ONDERZOEKSRAPPORT NR 8802

CUSTOMER-GENERATED INNOVATION IN HIGH TECH MARKETS

BY

P. VANDEN ABEELE & I. CHRISTIAENS

D/1988/2376/2

CUSTOMER-GENERATED INNOVATION IN HIGH TECH MARKETS

P. Vanden Abeele
I. christiaens

P. Vanden Abeele is professor of marketing at the Department of Applied Economics at the Katholieke Universiteit Leuven, Belgium.
I. Christiaens is Export Market Manager at FEMONT Inc., Atlanta, USA.

running title : Customer Innovation in High Tech

correspondence : P. Vanden Abeele, DTEW - KU Leuven, Dekenstraat 2, 3000 Leuven, Belgium.

CUSTOMER-GENERATED INNOVATION IN HIGH TECH MARKETS

P. Vanden Abeele

I. Christiaens

P. Vanden Abeele is a psychologist and economist by training. He also holds an MS Statistics and a PhD in Marketing from Stanford University. He is currently pursuing research in the area of High Tech Marketing. He teaches marketing and economic psychology at the University of Leuven.

I. Christiaens holds a degree of Commercial Engineer freom K.U.Leuven. He was a researcher in High Tech Marketing from 1985 to 1986. He is presently managing exports of industrial equipment to the U.S. market.

CUSTOMER GENERATED INNOVATION IN HIGH TECH MARKETS

This paper studies the phenomenon of customer-initiated innovations which is prevalent in industrial markets and which has become known as the Customer Active Paradigm (CAP) of innovation.
The paper discusses CAP conceptually and formulates a number of propositions concerning its nature and occurrence. It discusses the results of a survey study among High Tech firms, which largely support the propositions. Finally, managerial implications of the CAP paradigm for the supplier as well as for the customer are derived.

CUSTOMER - GENERATED INNOVATION IN HIGH TECH MARKETS

High Tech markets are characterized by intense product competition. To succeed, firms must excell in the continuous generation, selection, development and launch of new products.

Research on new product strategy (Cooper, 7,8) emphasizes the importance for success of pursuing a balanced product development program, i.e. of achieving a balance between technological prowess and market sensitivity while maintaining focus or exploiting synergies. Technologically driven firms seem to find it difficult to infuse their product development effort with an early market orientation. The earliest point at which this could be done is at the stage of idea generation, by allowing the market to play an active or passive role in contributing product ideas.

This paper studies the stages and determinants of the "Customer Active" mode of new product idea generation in the context of technologically advanced industrial markets. Following a conceptual and empirical exploration, implications for the recipient as well as for the generator of new product ideas will be presented.

1. Nature and applicability of the Customer Active Paradigm.

The sources of new product ideas are internal or external to the firm. Internally generated ideas will more easily suffer from the danger of not (adequately) addressing customer needs. Market-derived ideas should correspond more closely to customer demand and wants.

Unfortunately, customers are seldom able and motivated to articulate their latent needs and to convey them to potential suppliers. It is normally for the manufacturer to investigate customer needs, to develop and check the acceptance of new concepts and procucts, i.o.w. to be active (the "Manufacturer Active Paradigm" or "MAP", Von Hippel, 35). The motivation/ability to articulate and communicate new product needs or ideas should be higher with industrial customers, whose needs are better definable functionally and who have better technical knowledge. Von Hippel (36) is one of the leading students of the latter "Customer Active Paradigm" (CAP) for procuct innovation. He proposes that new product development in industrial markets often follows a customer Active mode, where the customer

- articulates his own need or problem
- sometimes develops a partial solution, blueprint, specifications or even a product prototype
- selects a manufacturer for his ability to further develop and to produce the solution, and transmits his idea to him

Under CAP, the passive role is now for the manufacturer, who waits for customers to manifest themselves with innovative product ideas.

The occurrence of the Customer Active Paradigm is the subject of several empirical studies (Von Hippel, 34,37; Berger, 2; Boyden, 6, Utterback, 20; Knight, 19; Enos, 12; Freeman, 16; Lionetta, 20). In his 1978 literature review, Von Hippel concludes that the Customer Active Paradigm does indeed occur, but to a variable extent, depending on the industry sector and the nature of the customer's request. A number of cases (Berger, 2; Boyden, 6) show a low incidence of CAP-activity in the chemical sector (engineering polymers, additives for plastics), while CAP users are more prevalent in sectors such as scientific instrumentation. Consequently, this paper will seek to shed more light on the variety of customer ideas or requests. Concerning the nature of customer requests, little appears from the available evidence, of the extent to which these are explicit on needs, solutions, products, etc. Thus, the customer's request could range from fairly general information on needs up to rather specific details on the solution sought.

Under the CAP paradigm a rather passive role is assigned to the manufacturer. But the extent of customer activity is shown by the literature to depend on several factors, some of which may be calling for manufacturer action to adjust to them or to control them. This suggests that the CAP paradigm could be morefully exploited by the manufacturer if he were to adopt a more active stance. Our research will therefore investigate the several stages that lead to CAP- innovation (e.g. the generation of customer ideas, their communication to and adoption by the manufacturer), as well as the determinants of the occurence of such activities). Further, the paradigm seems to assume that the customer is not actively involved in the commercialization stages following the transmission of the idea to the manufacturer. As discussed by Foxall et al. (15), the paradigm can be extended to incorporate customer activity beyond the idea generation stage. Our study will further pursue these ideas and discuss the strategic stances open to the customer w.r.t. his innovative potential.

2. Research objectives.

A first objective of our study is descriptive. Much of the extant evidence on CAP-innovativeness is obtained through intensive case studies with limited external validity. In this research, the more extensive survey mode is practised in order to provide an account of the occurrence and variety of CAP-behavior on a broader sample of technologically advanced industrial firms.

Our second objective is to advance and test a number of correlational or causal propositions on the determinants of, and internal relationships between, CAP behaviors. Since these propositions are tested on survey data, the usual cautions apply : correlations do not prove causation and the relationships we find may be inflated by single-method bias (Philips, 22).

Since the Customer Active Paradigm does not have the status of a theory, full-fledged hypotheses cannot be advanced, but rather tentative propositions.

Proposition 1 : Variety of innovative proposals

While case study accounts of CAP activity relate to a variety of industries, little systematic comparison has been done of the types of innovative proposals generated by customers. It is not likely that all customer ideas will bear on genuinely novel potential products.

The literature on innovation (Sahal, 27 ; Rogers, 26) indeed shows that radical product innovations are less typical than gradual improvements.

New applications for existing products and (limited) alterations or improvements to existing products should be easier to develop than fundamentally new products.

Proposition 2 : Determinants of Customer innovativeness

Available evidence (see above) suggests that e.g. CAP-activity is more intense in the instrumentation and equipment sector than in the chemical sector. These findings can be further refined. We expect to observe differences in customer innovativeness.

(a) by industrial sector, i.e. by the applications area of the technology

(b) by the nature of the technology itself. Customer process technology and industry sector do not overlap perfectly (e.g. a service industry may apply both the electronic computer and the telecommunication technology). Some technologies may lend themselves better to innovative customer activity than others.

(c) by the nature of the technology user, i.e. the firm or the user within the firm. Some company departments can be expected to generate more customer innovations than others, for example.

(d) by the nature of the technology supplier. Large vs. small suppliers or domestic vs. international suppliers could, for example, differentially affect the potential innovativeness of the customers.

Each of the subpropositions 2.a-2.d could, additionally interact with the nature of the customer's ideas (see proposition 1).

Propositon 3 : CAP communication, between customer and supplier. Customer ideas must reach the supplier to be of use to him. Various modes of transferring these can be envisioned. This leads to the following sub-propositons

(a) CAP and communication intensity correlate positively, i.e. there will be more communication where customers are more innovative. This may sound self-evident. However, one could imagine that the innovative customer would willingly or unwillingly keep the idea to himself, or choose communication channels to other audiences than suppliers.

(b) CAP-communication types can be distinguished into supplier-initiated and customer-initiated modes; additionally, third parties, e.g. other suppliers, technology watchers, may be instrumental in the communication.

(c) a variety of communication modes for customer ideas are available. Which mode is used may depend on the same factors that influence the occurence of CAP-innovativeness.

Propositon 4 : CAP adoption

Customer ideas, though generated and communicated, will not necessarily be adopted by the supplier. Based upon the previous propositions, we surmise that

(a) adoption of customer ideas will occur more frequently if customers frequently generate new product ideas

(b) adoption of customer ideas will depend on the frequency and mode of communication of customer ideas

(c) adoption of customer ideas will depend on characteristics of the supplier firm, e.g. relating to the availability of a receptive structure and culture for external ideas (vs. the "not invented here" syndrome).

3. Empirical Results from the Survey Study.

3.1. Sample and Data

This study is part of a continuing, repeated-survey study of High-Tech Marketing issues and practices. For this 1986 survey, the respondents are 294 self-designated marketing managers from a sample of technically advanced industrial-goods and -services firms in Belgium (reponse rate 30%). The respondent sample for this study overlaps partly with the sample for a previous study on New Product Programs (Vanden Abeele and Christiaens, 33); the overlapping observations will at some points be used to link useful information from both surveys.

The representativeness of the sampling frame as well as of the respondent sample cannot easily be established. Further, mail surveys do not allow to apply key-informant methodologies. The external validity of the results must therefore be approached with circumspection.

The self-administered questionnaire contains four sections, dealing with

a. the occurrence and nature of customer innovativeness
b. the occurrence and mode of CAP communication between customer and supplier
c. the extent of adoption of innovative customer ideas
d. a number of "demographic" questions concerning the supplier, his customers, the products and the technology.

While section d is operationalized through a number of categorical measures, sections a-c are measured on with self-descriptive statements on a 0-to-10 scale with labeled endpoints ("never-very often")

Unless otherwise stated, all subsequent statistical testing is carried out at the 95 (two-tailed) significance level.

Table 1 shows how the respondent sample breaks down by technology on the one hand and by product/market on the other hand.

Table 1 about here

3.2. Occurence and nature of CAP-activity

Table 2 shows the average response (and standard deviation of the mean) on 5 items designed to measure the occurrence of various kinds of customer innovativeness. These data do certainly not warrant the conclusion that the CAP-paradigm is the dominant mode for product innovation. They provide evidence, however, that customer innovativeness, when it occurs, bears not only on new product ideas, but also on new applications and (minor) modifications. It is probably correct to assume that some of the new product ideas referred to in fact cover improvements or new applications. The nature of the questions and measurement does not allow comparing the relative incidence of these different types of innovativeness, however.

Table 2 about here

The nature of the Customer Active Construct can be further validated in a convergent and discriminant sense. A first approach for validation is provided by the distinction between the Manufacturer Active and the Customer Active paradigm.
MAP and CAP are conceptually distinguished in the literature, but it is not clear whether these should be considered polar opposites or independent dimensions. Table 3 contains the varimax factor structure underlying 8 items intended to measure MAP and CAP sources of product innovation. The two retained factors show MAP and CAP as separate rather

than polar opposite innovation modes. If both CAP and MAP are desirable innovation modes, it should be possible to cumulate their impact on the product innovation performance of the firm. The expectation is that firms pursuing a joint CAP and MAP development mode would be more successful in their product development strategy than firms high on only one or on neither mode.

Table 3 about here

3.3. Determinants of CAP-activity

The major evidence concerning the determinants of CAP-activity, is shown in table 4, where the occurence of the product improvement mode, of the new product applications mode and of the new product idea mode is explained by multivariate regression on technology and sector dummies as well as on a number of continuous variates. Additional information is obtained from the analysis of bivariate correlations.

Table 4 about here

3.3.1. Nature of the technology

CAP-product improvement ideas are more frequent with the groups Agro/Biotech (comprising mainly less complex applications such as process equipment), Machinery and Automation.
This is consistent with the less complex and/or more accessible nature of the technologies concerned and with the need to adjust the technology to the physical requirements of the applications environment. This is confirmed by a significant correlation ($r=-26$, $p < .03$) between the

judged complexity of the technology and the incidence of CAP product improvement.

New applications do not bear any significant relationship to the technology or applications groups, contrary to our expectations.

The incidence of CAP-new product idea suggestions is signi^icantly lower in the areas of medical technology, machinery and measurement/ control equipment. A potential explanation, beyond absolutely lower levels of customer innovativeness in these cases, is that these customers are capable of implementing their own new product ideas and prefer not to share these ideas with suppliers, e.g. to preserve a basis for competitive advantage.

3.3.2. Nature of the end-user

CAP-activity should originate with users able and motivated to engage in innovative activity. Motivation may be task-related (process improvement, cost reduction, quality improvement) or personal (scientific or technical interest of the user). The regression results show a significantly higher incidence of new applications ideas when users belong to the R&D or to the Quality Control department (where existing equipment is often put to new tasks). New product ideas are more often obtained from end users in the Production/Production Methods department. This is understandable since these users face the problem of automating previously manual processes or of designing process equipment for the manufacture of new products.

Customer activity is expected to be more intense when supplies are to be integrated into end products. OEM customers work in close cooperation with suppliers in order to achieve an optimal fit of the supplies, and OEM customer innovations have direct repercussions on the needed supplies. This may explain the significant incidence of all three CAP modes when customers buy semi-finished products from the supplier. If the supplier works entirely to custom, however, the need for improvements or new applications is obviated, as shown by the negative regression weight for the "custom made" variable on the incidence of new

applications ideas.

3.3.3. CAP and manufacturer characteristics

A number of further relationships are found when relating several supplier characteristics measured in a previous survey (Vanden Abeele and Christiaens, 33) to customer innovativeness

First, suppliers belonging to a multinational entity tend to elicit more customer innovation activity. It is likely that multinational product standardization allows domestic subsidiaries less flexibility in adapting products to local customer needs. This is corroborated by the significant relationship between multinational subsidiary status and new applications CAP activity, shown in table 5.
A related study (De Bondt et al, 11) shows that domestic firms and local multinational subsidiaries belong to separate strategic groups and follow distinct product innovation strategies.

Next, table 5 brings out that firms entering new markets and serving new customer needs, as one would expect, elicit more product improvement activity by customers

Finally, respondents who rate their firms as superior in sales and marketing indicate that their customers are less active product improvers or new applications developers. Proficient market research, especially in the pro-active mode, will expectedly substitute for CAP innovativeness. If customer needs are well researched and known, the customer will feel less necessity to become innovative. While the substitution of the MAP-mode for the CAP mode may be an empirical fact, we have previously argued that MAP and CAP can and should preferably be pursued jointly.

Table 5 about here

3.4. Customer communication and innovation adoption

The intensity and mode of communication between customer and supplier is an important aspect of customer-sourced innovation. Respondents who judge their customers as more innovative, as one would expect, also report a higher frequency of supplier-customer contact. The mode of supplier-customer communication tends to be particular to the type of customer innovativeness, as evidenced by significant correlations between

- judged CAP innovativeness in new applications and communication of the idea throug direct observation by supplier personnel ($p<.01$) or via user groups ($p<.07$).
- judged CAP innovativeness in product improvement or new product ideas and customer initiated communication ($p<.02$ and $p<.01$ resp.) or communication through other suppliers of the customer (often themselves clients of the supplier) ($p<.03$ and $<.02$ resp.).

Though often only marginally significant, a number of partial correlations (partialling out the judged extent of CAP innovativeness) indicate that modes of supplier-customer communication may be peculiar to the technology or applications sector. Except for the finding that user groups are a preferred communication mode for group 5 (Office Equipment), the findings are heterogeneous and lack a ready explanation by lack of deeper insight :

- for Measurement and Control Instrumentation less use is made of customer-initiated communication and of the trade/scientific press
- for group 1 (Micro-Electronics, Telematics, Robots) customer observation by the supplier is better suited; the trade/scientific press is less suited as a CAP communication medium for the Machinery sector.

The incidence of customer initiated innovation (measured by the item "how often do you adopt customer-generated new product ideas/ improvements/ applications?") is influenced by the intensity, but also by the nature of customer innovativeness and of supplier-customer

communication. Partialling out the judged incidence of customer innovativeness, a number of significant correlations are observed. For product improvement as well as for new applications, adoption is more likely if the innovation is transferred by direct customer observation or by customer-initiated communication ($p<.01$ and $<.01$ resp.). User groups favor the adoption of product improvements ($p<.01$) but not of new applications ($p<.10$).
Journal publication benefits the adoption of new applications ($p<.10$) but not of product improvements.

Finally, the likelihood of innovation adoption (by the supplier) for product improvements is higher in the sectors of Medical Instruments ($p<.03$) and of Machine Construction ($p<.10$). The adoption probability of improvements or new applications is lower for standardized products.

Again, the above findings are diverse and do not always find an obvious explanation. Methodological artifacts such as a biased search for significant relationships and the confounding of judged customer innovativeness, communication intensity and adoption likelihood are viable rival explanations for the findings. Pending further exploration, however, the evidence is not in contradiction with the related propositions.

4. Discussion and implications

The evidence obtained from our survey study supports most of the propositions presented in section 2.
Customer innovativeness bears on improvements and new applications rather than only on new product ideas (proposition 1). The incidence of such CAP innovativeness is influenced by factors characterizing the supplier, the technology and the customer (proposition 2; no impact of the technology or product/market sector on the incidence of new product applications could be established, however). The incidence and nature of supplier-customer communication (proposition 3) and of innovation adoption by the supplier (proposition 4) seem to respond to the same

factors (our data did not allow investigating proposition 4.d).

The results, though awaiting further rationalization and confirmation allow us to discuss a number of implications for the supplier and for his innovative customer.

4.1. Implications for the supplier

The attractiveness of the CAP-mode for product innovation by the suppliers is evident and has been discussed in the literature (Von Hippel, 35). An important implication of our study is that suppliers can pro-actively manage their relationship with innovative customers in order to improve the capture of CAP-benefits. We recommend supplier activity in five areas, namely

1. identifying sources of customer innovativeness
2. encouraging customer innovativeness
3. facilitating the transfer of customer ideas
4. increasing the supplier's receptivity to customer ideas.
5. developing a CAP-idea selection policy

4.1.1. Spotting innovative customers

Our empirical research shows that customer innovativeness can bear on new product ideas, on new applications or on product improvements, and that each of these CAP strands is more prevalent in certain product/ technology sectors, types of customer firms (e.g. OEM's) and customer departments (R&D, Quality Control Production). The supplier should pinpoint firms or departments who have the particular motivation and capability required for innovative activity. These CAP-champions need to be identified as targets for a more proactive innovation strategy by the supplier.

This pleads for more attention to the role of supplier contact personnel in identifying active customer personnel and customer innovations, e.g. by devising ways to get salespersons "around" purchasing agents and "in" to see R&D, quality control and production people and their innovations. One suggestion is to train salespersons in product maintenance so that they will gain access to the relevant innovative customers/innovations. It is obvious that salesperson training and incentive structures should be designed to improve their CAP-attentiveness and sensitivity.

4.1.2. Facilitating customer innovative activity

Customer innovativeness hinges on the motivation and on the ability to be innovative. The ability to innovate depends on the product concept: some product concepts lend themselves better to adaptation and re-programming than others. It is, in addition, a mater of skills and means. Skills relevant to customer innovativeness, if not yet acquired, can be imparted through educational activities (training, scientific conferences, self-paced educational materials and programs). Means, if not available within the customer organization, can be offered by the supplier. Some firms offer to innovative customers facilities (e.g. user laboratories and advice) in order to enable them to develop new proposals and to assist them in their implementation. Incentives for customer innovativeness are of a material or psychological nature. Innovative customer personnel are driven by a professional and intellectual ethos. Supporting them in their innovative activities already serves as a motivator. Recognition of their intellectual and technical achievements (e.g. through scientific publication, awards, etc.) could be a potent incentive. Financial rewards to innovative organizations are a way of letting the customers share in the rents accruing to the supplier-adopter of the innovation. Where the innovation is transferred at non-concessionary terms, the active customer will contractually capture part of the innovation benefits. When the terms of the transfer are concessionary, the adopting supplier could still voluntarily let the innovative customer share in the rent, e.g. by selling to him at cost or at a reduced margin or by paying a modest

royalty. This may suffice to induce the active customer to refrain from making the know how available to third parties.

4.1.3. Facilitating the transfer of innovative information

The supplier can take the initiative in soliciting innovative ideas from customers by increasing his attractiveness as a destination for these proposals and by establishing appropriate communication channels. The first task is to increase the corporate visibility of the firm as one which is receptive to customer ideas.
Customers need to be informed of the supplier's "product innovation charter" (Crawford, 10), stating the arena of the product innovation activities and the skills of the firm in adopting external suggestions. Supplier contact personnel need to be trained and rewarded for spotting customer innovations. This task is not limited to sales people but extends to all personnel in touch with active customer personnel, e.g. in the R&D, Quality Control and Production departments. Specific communication channels can be built to manufacturers' departments in charge of external innovation idea sourcing.

4.1.5. Increase the supplier's receptivity to new ideas

This receptivity is a matter of people, structures and procedures. Suppliers facing active customers must ensure that innovative ideas will be received and dealt with in an expedient way which is satisfactory to the customer. Resistance resulting from the "not invented here" attitude needs to be overcome. The difficulties in assimilating and absorbing foreign technology have to be understood and evaluated correctly (the case history of technological acquisitions shows that the merger or fusion of own and acquired technology is all but easy). Specific organizational departments or functions such as New Product (Idea) Committees or User Labs can be put in charge of receptioning customer ideas and of developing these in close contact with the source. As in other areas of innovation management, specific

individuals acting in the role of champion can make the difference between success and failure.

4.1.5. Develop a CAP-idea evaluation and selection policy

As stated above, CAP generated ideas are not necessarily marketable nor compatible with the firm (Crawford, 9). As for supplier-generated ideas, the firm needs a policy concerning customer-generated innovations and a translation of that policy into an evaluation and selection procedure. Since the customer may have a physical or emotional involvement with this idea, it is useful to inform him of this policy.

4.2. CAP and the strategic interest of the innovative customer

The CAP literature is mainly sensitive to the interest of the supplier. It makes the implicit assumption that the customer is willing to divulge his innovation to the supplier, even at concessionary terms. The modern management literature (Porter, 23) stresses the strategic importance of technology as a competitive weapon and the need to include suppliers as well as potential entrants in the analysis of competitive market structures.
Process technology can be a significant strategic weapon and the core element of the firm's competitive strength.

The innovative customer should adopt an active stance towards his own process-innovation potential. Three different attitudes can be adopted : distal, cooperative and proximal.

Under the **distal stance**, process innovations are not considered core to the strategic thrust of the firm. Still, since the innovation is of interest to the supplier, there is some benefit to be captured. Rather than ceding the innovation to interested manufacturers, the customer can pursue an active policy of marketing his technology or, at least, of extracting some benefits from the adopter (e.g. by licensing or cross-licensing or by negotiating compensatory benefits such as cheaper supplies). This requires that the innovative customer be

organized to market process technologies and know how, an activity in which he is likely to be inexperienced. Ford and Walker (13) discuss the opportunities and managerial implications of various forms of technology marketing.

We wish to argue that the "distal" stance is most often adopted by default, and that it is ill adapted to the imperatives of a market in which technology is becoming a major competitive weapon. In this respect, the cooperative or the proximal approach provide a better answer.

Under the **cooperative mode**, the active customer is aware of the shared strategic interest of his technological potential to himself and to his supplier; the value, however, can only be realized through cooperation of these parties. Such cooperation can be effected through the market or through more direct, bilateral forms of coordination. The market form of coordination amounts to the active customer selling his know-how to all interested suppliers, with the result that he will obtain a fair share of the rents and be assured of competitive supply conditions. Where the market fails, coordination through technology sales, joint venturing or setting up spin-off ventures, are alternatives to achieve the needed coordination and protection of the know how. (Burgelman, 3).

Increasingly, firms realize that their process innovations can be the core of their competitive advantage. Under the **proximal strategy**, therefore, the customer strives to develop process innovations and to keep them from diffusing in the competitive environment. Many firms have learned that a liberal policy of allowing outsiders to inspect production and managemnt processes results in giving away valuable knowledge to present and potential competitors. If the process technology is competitively key, the innovative customer should resist supplier-initiated attempts to capture the benefits from the innovative potential of their customers.

5. Conclusion

This paper contributes to the literature on the Customer Active Paradigm by further clarifying its conceptual nature and by providing more detailed empirical evidence concerning the object and process of customer activity. The major insights contributed are that customer activity is of diverse nature and that it is observed under specific circumstances. This information leads to the conclusion that manufacturers can adopt a more active stance in order to incite, spot and transfer, and in order to follow up on customer innovativeness. At the same time, innovative customers should adopt a more strategic stance toward the supplier-relevant innovative know-how they develop.

Further empirical research is needed to obtain a better understanding of the CAP paradigm. Our particular recommendation is to devote attention to the processes through which customer ideas are transferred to the supplier and to the determinants of the adoption by suppliers of customer innovations.

TABLE 1 : TECHNOLOGY AND PRODUCT-MARKET AREA OF RESPONDENT FIRMS

TECHNOLOGY

GROUP 1 (n=42)
- Micro-electronics (active and passive components, etc.)
- Telematics (telephone, telegraph, audio-equipment, etc.)
- Bureautics (word processing, office computers, duplication, etc.)
- Robotics (industrial automation, precision robots, remote manipulation, etc.)

GROUP 2 (n=21)
- Biotechnology (genetic manipulation, cell cultivation, preservation techniques, etc.)
- Agro-industrial techniques (climatisation, automated husbandry, breeding and selection, etc.)

GROUP 3 (n=20)
- Space and Aeronautics (infrared equipment, meteorological equipment, board instrumentation, etc.)
- New Materials (composite materials, coatings, laser technology, superconductors)
- New Energies (nuclear, wind, solar, etc.)

GROUP 4 (n=24)
- Medical Technology (nutrition, measurement equipment, scanners, vaccines, etc.)

PRODUCT MARKET

GROUP 5 (n=52) - Office equipment and suppliers (typewriters, money tellers, office computers, etc.)

GROUP 6 (n=30) - Machinery (applications are electrotechnical, chemical, packaging and canning industry - sorting, weighing, filling, etc.)

GROUP 7 (n=46) - Electrical and Electronic Measurement and Control equipment (gas meters, heat meters, gas analyzers, pressure and flow measurement, etc.)

GROUP 8 (n=29) - Automation (industrial robots, remote manipulation, etc.)

GROUP 9 - Other

note : respondents can belong to technology - and to product/market categories simultaneously

TABLE 2 : OCCURRENCE OF VARIOUS TYPES OF CUSTOMER INNOVATIVENESS
(MEAN AND SD OF MEAN ON 0-10 SCALE)
(0=NEVER, 10=VERY OFTEN).

	mean	SD	n*
TO YOUR KNOWLEDGE			
. do your customers carry out minor product modifications?	2.6	.15	294
. do your customers carry out major product modifications?	1.0	.103	294
. do your customers develop new product applications?	3.0	.19	249
WHAT IS THE SOURCE OF YOUR IDEAS FOR NEW PRODUCTS ?			
. well developed proposals and requests by present customers	5.3	.19	278
. well developed proposals and requests by potential customers	3.5	.18	269

* sample sizes vary due to nonresponse, mainly due to non applicability of the item to some respondents.

TABLE 3 : VARIMAX ROTATED FACTOR LOADINGS FOR NEW PRODUCT IDEA SOURCES

ITEMS	FACTOR LOADINGS Factor I "CAP"	Factor II "MAP"
1. The firm sells to a limited number of customers, having developed products according to their instructions.	.76	-.15
2. The firm produces products developed by customers.	.59	-.09
3. The sources of new product ideas		
3.a. Detailed customer proposals	.83	.06
3.b. Detailed proposals by non-customers	.68	.19
3.c. Market Research	-.01	.79
3.d. External technology developments	.01	.74
3.e. R&D	-.12	.67
3.f. Competition	.08	.64
Total variance explained : 53% of which	50%	50%

TABLE 4 : REGRESSION ANALYSIS OF JUDGED CUSTOMER INNOVATIVENESS ON TECHNOLOGY, SUPPLIER AND CUSTOMER CHARACTERISTICS

	DEPENDENT VARIABLE Rated frequency of occurrence (0=never, 10=very frequently) of customer iniated		
INDEPENDENT VARIABLE	Product improvements	New applications	New product ideas
Intercept	2.257** (3.707)	3.372** 57.784)	-0.110 (-0.669)
Group 1	0.455 (0.579)	-0.109 (-0.203)	-0.048 (-0.237)
Group 2	2.160* (2.202)	0.008 (0.041)	-0.256 (-1.031)
Group 3	0.437 (0.396)	-1.161 (-1.479)	0.111 (0.359)
Group 4	0.564 (0.628)	-0.078 (-.123)	-0.507* (-2.049)
Group 5	0.313 (0.395)	0.213 (0.409)	0.029 (0.132)
Group 6	2.446** (2.627)	0.667 (1.007)	-0.645* (-2.251)
Group 7	-0.412 (-0.505)	-0.833 (-1.437)	-0.473* (-2.212)

Group 8	2.084*	0.153	-0.062
	(2.295)	(0.237)	(-0.260)
% of semi-finished products in total sales of supplier	0.037**	0.033**	0.008**
	(3.240)	(4.102)	(2.648)
% of custom made products in total sales of supplier	0.006	-0.019**	
	(0.792)	(-3.502)	
% of users in customer R&D and Quality Control Departments	0.009	0.034**	
	(0.646)	(3.216)	
% of users in customer Production Department			0.006**
			(2.931)
R-square (adj)	.08	.10	.09

notes 1. figures are regression coefficients and (in parentheses) t-values
2. significance level (two-tailed) : * = P < .05; ** = P < .01
3. for identification of groups, consult table 1
4. n = 251

TABLE 5 : REGRESSION OF CAP ACTIVITY IN IMPROVEMENTS AND APPLICATIONS ON SELECTED REGRESSORS.

INDEPENDENT VARIABLES	DEPENDENT VARIABLE : CUSTOMER INNOVATIVE ACTIVITY IN PRODUCT IMPROVEMENT	NEW PRODUCT APPLICATIONS
Intercept	1.65	2.64
	(3.80)	(4.97)
Multinational subsidiary Status	1.65	1.74*
	(1.72)	(2.41)
Supplier newness to market and needs	1.64**	0.31
	(2.88)	(0.81)
Proficiency of supplier marketing effort	-.92*	-.89**
	(-2.12)	(-2.70)
R-square (adj)	.14	.12

notes : 1. figures are regression coefficients and t-values (in parentheses)
2. significance levels (two-tailed) : * = p<.05; ** = p<.01
3. n = 67

B I B L I O G R A P H Y

1. ABRIKIAN, S.A. (1981) "New product Innovation : Empirical findings and marketing applications", Technical report 67, Stanford University, June 1981.
2. BERGER, A. (1975) "Factors Influencing the Locus of Innovation Activity Leading to Scientific Instruments and Plastics Innovation", unpublished M.S. Thesis, M.I.T. Sloan School of Management, June, 1975.
3. BURGELMAN, R.A. (1984) "Design for Corporate Entrepreneurship in Established Firms". California Management Review, Vol. 26, 3, Spring 1924.
4. BOOZ, ALLEN and HAMILTON, (1966) "Management of New Products", Chicago, 1966.
5. BOOZ, ALLEN and HAMILTON, (1981) "New Products Management for the 1980s : Phase I", Chicago, 1981.
6. BOYDEN, J. (1975) "A Study of the Innovation Process in the Plastics Additives Industry", unpublished M.S. Thesis, M.I.T. Sloan School of Management, June, 1975.
7. COOPER, R.G. (1984) "How new product stategies impact on performances, Journal of Product Innovation Management, 1, 5-18, 1984.
8. _____(1986) "Winning at New Products". Montreal : Mc Gill University Press.
9. CRAWFORD, C.M. (1975) "Unsolicited Product Ideas-Handle with care", Research Management, January 1975, p. 19-24.
10. CRAWFORD, C.M. (1983) : "New Products Management", Homewood, Ill., R.D. Irwin.
11. DE BONDT, R., SLEUWAEGEN, L. and R. VEUGELERS (1986) "Innovative Strategic Groups in Multinational Industries", Research Report 8605, Dept. of Applied Economics, Cath. Univ. of Leuven, Belgium.
12. ENOS, J. (1962) "Petroleum Progress and Profits", M.I.T. Press Cambridge, MA, 1962.

13. FORD, D. and C. WALKER, (1981) "Taking technology to market", Harvard Business Review, march-april 1981, 117-126.

14. FOXALL, R.G. (1984) "Corporate Innovation : Marketing and Strategy" Croom and Helm, London, 1984.

15. FOXALL, G.R., Murphy, F.S. and J.D. Tierny (1985). "Market Development in Practice : A Case Study of User-Initiated Product Innovation", Journal of Marketing Management, vol. 1, 201-211.

16. FREEMAN, C. (1967) "Chemical Process Plant : Innovations and the World Market", National Institute Economic Review, 1967.

17. GEMUENDEN, H.G. (1985) "Promotors : Key Persons for the Development and Marketing of Innovative Industrial Products.", paper presented to the EMAC Annual Conference, 1985, April 1985, p. 402-425.

18. HISRICH, R.D., PETERS, M.P. (1978) "Marketing a New Product : Its Planning, Development and Control" Benjamin Cunnings, 1978.

19. KNIGHT, K.E. (1963) "A study of Technological Innovation : The Evolution of Digital Computers", unpublished Ph.D. Dissertation; Carnegie Institute of Technology, 1963.

20. LIONETTA, W.G. (1976) "Sources of Innovation Within the Protrusion Industry, unpublished S.M. Thesis, M.I.T. Sloan School of Management, January, 1976.

21. MARQUIS, D.G. (1969) "The Anatomy of Succesful Innovations, Corporate Strategy and Product Innovation", 1969.

22. PHILIPS, L.W. (1981), "Assessing Measurement error in Key Informant Reports A Methodological Note on Organizational Analysis in Marketing", Journal of Marketing Research, 18, 395-415.

23. PORTER, M.E. (1980) "Competitive Strategy : Techniques for Analyzing Industries and Competitors", New York, The Free Press, 1980.

24. RIGGS, H.E. (1983) "Managing High Technology Companies", Lifetime Learning Publications, Belmont California, 1983.

25. ROCKWELL, J.RR., PARTICELLI, M.C. (1982) "New Product Strategy : How the Pros do it", Industrial Marketing, May 1982, p. 49-60.

26. ROGERS, E.M. (1983) : "Diffusion of Innovations" 3rd ed. The Free Press, New York.

27. SAHAL, D. (1981) "Patterns of Technolgoical Innovations", Addison-Wesley Publishing Company, 1981.

28. SAMPSON, P. (1970) "Can consumers create New products?", Journal of

the marketing Society, 1970.

29. SCHUMPETER, J. (1926) "Theorie der Wirtschaftsentwicklung", Duncker & Humbolt, München, 1926.
30. TUSHMAN, M.L., MOORE, W.L. (1982) "Readings in the Management of Innovation", Columbia University, 1982.
31. UTTERBACK, J.M. (1971) "The process of Technological Innovation withing the Firm", Academy of Management Journal, March 1971, p. 75-88.
32. UTTERBACK, J.M., ABERNATHY, W.J. (1973) "Patterns of Innovation in Industry", Technology Review, Vol. 80, N° 7, June-July, 1978.
33. VANDEN ABEELE, P., CHRISTIAENS, I. (1986) : "Strategies of Belgian High Tech Firms". Industrial Marketing Management, Vol. 15, 299-308.
34. VANDEN ABEELE, P., CHRISTIAENS, I. (1985) "Strategieën voor productontwikkeling- en vernieuwing, empirisch onderzoek bij Belgische high-tech bedrijven", Research Report nr. 8512, KUL, Departement Toegepaste Economie, oktober 1985, 28 pp.
35. VON HIPPEL, E.A. (1977) "The Dominant Role of the User in Semiconductor and Electronic Subassembly Process Innovation", IEEE Transactions on Engineering Management, May 1977, p. 60-71.
36. VON HIPPEL, E.A. (1977) "Has A customer Already Developed your Next Product?", Sloan Management Review, winter 1977, p. 63-74.
37. VON HIPPEL, E.A. (1978) "Succesful Industrial Products from Customers Ideas.", Journal of Marketing, Vol. 42, N° 1, 1978, p. 39-49.
38. VON HIPPEL, E.A., FINKELSTEIN S.N. (1979) "Analysis of innovation in automated clinical chemistry analyzers.", Science and Public Policy, Februari 1979, p. 24-37.
39. VON HIPPEL, E.A. (1982) "Appropriability of innovation benefit as a predictor of the source of innovation.", Research Policy, N° 11, 1982, p. 95-115.

VDA/lp/tekst12B