MANUFACTURER-USER RELATIONSHIPS IN TESTING
NEWLY DEVELOPED PROTOTYPES

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SUMMARY

During the last fifteen years, an increasing number of academics investigated various aspects of manufacturer-user interaction, usually from the perspective of developing innovations. Studies by Von Hippel and the IMP Group proved to be seminal and spawned a large number of publications about manufacturer-user interaction in various industries and various countries. However, all these empirical studies display a common focus on the integral product development process. In contrast, this paper presents the results of an empirical investigation into manufacturer-user interaction in testing newly developed prototypes. The main findings are integrated into a conceptual model which consists of eleven individual activities. This detailed decomposition allows for the formulation of practical guidelines with direct managerial relevance. Empirical evidence from various sectors of Dutch industry, particularly the medical equipment industry, is cited to illustrate how manufacturers acknowledge the critical importance of having prototypes tested by potential users, but lack a structural approach to this particular stage of the innovation process.
INTRODUCTION

The last fifteen years have witnessed a veritable upsurge of publications about buyer-seller relationships and manufacturer-user interaction. Theoretical thought, supported by empirical evidence, evolved from the *Customer-Active Paradigm* proposed by Von Hippel to the detailed studies conducted by the IMP Group. In turn, the results of these studies led to many publications about the involvement of users in the product development process.

What all these studies have in common (despite their many differences) is their focus on the total process of product development. However, this frequently results in conclusions and recommendations of a rather general and abstract nature. In order to provide detailed and practical managerial guidelines one needs to study specific stages of the process in greater detail. This paper presents the results of such an investigation by discussing manufacturer-user relationships in the context of testing newly developed prototypes with potential users.

The paper starts by describing the research in general terms, emphasizing that the findings presented in this paper are part of an in-depth investigation into the development of innovations within networks. The main results regarding the testing of prototypes with users are presented in the form of a general framework, which decomposes the external testing stage into eleven individual activities that need to be undertaken. The paper concludes with briefly mentioning the most salient managerial implications and linking the findings with Von Hippel's concept of *sticky data*.

RESEARCH METHODOLOGY

During the years 1985-1989 we conducted an extensive study of interaction patterns in developing new industrial products in the Netherlands. The empirical part of the study consisted of two separate parts.

1. A *preliminary investigation* during which five cases of industrial new product development from various sectors of Dutch industry were studied by conducting in-depth semistructured interviews with the persons involved in the projects. This investigation resulted in some surprising observations regarding the testing of
newly developed prototypes by potential users: (1) all of the firms acknowledged
the critical importance of this particular stage of the development process, (2)
despite this importance, four of the firms experienced major problems with this
external testing stage and (3) the collective experiences suggested a tentative
conceptual model that can be used to structure, explain and improve this particu­
lar stage of the innovation process.

2. Partly because of these results, the Dutch medical equipment industry was select­
ed for conducting a follow-up investigation. Due to the possible direct influence
on the patient’s health, every new piece of equipment intended for clinical use
requires clinical assessment and trial before market introduction. Seventeen cases
of new product development within thirteen firms were studied in great detail
with emphasis on having the newly developed prototype tested by potential users.
The results both confirmed the initial observations and suggested some additions
to the tentative model.

Both investigations were conducted along the following lines.
First of all, on the basis of publications, newspaper clippings, expert interviews and
chance contacts a number of suitable firms were selected. In the case of the follow-up
investigation, these firms could be said to constitute a fairly representative sample.
Typically, either a managing director, marketing manager or R&D functionary was
contacted and, after being briefed on the nature and objectives of the study, asked to
take part in the investigation. In specific cases a number of interviews with various
persons had to be conducted in order to identify and reach the person most closely
involved with the most recent innovation project.

Next, the basic information was gathered by means of semistructured in-depth personal
interviews with one or more persons at the manufacturer, while the majority of these
people were interviewed more than once. Each interview took between two and four
hours. Interviewees were asked to describe in general the process of product develop­
ment at their company and to give a detailed description of the most recent innovation
project. During these interviews special attention was paid to the stage of having
prototypes tested by potential users. The results were written down in comprehensive
reports and reviewed with the persons interviewed, thus inviting them to correct errors
of fact and supply additional information. The information thus obtained was supplemen­
ted by (a) the incidental study of documents (e.g. schematic representations of the
product development process, written down review procedures, market introduction
brochures, product information leaflets, articles and books) and physical artefacts (e.g. the innovation, mock-ups, test models and simulation devices) and (b) direct observation (e.g. of the testing of developed software, discussions between the manufacturer and major customers, and the functioning of prototypes at test sites). In a limited number of cases it was necessary to interview competitors and/or industry experts to gain insight in the market structure, the competitive position of the firm, the products offered by major competitors and the current technological and market developments.

Subsequently, potential users and third parties, insofar as they contributed substantially to the product development process, were interviewed in order to obtain additional information and cross-check the information provided by the manufacturer. Typically, one interview of two hours, supplemented by a limited number of phone conversations, proved to be sufficient to obtain the needed information.

Based on all interview reports, comprehensive case descriptions were drawn up. These descriptions, including an analysis in the form of summary conclusions, were eventually reviewed by the manufacturers.

Finally, all individual case descriptions were compared and analysed in order to formulate general conclusions and implementable guidelines.

Naturally, the procedure described above presents the ideal situation. While all cases from the preliminary investigation were studied along these lines, the follow-up investigation in the medical equipment industry sometimes necessitated deviation from this extensive data collection procedure. For seven of the thirteen manufacturers of medical equipment investigated, the comprehensive procedure outlined above was followed, sometimes resulting in conducting as many as ten in-depth interviews involving eleven different persons. In the remaining six firms (five of which were small and one of medium size), however, the managers operated under extreme time pressure and had only a limited amount of time available. In these cases, the desired information had to be gathered by means of only one personal interview, complemented by a few follow-up inquiries by telephone to obtain additional information. However, this presented no special problems because (a) all these cases were studied at the end of our investigation, (b) the innovation processes in question were relatively simple and (c) we benefited from the experiences gained previously.
TESTING PROTOTYPES: THE DIFFERENCE BETWEEN INTERNAL AND EXTERNAL TESTING

The results of the investigation show that the majority of the manufacturers interact predominantly with potential users during the process of product development. This interaction was mentioned as occurring particularly during the testing and launch stages, as would be expected, since users who have tested a prototype can be employed for promotional purposes during market introduction. However, here it should be noted that the testing stage consists of two widely different activities: internal and external testing.

After a manufacturer has developed a prototype, he goes on to test it internally to determine whether the product's performance meets its specifications and no technical flaws exist. These in-house tests may be very elaborate indeed and cause the manufacturer to return to the development stage to solve encountered problems or improve the design. For example, the Dutch firm Ammeraal Conveyor Belting has built a small-scale conveyor and uses it to test new belts under extreme conditions (newly developed belts may run continuously for two or three days while transporting all kinds of materials and products to test the limits of the product's performance). But, as these tests never actually measure product performance under real-life user conditions, manufacturers subsequently carry out external tests as well. For this purpose, a number of potential users are requested to test the product under actual user conditions. This illustrates the essential difference between both kinds of tests. Whereas the purpose of in-house tests is to test the product's functionality, the tests with users are generally undertaken as a last check on the match between the product characteristics and user requirements and to discover any problems that may arise in actual use. As Leiva and Obermayer remarked, "Evaluation, which must be performed under 'live' conditions using real customers, is a key to minimizing surprises at market entry".

A GENERAL FRAMEWORK FOR TESTING PROTOTYPES WITH POTENTIAL USERS

The collective experiences of the managers interviewed were used to derive a general framework regarding testing industrial innovations with potential users. The framework (a simpler version of which was presented in a previous publication) consists of eleven
activities (Figure 1), which are briefly discussed. For each activity, the discussion starts with describing the main results from the preliminary investigation in various sectors of the Dutch industry. To clarify the issues involved and deepen our understanding of this particular stage of the innovation process, the analysis explicitly addresses the most salient aspects of testing complex medical equipment innovations with potential users.

**Act. 1: Planning**

The stage of testing prototypes with potential users is initiated by consciously planning for it. The relevance of this first activity is illustrated by the cases from the Dutch medical equipment industry.

Four of the thirteen medical equipment innovations that actually reached the market (31%) were introduced without ever having been clinically tested by potential users. In all cases the firms in question displayed an excessive amount of confidence in their own technical abilities and the functioning of the product. Based on the initial positive results of the in-house tests, two products were modified slightly and subsequently introduced. A clinical evaluation was not thought to be necessary. In another case, a firm started production directly on the basis of product specifications formulated by a distributor. After having been confronted with subsequent failure in the market, the firm had to start from scratch and formulate new product specifications. Eventually, the prototype was tested by a user, but this concerned only the product's safety rather than its functioning in a clinical environment. The final case concerns a small manufacturer who had decided against testing prototypes with users as a matter of principle. The decision was based on prior negative experiences with medical specialists who were afraid to injure their patients by using unsafe new products and tested a new prototype only superficially on themselves.

Although, by skipping the clinical evaluation stage, a firm may manage to stay ahead of the competition, it is at the same time running the risk of launching an imperfect product.

**Act. 2: Timing**

The second activity concerns determining when the tests by potential users should be conducted (i.e. the timing of the external tests). On the one hand, the external tests should be conducted after the prototype has been tested internally with positive results. At the same time, the external testing stage must be concluded with positive results before full-scale production is started. Conducting the external tests too early entails
the risk of testing a product that is not fully developed yet: its characteristics may still
change as a result of the internal tests. Starting it too late means running the risk of
facing large and costly changes in the production process.

The investigation into the medical equipment industry provides two examples (15% of the
innovations actually introduced) where the firms involved launched the new product
prematurely owing to pressure of time. In one case this was due to an important trade
show while, in the other case, an impending annual sales meeting rushed the firm into
an untimely market introduction. Typically, at the outset of the project, the products
had been scheduled for introduction during the trade show or sales meeting, but the
actual development activities took longer than was anticipated. In order to achieve the
scheduled introduction date (market launch between two important trade shows or sales
meetings was generally considered useless), the clinical testing stage was skipped or
carried out superficially. This resulted in the initiation of redevelopment activities,
modification of the product, strained relationships with distributors and customers, loss
of credibility in the market, and a postponed market launch.

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small : 50 employees or less
medium : between 50 and 500 employees
large : 500 employees or more

Table 1. The number of users involved in clinical evaluation related to firm size.

Act. 3: Determining the number of test users

The study of the medical equipment innovation process demonstrated the significance of
determining the number of test users. Although undertaking clinical evaluations may be
an important determinant of the product's eventual success, its influence largely depends
on both the number and quality of the users involved. Table 1 shows that, in six cases,
the firms employed more than three users to test the developed prototype, the large
majority of these firms being of medium size. In four cases the prototype was tested by only one user. Sometimes this limited quantitative user involvement can hardly be avoided. One firm, selling expensive and complex medical equipment, was compelled to use just one site to test a prototype as the high investments and the essential intensive interaction with the user prevented the use of more than one.

**Act. 4: Selection of test users**
Picking the right potential users to test early versions of a product can be critical to the product's ultimate success\(^5\). Ensuring that the selected users are representative of
the market segment in question, is of the utmost importance as it determines the managerial value of the test results. In industrial markets, the matter of representativeness may be quite complex. Due to the derived demand, the manufacturer must not limit himself to his own customers when identifying the persons and/or organizations influencing the purchasing decision.\(^6\) We asked a limited number of firms (members of the study group *Commercialization of Industrial Innovations*, including some of the firms involved in the preliminary investigation) to determine the most important criteria in selecting potential users to test an innovation. As it concerned just a handful of firms, the results of the discussion should be considered indicative rather than conclusive. In order of decreasing importance the following criteria were agreed upon:

1. objective of the test,
2. user's representativeness of the specific (segment of the) market,
3. willingness to cooperate and/or innovation orientation,
4. market position and/or firm size and
5. existence of a relationship.

The first criterion refers to the distinction between technical and commercial objectives. When the purpose of the test is purely technical, the manufacturer must select a user capable of evaluating the technical performance of the product. In this situation, the user's representativeness is of minor importance, since the external test is in effect an extension of the technical tests performed in-house by the manufacturer. Afterwards, the prototype still needs to be tested by a number of representative users to test its functioning in practice. If, on the other hand, the test stresses the commercial aspects, the manufacturer should select users with a positive image and influence in the market. In practice, there is no dilemma in choosing one test objective in preference to the other; in fact, the selection of the test objective is determined by the complexity of the product and situation in question. Frequently, manufacturers try to combine both objectives and need to compromise.

Criterion 3 mentions a combination of the willingness to cooperate and the innovation orientation of the user. It assumes that potential users who are innovative themselves are more inclined to cooperate.\(^7\) Innovative customers have the added advantage that they often play a central role in the diffusion process.\(^8\) The importance of having new products tested by innovative customers has also been observed in connection with expensive consumer products.\(^9\) The criterion of innovativeness seems to be in contradiction to the demanded representativeness. However, sometimes both criteria can be
combined. For example, when a selected innovative customer is representative with respect to a specific application. In other instances, the manufacturer must look for a meaningful trade-off between both criteria.

Market position and size are combined in one criterion because of the obvious relationship between both variables. Sometimes it is advisable to select a large firm that is able to quantify the innovation’s user benefits, such as reduced maintenance costs.

While the existence of a relationship is only mentioned in fifth place, in practice this criterion is sometimes given much higher priority.

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Table 2. Criteria used for selecting test users related to firm size.

The manufacturers of medical equipment investigated reported a wide variety of criteria for selecting users to test newly developed prototypes (Table 2). In nine cases (75% of the cases where users were employed to test a prototype) the reputed know-how of the medical specialist or hospital in question was reported to be a major selection criterion. In contrast with the results of the preliminary investigation, an existing relationship was mentioned seven times as a selection criterion (58% of the cases). Often a specific university hospital with a positive attitude towards the manufacturer and its products was habitually employed to test new prototypes. The perceived commercial potentialities were mentioned in only half of the cases as an important reason in selecting users to test prototypes. In these cases the choice was generally based on the reputation of the specific physician (or institute) involved, and the willingness to test prototypes, publish the results, present the findings at national and international conferences and promote the new product with colleagues. This figure of 50% should be regarded as being low, due to the obvious link between testing a prototype and launching the innovation. In
two cases (17%) the 'selection' was based on a *chance contact*, that is the manufacturer was approached by a user with a new product idea, after which the manufacturer commenced development activities and employed the same user for testing the prototype. Because of the need for intensive interaction, culminating in frequent visits to the customer, *geographical proximity* of the customer was considered to be a great advantage by the manufacturer in two other cases. Finally, in only one case (8% of the cases studied) the manufacturer mentioned the *representativeness* of the user for the specific market segment as strongly influencing the selection of user sites. Summing up, there are some remarkable differences between the results from the preliminary investigation (carried out in various sectors of industry) and those from the study carried out in the medical equipment industry. In general, the test user's representativeness is considered very important while the existence of a relationship is considered to be an additional advantage rather than a serious selection criterion. Manufacturers of medical equipment, on the other hand, strongly emphasize the importance of existing relationships, while the user's representativeness is more or less ignored.

**Act. 5: formulation of objectives**

Although test objectives must be formulated by both the manufacturer (Act. 5A) and the potential users who are to test the innovation (Act. 5B), they do not need to be identical. The manufacturer's objective may be either technical or commercial, while the user may simply wish to keep up-to-date with technological developments. Whatever they may be, explicit objectives are necessary to allow for evaluation of the results. To avoid misunderstandings, both the manufacturer and the users should be informed about each other's objectives.

Nearly all medical equipment manufacturers employed users to test their prototypes with the explicit objective of testing the new product under actual conditions in a clinical environment. However, there was the one exception of a firm that asked a hospital's technical department to test the electrical safety of the innovation (thus changing the character of the test by a user and making it a simple technical test).

**Act. 6: Instruction**

Even though the actual testing takes place at the user site, it does not mean that the manufacturer does not need to be involved. Due to the innovative character of the product, the manufacturer may have to give detailed operating instructions to the user.
in order to prevent negative test results that are in fact caused by incorrect handling of the product. The manufacturer needs to instruct the user on the nature of the various tests to be undertaken, while he should also be aware of any additional tests performed by the user.

Without exception, the manufacturers of complex medical equipment provided their test users with instructions as to the innovation's operation. In one case the complex nature of the prototype demanded extensive training of the physicians and nurses who would have to use the equipment. The importance of instruction is further illustrated by the case of the small firm mentioned above under the heading planning: by improving the instruction of the physicians and registration of the test results (by determining and informing the physicians of the desired format of the needed information) the firm could use medical specialists to evaluate prototypes meaningfully.

**Act. 7: Execution**
The seventh activity of the framework, the actual execution of the market test, is carried out by the test user. However, the manufacturer may be involved indirectly (see Act. 8).

The investigation into the medical equipment industry identified two cases (17% of the cases investigated) where the execution of the clinical evaluations left something to be desired. In one of them, the manufacturer had an important hospital clinically evaluate a prototype while (the slightly modified) units of the trial production were already available. In the other case, the manufacturer, due to the involvement of an original equipment manufacturer who had direct relationships with users, the clinical evaluations were undertaken somewhat inefficiently. This resulted in delays and possibly in distorted information as well.

**Act. 8: Support and control**
As the external test involves a prototype, there is always the possibility of things going wrong, which can be very serious if the innovation involves the heart of the user's production process. Therefore the manufacturer is expected to guarantee quick corrective measures. For instance, consider the case of Ammeraal Conveyor Belting, Holland's largest producer of conveyer belts. Since the belts are a vital part of the user's production process, the firm guarantees fast replacement of broken or malfunctioning belts and

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bears all expenses. Under normal circumstances, that is when no immediate problems occur, a representative of the manufacturer could periodically visit the user to check on the test's progress. Such a regular inspection serves to (a) demonstrate the manufacturer's commitment to the test, (b) check whether the test is actually performed correctly, (c) get a first impression of the test results and (d) encourage the user to mention minor problems.

Some manufacturers of medical equipment commented on the need to visit the user frequently during the execution of the clinical evaluation. In the case of Philips Medical Systems, which is selling very complex and expensive medical equipment, an engineer was present at the user site (i.e. the hospital) one day per week to instruct the users, demonstrate new software, answer questions, solve problems, obtain first-hand information and check the equipment's functioning and the way it is used.

**Act. 9: Registration**

When the manufacturer is not actually present during the test, it is of the utmost importance that the user (a) knows what to measure and how to measure it and (b) passes the information in the desired format on to the manufacturer. To obtain objective test results it is desirable to have the test users fill in standardized evaluation forms.

Despite the importance of clinical evaluations and the need for detailed and structured information, in only half of the cases investigated did the manufacturer of medical equipment affirm the need for and existence of comprehensive formalized evaluation protocols (Table 3). In specific situations, such as the case of Vitatron which manufactures pacemakers, quite elaborate evaluation protocols are demanded by the government because of the involved potential dangers to the patient.

**Act. 10: Evaluation**

The test results can only be evaluated when the objectives of the tests have been stated unequivocally. To avoid misunderstandings, the results should be evaluated by the manufacturer together with the test user.

As mentioned above, in half of the cases investigated in the medical equipment industry, the manufacturer actually used comprehensive evaluation forms. In the other 50% of the
cases the firm relied on oral information from the user. It should be noted that three quarters of the small firms testing prototypes with users relied on oral information. One manager (of a firm with no previous relationships in the field of medical technology) justified it by saying "You cannot ask them to fill out comprehensive forms; you should be glad that they are willing even to talk to you!"

**Act. II: Follow-up**

The final, and often forgotten, activity concerns the follow-up of the test. *Follow-up* is a general term that can imply many different things. For example, the manufacturer should inform the potential user who performed the test of:

- the general results of the tests performed with other potential users,
- what will be done with the test results and
- the termination of the test (naturally, if the user is actually involved in the evaluation of the test results, he will be aware of the fact that the test has ended).

A totally different form of follow-up consists of using the names of the users who performed the tests successfully, together with their experiences regarding the innovation, in promotional material and sales presentations. It is up to the industrial marketer to take the initiative in these matters. An impressive customer list can give the company a reputation as an innovator or a technological leader.

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### Table 3. The mode of evaluating clinical test results related to firm size.

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Considering the criteria used by manufacturers of medical equipment innovations in selecting potential users to test prototypes, the most obvious kind of follow-up to the clinical evaluation stage is having the same users assist in launching the innovation. For this reason, these users may be referred to as launching customers and some manufacturers do speak of luminary sites when selecting users to test prototypes. The involvement of reputable physicians or institutes in launching the innovation lends additional credibility to the manufacturer’s claims and confirms the user’s reputation in the medical field. Nevertheless, only 60% of the innovations clinically evaluated by users were subsequently launched by the manufacturer with the assistance of these users.

The above description could suggest that the individual activities should be carried out one after the other. Figure 1, however, shows the selection of potential users and the formulation of the test objectives drawn in parallel, since the manufacturer cannot clearly separate these two activities. Consider the following example. When the sole objective of the test is to discover whether the product realizes the specified functions, the manufacturer will select a user who is able to evaluate the product from a technical and functional viewpoint. When, on the other hand, he plans to use the user’s name as an important promotional tool at the time of market introduction (the launching customer principle), he will choose a user who is well known in the market and enjoys a good reputation. Small firms that are technologically advanced, but rather unknown in the market, can be used to test the product's functioning but are useless as commercial references. The link between selecting the test users and formulating the test objectives is also expressed by the fact that objective of the test was mentioned as the most important criterion for selecting potential users to test an innovation. Similarly, determining the number of test users is strongly interconnected with formulating the test objectives as well. Activities 7 (execution), 8 (support and control) and 9 (registration) concern parallel activities, too.

The framework presented above should not be treated as a rigid model, a description of reality that can be used under all circumstances. Clearly, the relevance and content of the activities depend on the specific product and market situation. When a firm introduces a modified product into a market segment in which it has been selling for a long time, the whole procedure will be rather routine. The firm is familiar with the market structure, has relationships with major product users and has probably tested new
products with them before. When, on the other hand, a company introduces a very complex and innovative product into a market that is totally new to the firm, it has to conduct a detailed market study both to determine the structure of that market and identify the potential users most suitable for testing the innovation. The framework must be looked upon as a general scenario that offers guidelines to management that will prevent them from overlooking important aspects and will improve their decision making with respect to testing prototypes with potential users.

**MANAGERIAL IMPLICATIONS**

The model's implications for management practice are both numerous and (in part) obvious. The detailed analysis of each separate activity provides the manager with sufficient directions for improvement. Therefore, in this section we will focus on the more general implications that are of direct relevance to management practice.

First of all, it should be noted that the model firmly embeds the external testing stage in the process of product development. Planning and timing of the tests are carried out far in advance, while the follow-up links the external tests to the market introduction. Awareness of these interrelationships between the various stages of the development process enables managers to efficiently plan and carry out the external tests while fully capitalizing on its opportunities.

Secondly, the detailed description of the various activities distinguished in the model demonstrates that managers stand to benefit from careful planning. The individual activities are closely intertwined so that each separate activity should be given explicit attention and carried out with care in order to perform the tests successfully. Numerous examples from actual practice illustrate how relationships with major customers may be impaired because of mistakes made during external testing. In addition, careful design of the external tests may provide the manufacturer with a veritable wealth of critical information. A good example is provided by Mijnhardt, a Dutch manufacturer of long function diagnosis equipment, who had a prototype tested extensively by four groups of potential users: (1) a barracks, with military athletes in top condition to test the functioning at the upper end, (b) a hospital, with real patients to obtain clinical information, (c) a business firm, that intended to measure large numbers of employees, to test the durability and user friendliness of the device and (d) healthy young children to test the prototype's functioning at the bottom end. Furthermore, at the time of investi-
Additional tests were planned with very young sick patients to test the product under even more extreme conditions.

Thirdly, the empirical evidence demonstrates that manufacturer-user relationships in the context of testing newly developed prototypes frequently display symptoms of ossification. Once relationships are established and strengthened by good personal contacts, they tend to function during a number of successive development projects. This phenomenon was found particularly in the medical equipment industry, where long-term relationships with a limited number of high-quality specialists/hospitals are established in which the very existence of a relationship, rather than the characteristics of the project, determines the cooperation.

CONCLUSION

Particularly with respect to medical equipment innovations, the testing of prototypes with potential users was found to be a critical determinant of new product success and to strongly depend on the relationships involved. The relative importance of these manufacturer-user relationships may partly be explained by Von Hippel’s concept of *sticky data*. To put it succinctly, Von Hippel argues that quite frequently data are very sticky, with stickiness being defined as representing the cost of replicating and transferring data. The stickiness of data is hypothesized to be directly related to problem-solving activity: if data needed by a problem-solver are sticky the locus of problem-solving itself will shift to the location of that sticky data. The external testing stage of the product development process does more than just illustrate the point; it provides the perfect example. The very existence of sticky data at the user, that is data related to the actual conditions under which the innovation will be used, forces the manufacturer to conduct his problem-solving activity at the user site. The detailed description of the model presented in this paper shows that the external testing stage is not only a logical, but also a very critical part of the innovation process. While it offers the manufacturer various opportunities to obtain strategic information, its full potential can only be realized through careful planning and meticulous execution.
REFERENCES


