillsbury's "Bake-off" - a contest for the best baked good inventions by homemakers?])

## 3.0 The Reason that Need Information May Contain a Large Amount of Product Design Data

Why would anyone be so nice as to do some of your innovation work for you, and provide you with new product need information containing a great deal of product design data? In brief, some party will do the innovation work and provide that type of data if he needs the new product as much as - or more than - you do. Consider the two-axis diagram below. One axis represents the level of return on innovation investment (ROII) a user of an innovative product might expect if he made the investment to develop a given product. The second axis represents the level of return on innovation investment (ROII) a manufacturer of that same product might expect if he invested in its development. Notice the marker on each axis which represents the minimum ROII which would induce a product user or a product manufacturer to do the innovation work on a given product. Now, if we draw dotted lines from each of these minimum return markers as shown, we divide the total innovation return space into four segments, namely:

1. (upper left) in which only the innovation user will have sufficient incentive to innovate
2. (upper right) in which both user and manufacturer will have sufficient incentive to innovate - where we therefore expect to see cases of both user and manufacturer dominated innovation

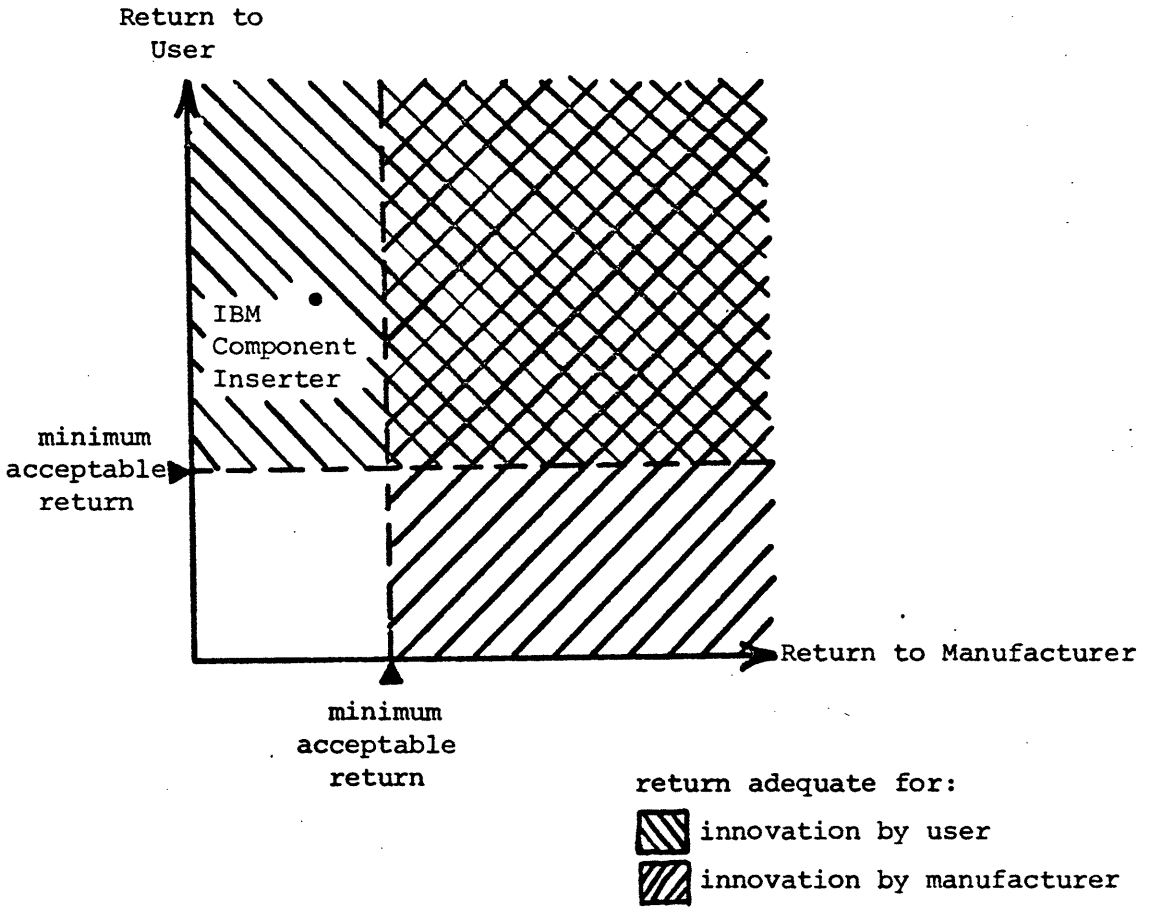


Figure 1: Return to Users and Manufacturers from Innovation Investment (ROII)

3. (lower left) in which neither party will have the incentive to innovate

4. (lower right) in which only the innovation manufacturer will have sufficient incentive to innovate

Having completed the diagram, we can - theoretically - place any new product innovation opportunity on it at a point which will reflect the ROII which that opportunity offers to user and manufacturer. (It is often very difficult to make exact ROII calculations in practice, but bear with us - we will show that ROII diagrams are a very useful

conceptual tool.) As an example, consider the component insertion machine innovation described earlier. As shown on the diagram, we judge that the opportunity to develop the basic invention into a new product was attractive to IBM (the innovative user) but not to the product manufacturer. After all, IBM had to invest more than one million dollars to develop the concept, but considered the expenditure well justified in terms of potential savings through the use of the equipment. The machine builder, on the other hand, could never justify such an innovation investment, only being able to see initially a few hundred thousand dollars in total sales of that equipment. The result of this combination of circumstances - high (estimated) ROII to user, low (estimated) ROII to manufacturer - is that, as described in the example, the user did most of the innovation work and triggered the manufacture of the innovative product by transferring a great deal of product design data to the manufacturer along with information about his new product need.

### 3.1 New Product Need Information and Design Data from Non-Users

Up to this point we have focused our discussion and examples on new product need information coupled to design data which comes from innovative product users. This was done simply for the sake of clarity. In reality, such new product information can come from any person or group which has the incentive to generate it - inventors, suppliers or what have you. As an example of an innovation case history in which a materials supplier did much of the innovation work and gave the product manufacturer need information with a large amount of product design data, consider the development of polyethylene film-wrapped bread:

Polyethylene film-wrapped bread was developed by Crown Zellerbach (a materials supplier) as a replacement for the cellophane wrap then used by many bread baking companies. Crown introduced the film commercially in 1957-58 along with an inexpensive machine adaptor, also of its design, which would allow baking companies to use the new film on their existing wrapping machines.

Material Suppliers as a group stood to gain far more from this innovation than did the machine builders or the baking companies. The total potential market for polyethylene bread-wrapping film was about $25 million annually in 1958 - divided among only a few suppliers. Total one-time sales of machine adaptors, on the other hand, amounted to only $20 million at most, while annual materials savings - divided between hundreds of bread manufacturing companies - was only $3-6 million.

## 4.0 Do You Get Need Information Containing Product Design Data? From Where?

It is important to recognize whether your firm gets, or can get, need information containing a significant amount of new product design data. If so, it is a valuable resource which offers you - free - information that it would cost you a good deal to generate from scratch.

Finding out whether your firm gets need information containing a large amount of product design data - and, if so, from what source - is most conveniently done in two steps. First, draw ROII maps of the product types you are interested in to see whether it is in someone's interest to provide you with product design data. Second, if the ROII analysis shows you should be getting such data, have someone explore the firm's past history for the need information which triggered your

past new products, to see how much product design information was provided, exactly who it came from, via what channels, etc.

4.1 Do an ROII Map

In mapping ROII, you don't have to get too precise (in fact, since many aspects of return important to innovators - such as improvements in product "quality" - aren't easily measurable, you can't be too precise). Just use your understanding of the markets you operate in and ask yourself, "Who gained what from past product innovations my firm brought to market - or would have liked to bring to market?"* If plastic bread wrap is a product innovation of interest to you, for example, you would draw a three axis ROII chart because three parties - bread wrap user (bakery), wrapping machinery builder and plastic wrap supplier would logically seem to have something to gain from the innovation. Consideration of the figures given in the bread wrap case would lead you to place the innovation at the point in the ROII chart shown.

As we see, the only significant incentive lay with the plastic wrap supplier. We would therefore predict that the supplier would provide need information to "you" the manufacturer, which contains a large amount of product design data - and as we saw from the case history, this is in fact what happened historically.

Fine, you say, but the chart shows the ROII to me, the manufacturer,

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*When making your estimates of ROII, note that "return" is whatever is important to the party involved. It may be monetary, as in dollars of product sold, or it may not be. (For example, instrument users are strongly motivated to develop scientific instruments by "return" measured in knowledge and peer approval.) Your knowledge of what's important to participants in your industry will help you see "return" as potential innovators would see it.

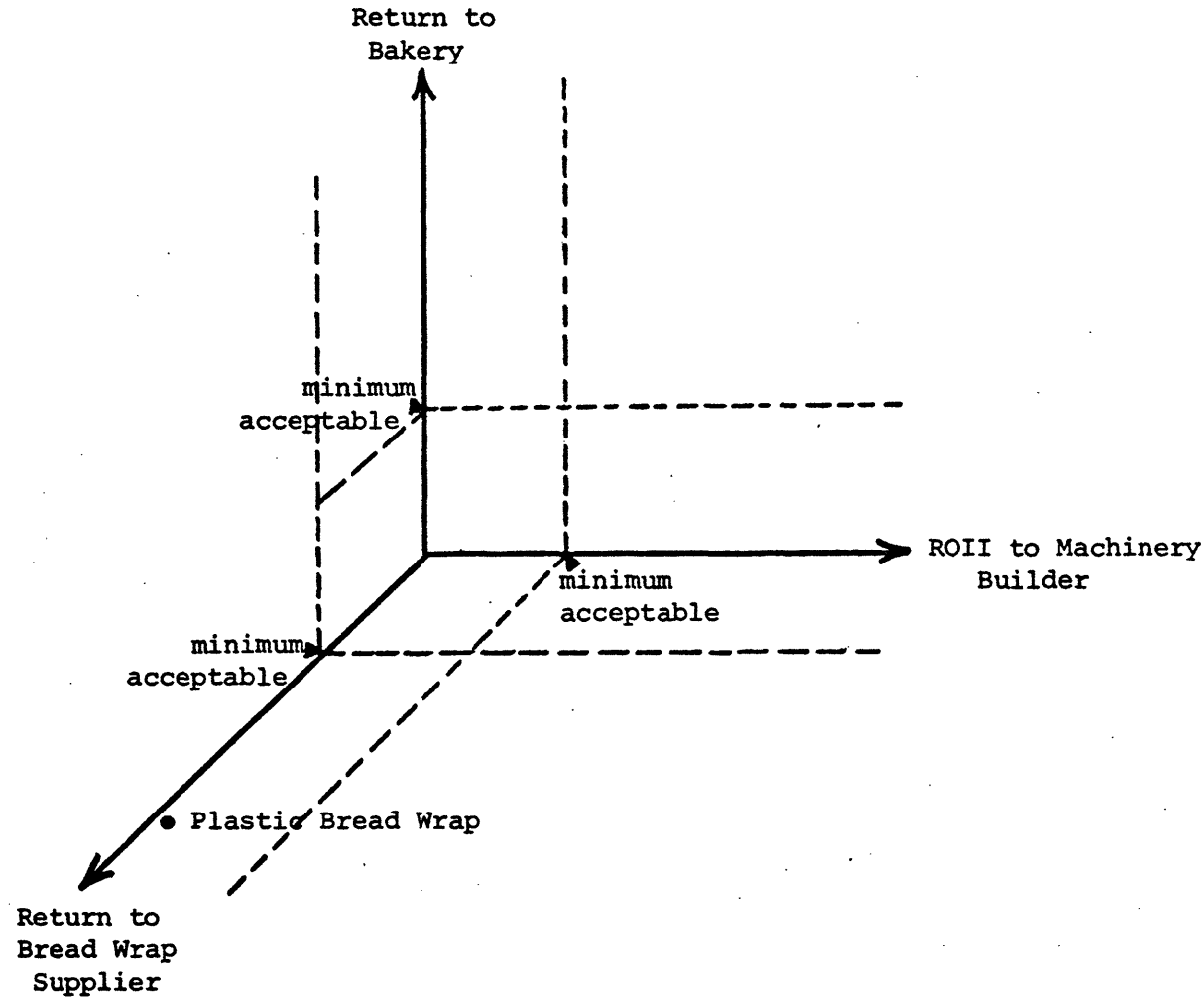


Figure 2

as low - so what do I care if I can expect a large amount of free product design data under such circumstances? The answer is that, while your ROII - return on innovation investment - is below the minimum acceptable if you undertook the entire innovation job, your return on a plastic bread wrap machine product might be quite acceptable if someone else undertook the risk and expense of developing the product for you.

Of course, innovations where your ROII would be attractive are even better. You may be able to find need information containing a

large amount of free product design data in these cases as well by looking in areas where your ROII and that of some other parties are both high. Areas of the ROII map which would be most attractive to a bread machinery manufacturer, therefore (to continue with the example), are shown as shaded in the figure below.

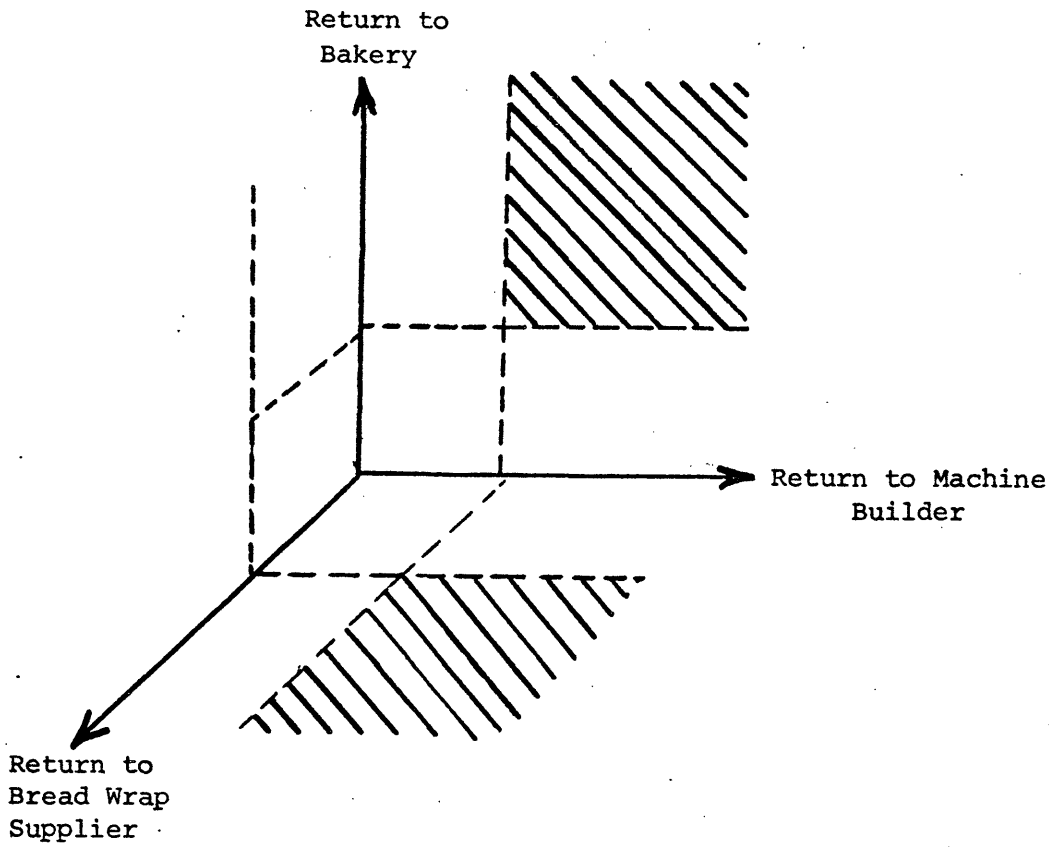


Figure 3

## 4.2 Get the Past History of Your Successful Products

Suppose that your ROII map exercise shows that there may be new product need information containing free product design information potentially available in product categories of interest to you. Your next step is then to study a sample of past product successes to see,

with the aid of hindsight, what need information containing product design data had been available if you had known where to look. The idea is to generate a pattern from past history which will show you what you should be looking for in the future.

The process of getting a proper sample, etc., is a bit technical and we won't go into it further here. (When you decide you want to carry out the analysis, you might want to refer to the sources listed as the end of the article.) What we would like to emphasize here, however, is that a sample of several cases (10-20) must be looked at before you can make a valid judgment about product design data you might expect in conjunction with new product need information in the future. Avoid making a judgment on the basis of just the one or two product histories which come to mind - no matter how successful those products were. You will almost invariably be misled. (Many avoidable corporate ulcers have been caused by decisions such as: "I can't stand the guy who developed our last great product" ... pause ... a swing to the telephone and ... "Personnel? Hire the next three guys who come in the door who have personalities you think I'll hate - and give them offices near mine!"

## 5.0 Organizing to Match Up with the New Product Design Data and Source of Your Need Information

Clearly, new product need information which contains a great deal of product design data must be managed differently from that which contains little. But before the proper steps can be taken, firms whose successful new products come from need information containing a large amount of product design data must recognize that fact. And,

unexpectedly, that's a problem. When you surmount that one, the remaining organizational problems involved in matching up to the solution content and source of your need inputs will seem easy.

## 5.1 Getting Your People to Recognize the Facts

While it's easy enough to generate the data to prove that a particular firm has sources of need information which also provide free product design data by using the ROII mapping and case sampling approach we discussed earlier, it's often very difficult to convince a firm's product development group that this is so. When you bring your facts down to your product development people, be prepared for the "Who invented that good thing?" - "Why me, of course" effect. When you say to them, "Look, I find that eight out of our last ten new product successes came to us in prototype form from users", be prepared to hear, "But, boss, that's ridiculous - our customers aren't inventive!" - and be prepared to be sympathetic. Consider the reasons why the casual observer might think that the product manufacturer is the innovator - even when you can prove that the product user was the innovator in fact:

- New product design data from a user which is noted and utilized by your new product group may be rare - it may happen only once per new product. On the other hand, instances in which your people train unknowledgeable customers in how to use the product are as frequent as sales, and go on for the lifetime of the product.
- Your people are - everyone is - surrounded by advertising that says, "Strongco introduces a terrific innovation to the market for the first time". Strongco doesn't mean to say it invented the product, only that it was first to produce and market it commercially. But, in the absence of countervailing advertising by inventing users, suppliers, etc. - advertising

they have no reason to engage in - it is natural that an impression that manufacturer equals inventor builds up over time.

- User - or supplier, or ... - prototypes are seldom manufactured as received by a manufacturing firm. Firm personnel will typically contribute at least some product engineering work to the prototype in order to make it more reliable, manufacturable, etc., while preserving the operating principles of the prototype. But add in man's tendency to consider his own contribution to a project as the key one, and ...

But stick to your guns despite the blizzard of counterarguments you are likely to get. Remember, you have the facts. And if your data indicate it, your firm does have access to need information offering valuable new product design data. Since there is no sense in expensively redoing what you can potentially get for free, it is important that the situation is understood by your people - at least to the level necessary for getting on with the task of organizing to use such design data effectively.

## 5.2 Organizing to Use Product Design Data Provided Along with New Product Need Information

After informing your new products group that you can prove that they don't play the role conventional wisdom has assigned to them - if indeed that is the case in your firm - and being duly hissed out of the building, what is your next task as a manager? We suggest that you examine the kind of need information you have obtained in the past which led you to your present roster of successful products. Look at them in terms of the type of product design data they provide you with gratis, and lay this out against a chart of stages of the innovation process as shown in the following figure.

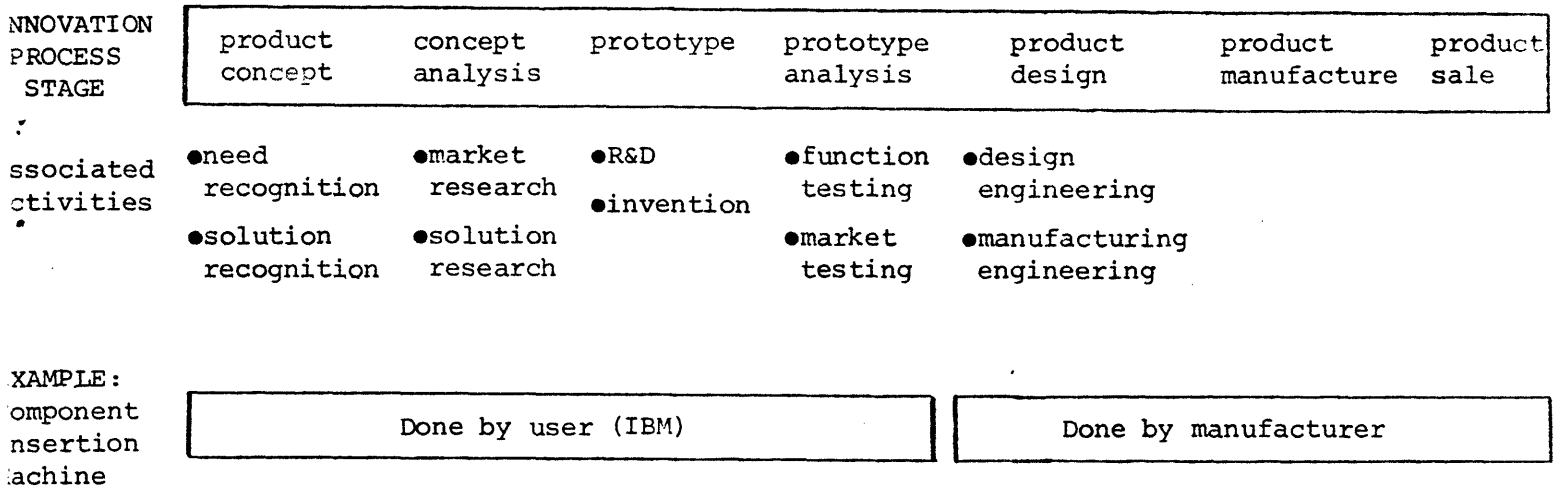


Figure 4

As an example, we have laid the innovation case history presented earlier against the stages of the innovation process shown above. Note that in this instance the user has done everything except the last stages of product engineering, manufacturing engineering, and sale.

What you will typically see is that the innovation work necessary to bring an innovation from gleam-in-the-eye to the marketplace is divided between you and others. If the pattern is consistent from case to case - and our research shows it often is - organize to do only that portion of the innovation process which history shows you do - but organize to do that portion superbly. If, for example, the pattern you find in your firm looks like the one shown above, learn that you do only product engineering in house and only hire product engineers. If you hire engineers skilled in the earlier stages of the innovation process, they will want to exercise their skills and will do the R&D - that the customer has provided you free along with the need information - all over again!

The same holds for marketing research. As an example, consider a recent conversation we had with a major consumer goods company. They had established that their highest payout products in the past had been more innovative than product repositionings and repackagings, and we were discussing the need information which led to the past successes. The focus of conversation was on how to plumb the consumer's psyche - stock in trade for consumer good market researchers - until we happened to ask if there wasn't some source of data representing a later stage of the innovation process which might also be tapped. Upon research the answer was "Yes". Each of the more innovative products under discussion had been preceeded by a similar product - marginally successful or a failure - put out by some small company! Analysis of the "experiments" performed by these small companies could provide the major company with much richer need and product design data than consumers could provide from scratch, and it was there for the collecting. Note that the company could start the innovation process over from scratch, but what a waste!*

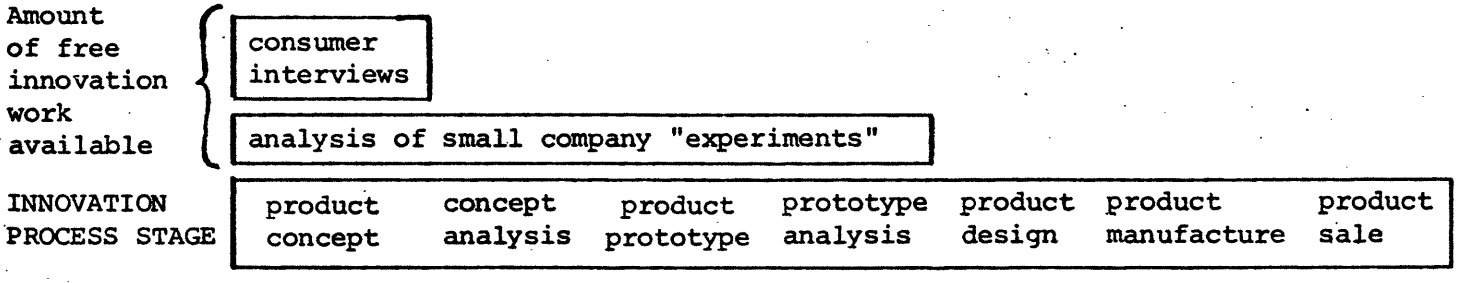


Figure 5

*Very large companies may worry that examination of the products of small companies for new product ideas may seem predatory to antitrusters - even if the small company hasn't made much of a go of the product and you are gathering data on what not to do as well as what to do. If this seems a problem, you might consider studying where the smaller company get the idea for its version of the product. Typically, its need information may also have more product design content than the consumer data you are otherwise forced to.

## 5.3 Match Up with the Source of Your Need - and Product Design - Information

In addition to learning how to use the product design data contained in the need information which come in - that is, learning to do only your share of the innovation process - it is important to learn where the need information useful to you comes from - and how it comes into your organization and at whose initiative, etc. Data on these matters can also be derived from your sample of 10-20 past innovations. And once the pattern is made visible, we have found, the changes needed to match up properly will be very clear.

To give the flavor of what we mean, let's walk through an example. Consider a study we did of the nature and source of need information leading to product innovations in two categories of process machinery - machines used to make semiconductors and machines used to make electronic subassemblies. Our first step was, as we have suggested to you, selection of a sample of new products developed in the past which were very successful - the type you might want your firm to come up with in the future. (We needed a sample of about 50 cases for our purposes, but 10 to 20 will usually do nicely for your purposes of within-firm planning.)

Our second step was to carefully search for the product design data content and source of the need inputs which lay behind each of these successful new products. In the case of our process machinery sample, we found the need information came overwhelmingly from product users and, in about two-thirds of all cases, contained product design data on field-proven prototypes of the new products. So far so good - but how did the manufacturer get this need information and product design data? We studied our sample of cases further and found two main patterns:

- In 35% of the cases, manufacturers got the data by having innovative users on their roster of customers. While selling their existing products to these users, they took the initiative to ask of user engineers: "What have you done that's new and useful lately?" Usually the engineers were happy to explain.
- In 26% of the cases, manufacturers were sought out by innovative users and given the need and design data (and a purchase order) because the innovative user needed an outside source of supply for an equipment innovation. Usually, in these cases, the user chose to deal with a manufacturer he had bought from in the past.

Interestingly, in another 26% of the cases we found that new product needs plus extensive product design data were available from users had the manufacturer looked for them - but he didn't. Instead, he went to the great expense of reinventing what he could have gotten for free.

Given these patterns, the strategy of a manufacturer seeking new products in the semiconductor and electronic subassembly process equipment fields is clear:

1. He should get into the market with a standard product of interest to innovative users - anything which will allow him to establish a sales and service relationship with the right group of user engineers.
2. He should hire people to deal with users who can recognize potential new products when they see them as well as sell the standard line. (This would be a tall order if <u>all</u> your sales and service people had to be to this standard - but they don't. Only some users are innovative, and only they need be dealt with by top-flight personnel. Look at your sample again and it will tell you who the key users are. In our sample, it was those few user companies with the greatest annual sales.)

3. He should organize his new product development group so that it is easy and normal for new product ideas with a large amount of free product design information to come from sales and service, then be passed to marketing research (for assessment of market potential, etc.), and then be passed to product engineering and on to manufacturing and sales.

Now, what should your strategy look like?

## Suggestions for Further Reading

1. Eric von Hippel, "The Dominant Role of Users in the Scientific Instrument Innovation Process", Research Policy (in press).

2. Eric von Hippel, "The Dominant Role of the User in Semiconductor and Electronic Subassembly Process Innovation", M.I.T. Sloan School of Management Working Paper #853-76, April 1976.