“Integrating Expert Customers in New Product Development in Industrial Business - Virtual Routes to Success”

AUTHORS	Andrea Hemetsberger Georg Godula
ARTICLE INFO	Andrea Hemetsberger and Georg Godula (2007). Integrating Expert Customers in New Product Development in Industrial Business - Virtual Routes to Success. *Innovative Marketing* , *3*(3)
RELEASED ON	Tuesday, 25 September 2007
JOURNAL	"Innovative Marketing "
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
0	0	0

INTEGRATING EXPERT CUSTOMERS IN NEW PRODUCT DEVELOPMENT IN INDUSTRIAL BUSINESS – VIRTUAL ROUTES TO SUCCESS

Andrea Hemetsberger*, Georg Godula**

Abstract

Customer integration in new product development processes (NPD) has become a potent idea in the innovation literature and enjoys increasing attention in business. In general, methods of customer integration can considerably improve a firm's knowledge base for new product development, particularly when customer knowledge can be incorporated, which otherwise remains tacit. Interestingly, no method has been developed yet which can help to exploit customers' expertise at exactly those stages in the NPD process where user's wants and aspirations have to be translated into product specifications. The emerging new methods of Virtual Customer Integration represent promising new methods for filling this gap. However, these methods must fulfill certain requirements in order to gain competitive advantages from customer integration. We introduce a framework that helps to select the most appropriate method and tool of customer integration, according to the particular requirements of an industrial organization in the design and prototyping stage. Establishing these criteria is critical as they directly derive from a firm's innovation strategy. Hence, those criteria have to be elaborated in detail. This article provides a business case which shows how to do that and what implications can be derived for choosing appropriate methods of virtual customer integration.

Key words: New Product Development, Customer Integration, Business-to-Business, Virtual Tools.

Introduction

Customer integration in new product development processes (NPD) has become a potent idea in the innovation literature and enjoys increasing attention in business. Prahalad and Rameswamy (2000) argued that companies must incorporate customer experience in their business models for several reasons. Firstly, in today's business-to-business markets there is increasing pressure to effectively and efficiently innovate, which encourages companies to use customers as a valuable source of competence. Secondly, in industrial high-tech markets product developers are prone to blunder into a characteristic situation of escalating commitment (Biyalagorsky et al., 2006) with regard to their innovation project. Thirdly, high-tech industries tend to establish close business-to-business relationships with strategic key customers thus loosing sight of the mass market demands. Hence, mass customer integration, and customer integration in general, could be vital for successful new product development (NPD), and beyond.

In general, methods of customer integration can considerably improve a firm's knowledge base for NPD, particularly when customer knowledge can be incorporated, which otherwise would remain tacit. Furthermore, the kind and amount of customer information required for product development vary considerably according to the stage of NPD, and also from project to project. With regard to this, information and knowledge requirements are highest at the ideation, designing and prototyping stages. Interestingly, no method has been developed yet which can help to exploit customers' expertise at exactly those stages in the NPD process where user's wants and aspirations have to be translated into product specifications. The emerging new methods of Virtual Customer Integration (VCI), which are predominantly researched at the MIT Sloan School, promise to become an invaluable extension to conventional methods, particularly at product prototyping and design stages

---

* University of Innsbruck, Austria
** MH | direkt Asia, China.

of the NPD process. These virtual tools enable rapid prototyping and immediate adjustment of product features to customers' ideas. Particularly in the most sensitive stage when customer requirements must be translated into product specifications, virtual methods of customer integration appear to be a big step forward.

In the following, we will briefly define virtual customer integration, and describe current methods and tools of virtual customer integration. Furthermore, virtual customer integration methods must fulfill certain requirements in order to gain competitive advantages from customer creativity, accuracy of information, and improved time-to-market. We introduce a framework that helps to select the most appropriate method and tool of customer integration, according to the particular requirements of an industrial organization. Establishing these criteria is critical as they directly derive from a firm's innovation strategy. Hence, these criteria have to be elaborated in detail. We will provide a business case which shows how to do that and what implications can be drawn from practical experience. Finally, we will discuss the main advantages and potential drawbacks of such methods.

Virtual Customer Integration

Recently, the virtual corporation as a network of complementary skills and competencies has been seen as an approach that offers comparative advantages for companies that insist on a high level of flexibility and a low level of bureaucracy (Rautenstrauch, 2002). However, companies that plan to build up a virtual corporation need to have information and communication technologies like the Internet or Groupware applications, combined with the ability and the tools which enable the network organization to work and to reduce transaction costs at the same time. Tools and methods of Virtual Customer Integration (e.g. Dahan and Hauser, 2002b) promise to provide exactly these technological possibilities. The term "virtual" does not primarily refer to online or being networked, but rather means that an "individual encounters synthesized experiences created by computers which are performed in such a way that the experiences to some extent are experienced as real experiences by the user. The individual will, through uncontrolled and controlled reactions in real time influence the computer generated virtual reality" (Ottosson, 2002). Hence, virtuality refers to some kind of simulation of reality. The advantage of virtuality obviously consists in the possibility of virtually creating objects, which are not materialized, not yet existing, and which can be altered by a simple click. Hence, costly prototyping could be avoided.

At the MIT laboratories, a considerable number of different tools have been developed and still are being improved. Listening in was introduced by Urban and Hauser (2004) as a new indirect method of detecting unmet customer needs by observing customer interactions with an Internet-based sales recommendation system for trucks. While the virtual salesperson attempts to identify the ideal, current-model truck for each respondent, a virtual design engineer notes which product attributes leave the customer the most unsatisfied. The virtual engineer then "interviews" the customer to better understand the unmet needs and how to best resolve the inherent tradeoffs that prevent those needs from being met.

With Virtual Brainstorming (VB), a system also referred to as "Web-based Asynchronous Ideation", Toubia et al. (2004) promise to overcome many drawbacks of conventional methods such as travel time and costs constraints of participants, low energy levels or lacking creativity and free-riding problems. With this method, customers, external partners, or internal development team members are invited to participate in an idea generation exercise in which the incentives are fine-tuned to encourage participants to think hard and generate ideas that are relevant and not redundant with previous ideas.

Similar to Virtual Brainstorming, the Information Pump (IP) is a web-based interactive game with fine-tuned incentives however, with special focus on truth telling. It "pumps" information from customers about their true needs or perceptions of new concepts and shows how they describe their impressions (Dahan and Hauser, 2002b). The incentives of this "online focus group" are based on "honest reward-" and game theory to encourage both truth telling and creativity to overcome problems faced in conventional focus groups (Prelec, 2001).

Conjoint analysis is the most widely used method to understand customer trade-offs among product feature expectations (Paustian, 2001). Interactive web-based conjoint analysis (WCA) interfaces are moving the existing set of conjoint methods to the web while exploiting new capabilities to present products, features, product use and marketing elements in streaming multimedia representations (Dahan and Hauser, 2002b). Because industrial products are typically complex and comprise many features, product development teams require preference measurement methods that can handle more customer needs and provide prioritizations among substantially more features (Toubia et al., 2003). The new web-based interfaces rely on proven estimation methods while bringing exactly those advanced conceptualization to virtual features so that they might be tested earlier in the process and with greater speed (Dahan and Hauser, 2002b). By exploiting new computational algorithms to select questions rapidly, the FastPace (FP) tool gathers a considerable amount of information on preferences, using far fewer questions than existing methods, like fixed (web-based or conventional) conjoint measurement. However, even with adaptive methods, the number of parameters that can be estimated is limited by respondent fatigue. This limits the number of features that can be tested. A possible way out of this research dilemma is offered by the user design method.

User design (UD) exploits the interactivity of modern information technology to enable users to design their own virtual products and thus provides the means for development teams to understand numerous and complex feature interactions and enabling customers to learn their own preferences for new products (Dahan and Hauser, 2002a). Van Buiten (1998) describes such an approach applied to the design of future helicopters, which improves on the usability of traditional configurators by enabling respondents to drag-and-drop their preferred features onto a design palette that illustrates the fully integrated product. Similar applications in business-to-business settings have been reported for copy finishers (Dahan and Hauser, 2002b). User design sacrifices the generality of conjoint-based methods in order to handle more features that might possibly interact.

Because holistic descriptions are critical to ultimate customer and buying-center purchase decisions, product development teams often need to move beyond feature-based methods, especially later in the product development process (Dahan and Hauser, 2002a). Accordingly, in Virtual Concept Testing (VCT) respondents view new product concepts and express their preferences by “buying” their most preferred concepts at varying prices. These choices are converted into preferences for each concept by conjoint-analysis-like methods in which the rank-order selections are explained with the two variables, price and concept, as described in Dahan and Srinivasan (2000). VCT enables the development team to get rapid and inexpensive feedback on the product that includes descriptions of the product and its features, illustrations of the product in use, and marketing elements such as brochures, magazine articles, advertisements, and simulated word of mouth.

Finally, with Toolkits (von Hippel, 2001; von Hippel and Katz, 2002) manufacturers actually abandon their efforts to understand users’ needs accurately and in full detail. Instead, they outsource key need-related innovation tasks to the users themselves after equipping them with appropriate virtual “toolkits for user innovation” to design and develop their own products, ranging from minor modifications to major new innovations (Thomke and von Hippel, 2002). Computer simulation, for example, allows customers to quickly try out ideas and design alternatives without having to manufacture the actual products. Its goal is to provide customers with enough room for creativity to design innovative custom products that will satisfy their needs.

Each of the methods and tools described provides different information and helps incorporating different kind of customer knowledge into the NPD process. In the following, we will introduce a framework that categorizes virtual tools and methods for customer integration alongside two dimensions: NPD stage, and depth of knowledge exchanged.

Deciding on the Appropriate Method

Finding the appropriate method for customer integration in NPD is not self-evident. First, the tools and methods produce different information. Some are directed towards gathering ideas, some provide evaluations of possible product features, and some are even able to leverage customer innovative behavior. Hence, these tools are targeted at different stages in an NPD process. Secondly, and related to these stages, the tools differ in their ability to import in-depth customer intelligence. Depending on the business in question, on the particular project, and therefore on the expertise necessary, different kind of knowledge and Know-How from the customer will be sought after. In order to capture the knowledge dimension in our framework, we draw on Nonaka (1994) and Nonaka et al.'s (1998) distinction between explicit and tacit knowledge. Explicit or codified knowledge refers to knowledge that is transmittable in formal, systematic language such as words and numbers. Tacit knowledge, on the other hand, has a personal quality, which makes it hard to formalize and communicate. Tacit knowledge is deeply rooted in practice, commitment and involvement in a specific context. Hence, it is difficult to externalize and to capitalize on, unless it is indirectly made accessible through a particular method or tool.

This distinction between explicit and tacit knowledge leads to three possible levels of knowledge exchange between a manufacturer and its customers. As depicted in Figure 1, manufacturers and customers might want to share knowledge on an explicit level with the help of particular virtual tools and methods. Second, some of these methods might also help customers to externalize tacitly held knowledge. Customers, for instance, might not be aware of, or able to express their needs and wants with regard to new product design. Virtual applications can simulate several different designs or even help customers to design their own product according to their needs. Third, manufacturer and customer might even exchange tacit knowledge, for instance in a two day workshop, and both gain new expertise.

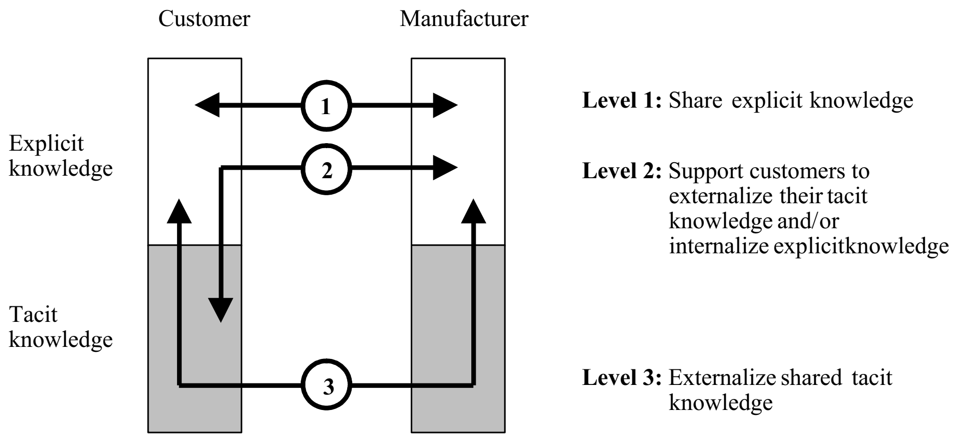

Fig. 1. The three levels of knowledge transfer, adapted from Nonaka et al. (1998)

Particularly at the first stages of NPD when ideas have to be generated and translated into new technical solutions, the NPD team particularly needs information on how to translate customer aspirations, needs and wants into technical product features. According to Cooper (2000), these stages in a NPD process are the most decisive ones. First, translating ideas, aspirations and wants into product features gives room to several misunderstandings between manufacturer and customer. Second, the consequences of such an unsuccessful translation could be devastating as the design team might develop costly high-tech solutions, which in the end do not fit the demand of the market. As much of the knowledge needed from the customers is embedded in everyday practice and thus tacit, manufacturers must find appropriate ways to support customers to externalize tacit knowledge. One very common solution to this problem is face-to-face cooperation between manufacturers and their customers. However, it is difficult to find customers who can afford the time and are motivated to cooperate. Furthermore, close cooperation is costly and time-consuming. Tools of virtual customer integration provide cost-effective and time-saving solutions to this problem. In the following, we will provide a classification of several virtual methods and tools according to their suitability for different stages in the NPD process, and the level of knowledge to be exchanged.

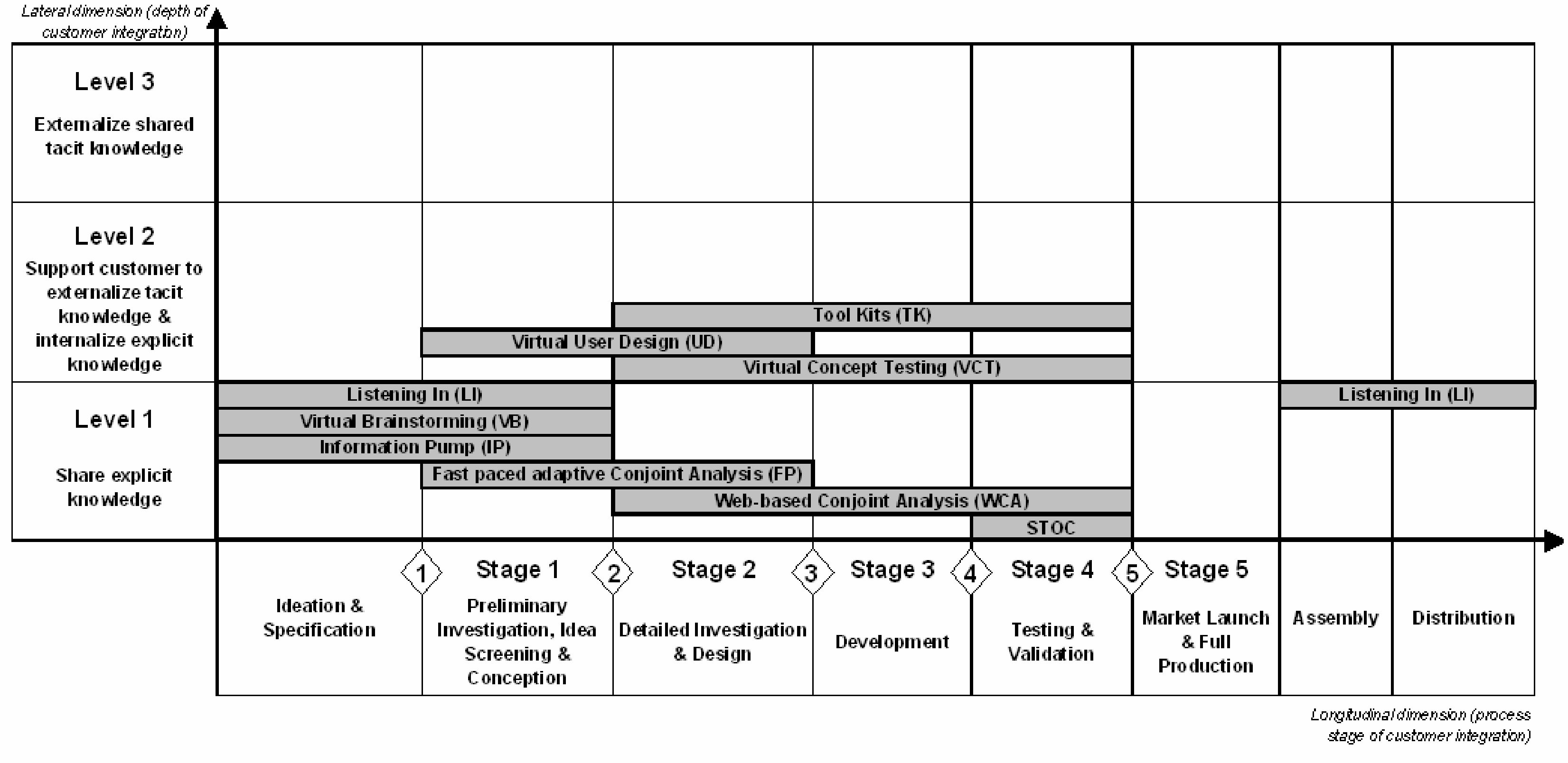

Fig. 2. Classification of Virtual Customer Integration methods along the industrial NPD process

Figure 2 exhibits the stages in the product development process on the longitudinal axis, and the according level of knowledge exchange on the lateral axis. It shows how several virtual customer integration methods may be classified accordingly. Several clusters of methods and tools can be identified. Listening in, Virtual Brainstorming, the Information Pump, and Fast Paced Adaptive Conjoint Analysis offer feasible methods for sharing explicit knowledge at the first NPD stages of "Ideation & Specification" and "Preliminary Investigation, Idea Screening & Conception". In addition, Fast Paced Adaptive and Web-based Conjoint Analysis constitute interesting alternatives in sharing explicit knowledge like customers' trade-offs among features at the stages of "Detailed Investigation & Design", "Development" and "Testing & Validation". Particularly with regard to the speed of data collection and cost-saving aspects, these methods outperform conventional methods of Conjoint Analysis. Figure 2 shows that Tool kits, User Design, and Virtual Concept Testing represent promising new methods for supporting customers to externalize tacit knowledge at the stages of "Detailed Investigation & Design" and "Development". Herein lies the most valuable contribution of virtual methods of customer integration. Whereas conventional methods of consumer research either provide only explicit knowledge, or demand highly committed partners, time and money, as for instance the lead user method (von Hippel, 1986), virtual methods enable customers to demonstrate what they want instead of having them formulate and transfer their tacit knowledge into abstract concepts or utterances. With Virtual User Design, for instance, engineers can build together their favorite version of a new technical device. However, when tacit knowledge is to be shared between business partners, face-to-face methods still outperform their online counterparts (Hemetsberger and Godula, 2007). One of the main reasons for the lack of appropriate virtual tools for sharing tacit knowledge is that most of them are currently administered online. However, when used in face-to-face cooperation for demonstration and testing purposes, virtual tools might as well be used within a community of practice approach (Wenger, 1998) and help sharing tacitly held knowledge among manufacturers and customers.

In order to be able to decide on the most efficient and effective method of virtual customer integration for a particular company, establishing selection criteria seems appropriate. We argue that these criteria must be adapted to a company's innovation strategy in order to provide useful information, and ensure effectiveness and efficiency. In the next section we will provide a summary of possible selection criteria and give an example of how they can be elaborated and adapted to the particular needs of a high-tech global industrial player.

Requirements for Customer Integration in a Global Industrial Business – a Case Study

Practitioners should be alert that the quality of marketing data is vital for the success of their NPD processes. However, the exact requirements vary from project to project and depend on the overall company context. By creating particular requirements for Virtual Customer Integration, which are receptive to strategic necessities of a company, delicate pitfalls may be avoided, and valuable knowledge resources exploited. In the following, we will describe them in detail and provide an anonymized business example from the electronic industry. We will use the made-up word ELECTRON for the company throughout the paper.

Strategic positioning in an international niche market

ELECTRON is a global player in a high-tech, and very specialized niche market. Its technical devices are complex and their use demand electronic engineering expertise. From ELECTRON's position in the market and its strategic positioning statement, several requirements for customer integration can be derived. Their positioning statement reads as follows: "We provide means for our customers to ensure proper functioning of XXX and their components. With our products and services we set new standards in primary and secondary testing technology for the worldwide XXX industry by using innovative technologies." Furthermore, a precise and distinctive position is envisioned: "Best perceived customer value through clear commitment to innovation, supreme technical application know-how and extraordinary customer service." This positioning suggests that virtual customer integration methods and tools should be capable of displaying complex products and present complex interrelations. Hence, they should allow for different modalities, like physical, verbal, and visual stimuli.

In addition, the following benefits deriving from ELECTRON's unique company culture should be considered and communicated: "Highest "fun factor" for ELECTRON's partners through its friendly, honest, dynamic, positive, open-minded and colorful (literally and figuratively) company culture". This would call for methods, which are perceived that way, which are colorful, open-minded thus which are able to transport the company position and culture. However ELECTRON's relatively small size, of approximately 150 employees, and a limited marketing research budget and capabilities impose restrictions with regard to market research expenditure and internal feasibility. Data should be easy to collect, easy to handle, support internal knowledge and support internal processes. Finally, the nature of industrial markets as well as the company's degree of internationalization, add further specific peculiarities to ELECTRON's customer integration requirements. Purchasing decisions, for instance are made in buying centers. Therefore, control over the person who responds is important. Furthermore, as customers are working out of office and usually are preoccupied with other priorities, data collection also should be flexible, but still be interesting enough to prevent from necessitating incentives. In concluding, adequate customer integration methods should score high (respectively low on negative attributes e.g. costs) on the following requirements:

- Ability to handle complexity
- Ability to transport position/image
- Ability to use physical stimuli
- Ability to use verbal stimuli
- Ability to use visual or virtual stimuli
- Flexibility/Interactivity of data collection
- Internal feasibility (know-how, software, etc.)
- Monetary cost (-)
- Necessity of (extrinsic) incentives (-)
- Requirements towards exchange partner (know-how, IT capabilities, etc.) (-)
- Control over who responses (i.e. roles within the buying center)

Process-oriented organizational structure

The organizational structure of the company necessitates further distinctive requirements concerning customer integration. ELECTRON has implemented a process-oriented organizational structure, which has to be considered in customer integration. Its main processes include order winning, product management and technology services, and product renewing processes. Customer integration methods should support these processes and be able to disperse knowledge throughout the organizational structure. Furthermore, Regional Sales Management (RSM), Sales Engineers (SE), Product Managers (PM), and individual project leaders should be able to contribute, for instance in terms of survey design and data collection or the evaluation and internal spreading of customer market knowledge, as well as benefit from this knowledge. In addition, synergy effects for the sub-process "Marketing Communications and Services" (MCS) should be realized. This leads to the further requirements:

- Practicability for main business processes (PM, RSM & SE, etc.)
- Support of internal knowledge dispersion
- Synergy effects for external MCS requests

Gate Criteria within the established Stage-Gate process

Within the established Stage-Gate process at ELECTRON, the market knowledge related criteria for decision making at gates 2 and 3 are primarily whether a market need exists, what the possible customer benefits are, market demands, value for money, and market attractiveness. Although the precise requirements for customer integration will vary with specific projects, commonly required criteria to ensure fast, in-depth probing of customer wants and needs in ELECTRON's international markets can be derived. Here, general criteria of market research quality are applicable, such as the quantity of knowledge which can be accumulated, speed of data gathering, response rates, and control of measurement errors. In addition, as the company is innovation leader in the market, competitive security issues have to be considered and add further requirements to the list. Two further qualitative attributes of customer integration processes can be added from Engelhardt and Freiling (1995): interval of integration and duration of integration. By scoring high on these requirements, customer integration methods are expected to deliver higher quality of knowledge transfer.

- Quantity of knowledge transfer
- Probable response rate
- Control of interviewer effects
- Control of the data collection environment
- Speed of knowledge transfer
- Speed of data analysis and evaluation
- Speed of knowledge transfer/response
- Speed of prep/survey development
- Confidentiality of knowledge transfer
- Detail of confidential internal knowledge (-)
- Duplicability of (confidential) knowledge (-)
- Accuracy on sensitive questions
- Possible legal protection
- Possible intervals of integration
- Duration of integration

Established customer contact points

The company has established various customer contact points and channels of customer knowledge transfer. They can be classified into concentrated or dispersed ones to denote whether several customers can be reached at the same place, or not. Concentrated contact points, for instance, are user meetings, trade and road shows, conferences, or customer visits at the development center of the company. Dispersed contact points are direct contacts of single customers, visits, direct mails, and services. Ideally customer integration methods should be applicable at all points without work-intensive adaptation. Two more requirements can be added, accordingly:

- Applicability for concentrated contact points
- Applicability for dispersed contact points

Conclusions and evaluation of VCI methods according to ELECTRON's requirements

As Table 1 shows, company-specific requirements lead to a detailed evaluation of Virtual Customer Integration methods, which best fit the needs of ELECTRON. While these requirements must be carefully elaborated by a strategy team, evaluation techniques may vary. In this case, a three point measure was considered as sufficiently accurate. Other companies might prefer to use a 5-point scale, and even apply importance weights to the five classes of criteria. In the case of ELECTRON, the NPD team decided not to weigh the criteria, because relative importance weighs were very difficult to argue. Deciding upon the relative performance of a specific Virtual Customer Integration Method on a particular criterion is subjected to long negotiation processes. Measures, therefore, are not accurate but should rather be thought of as an important team process that contributes to a common understanding of strategically important issues in new product development. 'x's were used for ranking in order to signal the inaccurateness, and qualitative nature of the measures. 'x's, then, were simply counted and added up. Sums of 'x's on negative criteria, as for instance monetary costs of implementation, were deduced.

Table 1

Classification and evaluation of Virtual Customer Integration methods based on company-specific requirements for the NPD process

xxx = high applicability xx = medium applicability x = weak applicability blank = not applicable	Information Pump IP	Listening In LI	Tool Kits TK	User Design UD	Virtual Brain-storming VB	Virtual Con-cept Testing VCT	Web-based Conjoint Analysis WCA	Fast-Paced Adaptive Conjoint Analysis FP ACA
Nature of knowledge transfer								
Ability to handle complexity	xx	xx	xxx	xxx	x	xx	x	x
Ability to use physical stimuli								
Ability to use visual or virtual stimuli	xxx	xxx	xxx	xxx	xx	xxx	xxx	xxx
Ability to use verbal stimuli	x		x	xx	xx	xx		
Flexibility/Interactivity of data collection	xx	xxx	xxx	xxx	xxx	x		xx
Possible intervals of integration	x	xxx	xx	xx	x	x	x	x
Duration of integration	xx	xx	xxx	xx	xx	xx	x	x
Quantity of knowledge transfer	x	xxx	xx	xxx	x	xxx	xxx	xxx
Probable response rate	xx	xxx		xx	xx	xx	xx	xx
Σ	14	19	17	20	14	16	11	13
Error control								
Control of interviewer effects	x	xx	xxx	xxx	xx	xxx	xxx	xxx
Control of the data collection environment	xxx							
Control over who responses	xxx		x	xx	xx	xx	xx	xx
Σ	7	2	4	5	4	5	5	5
Feasibility/Costs								
Ability to transport position/image	xx	xxx	xxx	xxx	xx	xxx	xx	xx
Practicability for Marketing Processes	x	x		xxx	xx	xxx	xx	xx
Internal feasibility (know-how, software, etc.)	x	x		xx	xx	xx	x	x
Support of internal knowledge dispersion	x			xx	xx	x		
Applicability for concentrated contact points	xxx			x		x	x	x
Applicability for dispersed contact points		xxx	xxx	xxx	xxx	xxx	xxx	xxx
Synergy effects for external MCS requests	xx	xx	xxx	xxx	xx	xxx	xxx	xxx
Σ positive	10	10	9	17	13	16	12	12
Requirements towards exchange partner (-)	x	xx	xxx	xx	x	xx	xx	xx
Monetary cost (-)	xx	xxx	xxx	xx	xx	xx	xx	xx
Necessity of (extrinsic) incentives (-)	xx			x	xx	xxx	xxx	xxx
Σ negative	-5	-5	-6	-5	-5	-7	-7	-7
Σ positive - negative	5	5	3	12	8	9	5	5
Speed								
Speed of data analysis and evaluation	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Speed of knowledge transfer/response	xxx	xxx	x	xxx	xxx	xxx	xxx	xxx
Speed of prep/survey development	x	x	x	xx	xx	xx	xx	xx
Σ	7	7	5	8	8	8	8	8
Confidentiality								
Accuracy on sensitive questions	xxx	xx	xxx	xx	xx	x	xx	xx
Possible legal protection	xxx		xxx	xx	xx	xx	xx	xx
Σ positive	6	2	6	4	4	3	4	4
Detail of confidential internal knowledge (-)	xx		xx	xxx	x	xx	x	x
Duplicability of (confidential) knowledge (-)	x	xxx	xxx	xxx	x	xxx	xxx	xxx
Σ negative	-3	-3	-5	-6	-2	-5	-4	-4
Σ positive - negative	3	-1	1	-2	2	-2	0	0
Σ	**36**	32	30	**43**	**36**	**36**	29	31

According to the detailed evaluation in Table 1, Virtual Concept Testing, Virtual Brainstorming, and the Information Pump scored second, but were identified as very capable methods for successfully integrating customers into the early ideation and preliminary stages, and prototyping stage of ELECTRON's NPD process, respectively. User Design seems of particular interest and immediate applicability for various stages in the NPD process of ELECTRON. Virtual User Design offers exactly what the company was looking for: fast and quantitative feedback on complex product concepts at early stages of the product development process. For ELECTRON as a high-tech, hard- and software company it should be relatively easy to develop configurators within a short time and under low cost. Particularly new product concepts at early project stages could benefit substantially from this engaging new approach and underline ELECTRON's innovative and "colorful" image. However, the speed effects on research and knowledge transfer will not be realized until a constant online network of target group users is established. It is therefore also recommended to establish a growing online community and user panel recruited from a worldwide customer base. Similarly, Virtual Concept Testing could offer comparable benefits for more developed concepts at later stages of the NPD process. Market acceptance and sales forecasts could then be predicted much earlier and with a far more solid data base.

Based on Figure 2 and Table 1, all Virtual Customer Integration Methods can also be ranked according to the appropriateness for different stages in the NPD process. Based on Table 2, depicted below, ELECTRON could actually develop a company-specific portfolio of methods which perfectly suits their NPD strategy. It is important to note, however, that strategic objectives are subject to changes over time. Hence, adaptations are necessary from time to time. Furthermore, as these measures and rankings are idiosyncratic, criteria, evaluations, and rankings must be developed and adapted according to the specific strategic objectives of a company.

Table 2

Ranking of Virtual Customer Integration methods per stage in the NPD process, based on company-specific requirements

Ranks	Ideation & Specification	Stage 1 Preliminary Investigation, Idea Screening & Conception	Stage 2 Detailed Investigation & Design	Stage 3 Development	Stage 4 Testing & Validation
Rank 1	Listening In Virtual Brainstorming Information Pump	User Design	User Design	Virtual Concept Testing	Virtual Concept Testing
Rank 2	___	Listening In Virtual Brainstorming Information Pump	Virtual Concept Testing	Toolkits Web-based CA	Toolkits Web-based CA
Rank 3	___	Fast paced adaptive CA	Fast paced adaptive CA	___	___
Rank 4	___	___	Toolkits Web-based CA	___	___

As a consequence of this analysis a Virtual User Design pilot was developed and tested in the market. For competitive security reasons we cannot report on the implementation of the tool however we can draw some implications from the first experiences of the company. The subsequent discussion of the advantages and drawbacks of virtual customer integration is based on literature as well as the company's internal post-project review and qualitative evaluation of this first User Design pilot.

Advantages and Drawbacks of Virtual Customer Integration – Learning from Experience

Virtual customer integration can yield huge gains with regard to customer knowledge, decreased costs and time-to-market. However, some particular considerations have to be taken into account in order to leverage these effects. Technical issues and computer literacy are to be thought of as well as sampling issues and possible measurement errors. In addition to this, there are also more specific issues regarding industrial markets which have to be considered. Among these issues is customer participation motivation, which suffers from shortage of time of customers and multiple requests from other manufacturers. Secondly, industrial companies are also faced with the potential hazard of uncovering secret information. Finally, industrial companies also have to clarify the role of sales force assistance with regard to computer-assisted research.

A delicate issue in online surveying is that inappropriate or excessive process transparency may be detrimental to the firm's market competitiveness since it may forewarn competitors about new product developments (Nambisan, 2002). Hence, managers have to carefully define the level of transparency and security in Virtual Customer Integration, as well as the type of customers with whom they would like to share information. Researchers agree that, when conducted with caution and according safety arrangements, these new online methods should not impose greater risks than written or verbal marketing research.

In industrial business, marketing success is built on trust-based relationships with clients (Urban et al., 2000). Virtual Customer Integration methods offer sustainable benefits as a customer relationship tool and thereby help to strengthen the positive customer-oriented image of sales engineers and the manufacturer's company alike. For example an engaging design task or an interesting question that allows respondents to express their opinions in their own way instead of just picking from item lists can strengthen business relationships.

Nambisan (2002) claims that customer participation in virtual product development and support is almost always a voluntary effort. He identifies three types of benefits which customers could realize by participating in NPD: product or service-related benefits (active involvement to ensure product quality, possibility to incorporate most wanted features, gain knowledge and support manufacturer's efforts, satisfy both creative urges and technology-related curiosity, et cetera), benefits derived from membership in the customer or user community, and medium-related benefits that customers may derive from interaction with a compelling online environment. Furthermore, the challenge of mastering design tasks, and gaining recognition for successful co-design are potent motivators for participation. Nonetheless, ELECTRON's experiences in the B2B context are mixed. Non-response is mainly a problem of time, and also due to a lack of sales force assistance. There is no doubt that sales force is the most important and closest link to the broad customer base in industrial business, therefore they have to be integrated in the design and application of VCI tools. Hence, customer integration is not only a task of NPD project managers, but a company-wide joint enterprise of strategic importance.

Recapitulating, as with all computer assisted survey approaches, virtual customer integration methods offer increased cost effectiveness, decrease in coding errors and speed. In the case of online application, results can be immediately transferred to the NPD researcher for administration or analysis. Furthermore, Srinivasan et al. (1997) argued that customer-ready prototypes provide customers with the additional, non-attribute-based information with which knowledge can be leveraged, which otherwise would remain tacit. In addition to bringing more customer input to the NPD process, virtual customer methods might also encourage a greater number of concepts to be explored and tested with customers before "freezing" the design of a new product. Another advantage is, that web-based virtual customer methods can be completed by respondents remotely, thus covering a global customer base. The mass market can be included in concept testing, and more in-depth customer relationships might develop. Manufacturers as well as customers will profit from more efficient and accurate new product development and industrial design, decreased costs and time-to-market, and hopefully also from a more enjoyable and fun way to cooperate.

References

1. Biyalagorsky, Eyal, William Boulding and Richard Staelin (2006), "Stuck in the Past: Why Managers Persist with New Product Failures", *Journal of Marketing*, 70 (April), 108-121.
2. Cooper, Robert G. (2000), "Doing it Right – Winning with New Products", *Ivey Business Journal*, July-August 2000, 54-60.

3. Cooper, Robert G. (2001), *Winning at New Products: Accelerating the Process from Idea to Launch*, 3rd edition, NY: Perseus Books Publishing.
4. Dahan, Ely and Srinivasan, V. (2000), "The Predictive Power of Internet-Based Product Concept Testing Using Visual Depiction and Animation", *Journal of Product Innovation Management*, 17 (2), 99-109.
5. Dahan, Ely and John R. Hauser (2002a), "The Virtual Customer", *Journal of Product Innovation Management*, 19 (5), 332-353.
6. Dahan, Ely and John R. Hauser (2002b), "Product Development – Managing a Dispersed Process", in Weitz B. and Wensley R. (eds.), *The Handbook of Marketing*, London, UK: Sage Publications.
7. Engelhardt, Werner H. and Jörg Freiling (1995), "Integrativität als Brücke zwischen Einzeltransaktion und Geschäftsbeziehung," *Marketing ZFP*, 17 (1), 37-43.
8. Hemetsberger, Andrea and Georg Godula (2007), "Virtual Customer Integration in New Product Development in Industrial Markets: The QLL Framework", *Journal of Business-to-Business Marketing,* 14 (2), 1-40.
9. Ibeh, Kevin, Jürgen K.U. Brock and Josephine Y. Zhou (2004), "The Drop and Collect Survey among Industrial Populations: Theory and Empirical Evidence", *Industrial Marketing Management*, 33 (2), 155-165.
10. Nambisan, Satish (2002), "Designing Virtual Customer Environments for New Product Development: Toward a Theory", *Academy of Management Review*, 27 (3), 392-413.
11. Nonaka, Ikujiro (1994), "A Dynamic Theory of Organizational Knowledge Creation", *Organization Science*, 5 (1), 14-37.
12. Nonaka, Ikujiro, Patrick Reinmoller and Dai Senoo (1998), "The ART of Knowledge – Systems to Capitalize on Market Knowledge", *European Management Journal*, 16 (6), 673-684.
13. Ottosson, Stig (2002), "Virtual Reality in the Product Development Process", *Journal of Engineering Design*, 13 (2), 159-172.
14. Paustian, Chuck (2001), "Better Products through Virtual Customers", *MIT Sloan Management Review*, 42 (3), 14-15.
15. Prahalad, C.K. and Venkatram Rameswamy (2000), "Co-opting Customer Competence", *Harvard Business Review*, (January-February), 79-87.
16. Prelec, David (2001), "Readings Packet on the Information Pump", *MIT Sloan School of Management*, http://mitsloan.mit.edu/vc/papers/IPPacket.pdf, accessed August 2003.
17. Rautenstrauch, Thomas (2002), "The Virtual Corporation: a strategic option for Small and Medium sized Enterprises (SMEs)", *Proceedings of Association for Small Business and Entrepreneurship*, St. Louis, 18-23.
18. Srinivasan, V., William S. Lovejoy and David Beach (1997), "Integrated Product Design for Marketability and Manufacturing", *Journal of Marketing Research*, 34 (1), 154-163.
19. Thomke, Stefan and Eric von Hippel (2002), "Customers as Innovators: A New Way to Create Value", *Harvard Business Review*, 80 (4), 74-81.
20. Toubia, Olivier, Duncan I. Simester, John R. Hauser, Ely Dahan (2003) "Application and Test of Web-based Adaptive Polyhedral Conjoint Analysis", *Marketing Science*, 22 (3), 273-303.
21. Toubia, Olivier, John R. Hauser and Duncan Simester (2004), "Polyhedral Methods for Adaptive Choice-Based Conjoint Analysis", *Journal of Marketing Research*, 41 (1), 116-131.
22. Urban, Glenn L., Fareena Sultan and William J. Qualls, W.J. (2000), "Placing trust at the center of your Internet strategy", *Sloan Management Review*, 42 (1) (Fall), 39-48.
23. Urban, Glenn L. and John R. Hauser (2004), ""Listening In" to Find and Explore New Combinations of Customer Needs", *Journal of Marketing*, 68 (April), 72-87.
24. Von Hippel, Eric (1986), "Lead Users: A Source of Novel Product Concepts", *Management Science*, 32 (7) July, 791-805.
25. Von Hippel, Eric (2001), "Perspective: User Toolkits for Innovation", *Journal of Product Innovation Management*, 18 (4), 247-257.
26. Von Hippel, Eric and Ralph Katz (2002), "Shifting Innovation to Users Via Toolkits", *Management Science*, 48 (7), July, 821-833.
27. Wenger, Etienne C. (1998), *Communities of Practice: Learning, Meaning, and Identity*, Cambridge: Cambridge University Press.