Entrepreneurial Opportunities with Toolkits for User Innovation and Design

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Abstract:

This article discusses a promising entrepreneurial opportunity: toolkits for user innovation and design. This innovative method of new product development (NDP) shifts the design task to the customer by making use of recent developments in IT, media, and production technologies. The customer, in turn, gets a product that perfectly suits his/her needs. This new approach challenges the time-consuming and costly traditional approach of screening the market for new product needs which are then converted into novel or adapted products.

Our analysis shows that there are basically two different ways to exploit this opportunity. First, by means of high-end toolkits, radically new products can be gathered. Second, low-end toolkits can be used efficiently to further exploit seemingly mature markets. We argue that in particular startups might be in the best position to take advantage of these entrepreneurial opportunities. They can either enter the arena of manufacturers or they can act as new intermediaries between manufacturers and users.

Introduction

New media and in particular the World Wide Web have brought about a spate of new business ideas.[1]

Above all, these new technologies have transformed the way in which people communicate, the speed and quality with which decentralized interaction takes place, and the way in which business partners and customers can be integrated into various stages of a firm's value chain. Porter (2001) argues that the Internet is nothing but an enabling technology that can be used, wisely or unwisely, in almost any industry and as part of almost any strategy. Entrepreneurship in this context takes on the role of seeking out and exploiting new opportunities which have the potential to be turned into profitable businesses – be it by established firms or new ventures (Shane and Venkataraman 2000).

The aim of this article is to discuss one new business opportunity arising from the emergence of new media: Toolkits for User Innovation and Design. In a nutshell, toolkits are a new way of facilitating new product development (NPD). Instead of the time-consuming and costly approach of screening the market for new product needs, which are then converted into novel or adapted products, toolkits allow producers to outsource certain design tasks to customers. In this way, products can be developed much more quickly and at lower cost. Customers, in turn, get exactly what they want – a custom product that suits their individual needs precisely. This approach allows manufacturers to serve ‘markets of one‘ and to handle large and small customers in the same way. This new approach has only been adopted in few industries so far. However, it constitutes a promising opportunity for entrepreneurs. On the one hand, the customer-as-innovator approach may yield radical new innovations, which in turn can create new markets and even new industries. On the other hand, incremental innovations and product

adaptations by users can be used to further exploit seemingly mature markets in a profitable way. New companies may emerge and offer custom products based on toolkits themselves, but acting as intermediaries between manufacturers and customers might also be a winning strategy.

The paper is structured as follows: First, the importance of customer input for new product development is highlighted, after which new media tools that allow more reliable identification of user needs are presented. We argue that the traditional innovation process of generating new products still faces many problems despite these improvements. Next, a new way to tackle these issues is put forth: Toolkits for User Innovation and Design. Building on this, we identify and expound entrepreneurial opportunities derived from toolkits. Finally, we conclude with suggestions for further research.

Background: Recent Trends in NPD

New media – and in particular the emergence and diffusion of the internet – have added dramatic new capabilities to NPD. Prospective customers can now be integrated by means of new media tools into early stages of product development more easily, leading to a more accurate understanding of what customers need and want at a point when less time and money is at stake. The importance of customer input for new product development has been demonstrated extensively in the literature: Not listening to the customer's voice at all with regard to NPD might lead to expensive product failures such as Philips' CD-I, Apple's Newton and Sony's BetaMax, to name but a few examples (Rosen, Schroeder and Purinton 1998).[2] It is a common practice among manufacturers to gather data from representative users or customers from a respective target market and to use need information to generate ideas for

solutions leading to new products (e.g., Hamann 1996, Rangaswamy and Lilien 1997, Lonsdale, Noel and Stasch 1996). In order to minimize the risk of product failure, this need-related information from customers is integrated iteratively at many points in the NPD process, including the rapid evaluation of ideas early in the process, the identification of important ‘delighter‘ features as the product concept is refined, detailed measures of the importance of customer needs as the product is engineered, and accurate evaluations of prototypes as the product comes to pretest and test markets (e.g., Cusumano and Selby 1995, Dahan and Hauser 2001, Holmes 1999). Thus, after many time-consuming iterations between the customer and manufacturer, a new or adapted product is found – usually at high cost, and always involving the risk of being a flop.[3]

In addition to these traditional market research techniques for NPD, new media – and above all the new communication and information technologies of the World Wide Web – have enabled manufacturers to get a clearer picture of customers' needs and their expectations of new products. Dahan and Hauser (2001) present new web-based customer input methods, with each tool having its appropriate application in the various stages of the development process. Early in the process, for example, Fast Polyhedral Adaptive Conjoint Estimation based on algorithms and simulations can be used to find the most important product features quickly and with relatively few questions. Later in the design process, Virtual Concept Testing might be applied to identify the most promising concepts so that customer's choices can be converted into preferences (Dahan and Hauser 2001). Confronted with traditional market research in NPD, these new media tools are more efficient in terms of accuracy and cost. The risk of new product failures can be reduced significantly, as many more concepts can be tested and explored before the design of a new product is ‘frozen‘ (Dahan and Hauser 2001). Srinivasan, Lovejoy and Beach (1997) also underline the importance of in-depth concept testing for reliable and accurate product development in this stage of the process. In

summary, new media have contributed new methods to NPD which have proven valuable for identifying opportunities, improving the design and engineering of products, and testing ideas and concepts at a point in the process when less time and money is at risk (Dahan and Hauser 2001).

In spite of these new methods of customer input, there are several problems relevant to manufacturers in the NPD process. First, customer input is restricted to need-related information. Understanding customers' needs is, however, a costly, time-consuming, and inaccurate process for manufacturers (von Hippel and Katz 2002). As need-related information is very expensive to acquire and complex to transfer, customers might have problems giving the manufacturer a clear and complete picture of what they want. Furthermore, it is questionable whether they know exactly what they are looking for themselves (Thomke and von Hippel 2002). In addition, it is very difficult to translate need-related information into solution-related information, i.e., product development specifications (Urban and Hauser 1993).

Second, empirical studies have shown that ideas and subsequently products generated by traditionally used processes are rarely breakthroughs (Eliashberg, Lilien and Rao 1997). Von Hippel (1986) suggested that manufacturers can learn a lot more from the customer side in NPD than information about their needs alone, namely solution-related information which is responsive to unmet needs. It has been shown that radical innovations often come from users instead of manufacturers. Von Hippel (2002) gives an overview of the fields studied, ranging from computer innovations (Knight, 1963), petroleum processing (Enos, 1962), the semiconductor industry (von Hippel, 1977) to snowboarding and windsurfing (Shah, 2000). In addition, studies in various markets have revealed that a substantial number of customers reported having developed a new product for personal or in-house use, meaning that user

innovations are not a rare occurrence (von Hippel 2002). The innovativeness of users, their willingness to engage in problem solving and their ability to come up with their own solutions, has hardly been taken into consideration in traditional customer integration in NPD so far.

Third, the high costs of traditional techniques in the NPD process require a substantial volume of the new product's target market to be justified. However, the demand side of many markets is becoming more and more heterogeneous. Therefore, as several industries move toward serving ‘markets of one‘, the volume of homogeneous demand is shrinking dramatically, which encumbers traditional methods of understanding and responding to customer needs, particularly in terms of cost (Thomke and von Hippel 2002). In an empirical study of Apache's security software, Franke and von Hippel (2002) found that users in fact have very unique needs, leaving many customers dissatisfied with standard products. Users turned out to be willing to pay considerable sums for improvements which satisfy their individual needs.

In summary, it can be stated that new media and technologies have brought about new NPD methods to reveal customer needs for and evaluations of potential new products in a more efficient and reliable way. The original roots of the underlying problems, however, cannot be tackled straight away by doing things ‘better‘, but by seeing things ‘differently‘.

Toolkits for User Innovation and Design – a new opportunity

The coincidence of two technological developments opened the gateway for a radical new form of manufacturer/customer interaction with regard to NPD: toolkits for user innovation and design. The first trend is the development of new communication tools. New media tools,

in particular the internet, allow manufacturers to exchange information with individual customers rapidly and at low cost. With regard to the speed and potential intensity of interaction, it can almost be seen as a new form of communication. Subsequently, the product needs of each customer can be handled individually.[4]

The second important trend is the development of new production methods. Mass-customizing production methods have brought down the fixed costs of tooling in manufacturing dramatically (Zeid, McDonough and Kamarthi 2001). Furthermore, advances in flexible manufacturing systems and modularization have enabled individual goods to be produced, i.e., custom goods in single-unit quantities, with near mass-production efficiency (Tseng and Jiao 1996, Pine 1993).

These tendencies might subsequently lead to the decision to outsource the entire task of designing new products to the users. One spontaneous objection to this idea is that most users will not have the technical means to do so. In economic terms: The cost of design (which includes learning costs) exceeds the expected benefit.

Thus it would be a good idea for a manufacturer to equip its users with a toolkit which *enables* them to convert their ideas into products by providing the framework for (1) trial-and-error experimentation and (2) immediate feedback on the outcome.

This brings customer input in NPD to a new level. Instead of screening the target market for new product needs and desperately trying to translate this vague need information into product specifications, manufacturers can enable customers to act as innovators. This approach appears *possible* because users, as discussed above, are often highly innovative. It appears *reasonable* as it allows the customers' heterogeneous needs to be met more effectively (von Hippel 1999).

This pattern of outsourcing design tasks to users has been observed in some cutting-edge high-technology fields and has the potential to become a major trend in other industries as well. The custom computer chip industry started to apply this radical new approach back in the 1980s by allowing user engineers with ordinary skills to design ASICs (application-specific integrated circuits) entirely on their own with toolkits for user innovation (von Hippel 1998). This happened because the cost of not understanding user needs had reached high levels. If an error due to incomplete or inaccurate specification of user needs occurred late in the design process, corrections could cost months in delays and hundreds of thousands of dollars (von Hippel 1999). The market for such custom integrated circuits grew to more than $15 billion, development time was decreased by 2/3, and development costs were also reduced significantly (Thomke and von Hippel 2002). In addition to the computer chip industry, von Hippel and Katz (2002) also describe the first successful experiments with the toolkit approach in other B2B branches such as the specialty flavors industry (e.g., BBA, now International Flavors and Fragrances), the custom food products industry (Nestle Food Services), and the software industry (Stata Corporation).

Not all toolkits allow for radically new products. Specifically in consumer markets, there are also toolkits where the focus is not so much on radical innovations (as opposed to high-end toolkits) as on product adaptation and individualization. Users equipped with these low-end design toolkits build their own unique products, such as shoes, watches, or bags, which are then produced individually by the manufacturer. These design processes are likely to yield incremental innovations and functional improvements in standard products, and the improvements sometimes hold the potential of becoming standards themselves. Also, these low-end toolkits may well reap the social benefits of individualization (i.e., the demonstration of individuality) and the psychological benefits of being the creator of the product (‘pride of authorship‘) (Franke and Piller 2002a).

The phenomenon of shifting certain innovation tasks from the locus of the manufacturer to that of the customer by means of toolkits for user innovation was first theoretically analyzed by Eric von Hippel. He explains the outsourcing of innovation-related problem solving to users with the theory of sticky information. In brief, this theory states that need-related information in NPD is costly to acquire, transfer and use (von Hippel 1994). Discovering needs usually involves an iterative process of trial and error which is sometimes called learning by doing (e.g., Barron 1988, von Hippel and Tyre 1995, Rosenberg 1982). The idea behind the toolkit approach is to re-partition the product development task into sub-tasks, each primarily requiring information from either the user or the manufacturer. Instead of lengthy and costly ping-ponging between the manufacturer and user in the course of NPD, learning by doing and trial-and-error cycles are executed entirely by the user or the manufacturer for each sub-task (von Hippel and Katz 2002). Customers are willing to bring in their innovativeness and to take matters into their own hands, as they will benefit directly from the new product needed.[5] When the stickiness of relevant user information is high, the customer-as-innovator approach may lead to more rapid and effective product development and to higher product satisfaction. Hence the problem of users knowing what they need but not being able to describe or encode their needs precisely, and/or the problem that they themselves do not know what the ‘right‘ solution is prior to trial-and-error experimentation, can be bypassed by means of toolkits (von Hippel 1998). Manufacturers save time and money by outsourcing key need-related design and development activities, they are able to handle large and small customers in the same way, and product failures can be avoided.

In his exploratory studies, von Hippel found that successful toolkits contain several functions (von Hippel 1999). First, he recommends enabling complete trial-and-error designs cycles in order to allow efficient learning by doing (von Hippel and Katz 2002). The entire iterative

design process, including testing, evaluation and any necessary improvements, can then be carried out by the user. Second, successful toolkits offer an appropriate solution space.

In this context, 'appropriate' means that sufficient freedom is allowed for creativity and specific design needs (without exceeding the manufacturer's production capabilities). For example, custom integrated circuit manufacturers offer a huge solution space in terms of interconnected logical elements, although limits with respect to chip size and other properties cannot be overcome by existing production settings (von Hippel and Katz 2002). Next, in order to minimize customer effort, successful toolkits allow users to work in their own design 'language'. Furthermore, users should be provided with module libraries, because their design will rarely be novel in all parts of the product and their creative work can be focused on certain aspects. Less innovative users will confine themselves to small improvements in the standards offered, while innovative users can build new products from scratch.

Research on toolkits for user design and innovation is still in its early stages. The conceptualization of this phenomenon and the exploration of possibilities, limitations, and the underlying theoretical patterns of these new instruments only constitutes an initial step. A recent literature overview by Franke and Piller (2002a) reveals that although there are many research articles on technical aspects of toolkits and the production environment – the production side of the phenomenon (e.g. Anderson 1997, Bourke 2000, McHugh 1996) – many questions concerning the *design* side of individualization and innovation still remain unanswered (von Hippel and Katz 2002, Thomke and von Hippel 2002). For example, there is hardly any research on the question of how users interact with such toolkits and how the toolkit should be designed as a result.

Exploiting the Opportunities Offered by Toolkits for User Innovation and Design

In this section, we discuss how and by whom the opportunities presented by toolkits can be converted into profitable business. In general, there are various modes of exploitation, and both new ventures and existing firms can assume the role of the entrepreneur who exploits the opportunity.[6]

Before turning to the discussion, we have to concede that toolkits might not be suitable for all industries, all manufacturers, or all types of customers right away. Thomke and von Hippel (2002) expect the customer-as-innovator approach to take off in response to three major industry signs: First, market segments will decrease while customer demand gets more and more heterogeneous. The costs of responding to the customer's unique needs can not easily be passed on down the value chain, namely to the customer. Second, customer loyalty will start to erode, as many iterations in satisfying customer's needs are required. On the one hand, manufacturers do respond too slowly or even incorrectly to customer needs, and on the other hand the individual needs of small customers can not be satisfied at all. Third, manufacturers already use a high degree of computerization in internal product development, and the production process is capable of producing custom products.

Modes of Exploitation

Modes of exploiting the toolkit approach depend directly on what the toolkit allows the user to do: we therefore distinguish between high-end toolkits (offering a huge solution space to users) and low-end toolkits (offering only a small design freedom).

a) High-end toolkits as a source of radical innovations

High-end toolkits offer a theoretically unlimited solution space within the production capabilities of the manufacturer. They enable creative new solutions to old problems as well as the detection (and solution) of new problems. Thus their outcome can be new functions and even completely new products.

As stated above, studies in the field of user innovation have shown that many users in various markets reported having developed or significantly modified a product for their personal or in-house use (von Hippel 2002). Obviously, their needs are not satisfied by standard products. Manufacturers who hunt for these innovations – e.g., by the lead-user method – often find that these ideas have greater commercial potential than other new products. A recent performance assessment of the lead user concept in NPD at 3M Corporation revealed that the average annual sales of products generated by lead users were projected to be 8 times higher than forecast sales for 'traditional' projects. Furthermore, each funded lead user project should yield a major new product line, thus constituting real a breakthrough (Lilien et al. 2002).

The idea of toolkits is to turn the 'hunter' into a 'planter'. Instead of hunting for this kind of lead user, high-end toolkits can be used to 'grow' a firm's own innovators. A good example of such a strategy can be found in Stata, a company which offers highly advanced and innovative statistical analysis software. The innovativeness of the software is achieved by the systematic utilization of the users' innovativeness. Stata come in two forms: a standard software package and a toolkit in the form of a simple programming language. Users who wish to compute new statistical procedures with software (and have a minimum level of programming skills) are thus enabled to develop new modules that can be run by Stata. If these modules turn out to be error-free and are considered to be of interest for other users, they are incorporated in the next standard software release (von Hippel and Katz 2002).

Many users indeed have good ideas but not the technical means to realize them in full, let alone to fine tune them in learning-by-doing activities. For example, a PC user might easily come up with the idea of an electronic pen instead of a computer mouse, which might allow more precise operation. Unless s/he is an electrical engineer, s/he will not have the skills to follow through with his idea.

The major benefit of toolkits lies in the fact that users equipped with them do not necessarily need the skills and equipment to convert their ideas into products. All they need is an innovative idea of how a specific need situation can be overcome and the ability to operate the toolkit. The drudgery of testing for feasibility and finally producing the product is handled by the toolkit and the manufacturer.

Although there are users who have the skills and/or equipment to complete the development process on their own, toolkit use might still be more efficient and may yield a substantial net benefit in comparison to the do-it-all-alone strategy. In addition, users who are only interested in inventing certain parts of an existing product can pick standard components from the module library and concentrate on what is crucial to them. Imagine a toolkit for computer games which permits users to create their own game or certain parts of an existing game. The game inventor can concentrate on what is most important: the content, i.e., the game itself.

Innovations derived from this type of toolkit could be marketed successfully to a broader target group. It has to be noted, however, that even high-end toolkits reach limits in terms of what they can do. For example, a toolkit for designing bicycles will not enable users to invent a new car. It might also limit the customer's freedom to certain parts of the underlying product, such as the wheels of the bicycle. Manufacturers might be forced to do so because of production limitations, as designs that go beyond what can be produced would require additional investments to manufacture the required product (von Hippel and Katz 2002).

b) Low-end toolkits for individualization

Another possible way to exploit toolkits is to allow incremental innovations, product adaptations and individualization. Not all users need radically new solutions. Learning the design language and devoting the time to deploying a high-end toolkit might involve an investment which does not pay off for the average user. For example, only users with a *very* high need for new statistical analyses are likely to have the incentive and the skills to invent a new statistics module in Stata.

Hence the major field of toolkit applications might be the (further) exploitation of existing markets through individualization. Franke and Reisinger (2002) found that current practice in market segmentation generally leads to high levels of total variance left as within-segment variation (on average over 50%). This means that a significant part of the market remains unserved in seemingly mature markets covered by a number of standards. Exploiting this 'dark side of the market' constitutes a new opportunity within existing markets: If a manufacturer manages to deliver the individualized solutions customers are looking for, s/he is likely to reap a premium for such offerings.

In an empirical study of Apache's security software, Franke and von Hippel (2002) show that users are willing to pay a considerable premium for a program that fully satisfies their (highly specific) needs (the premium they are willing to pay adds up to $700,000 for the sample of 137 users). Users who modified the product with the toolkit offered were significantly more satisfied than users who did not adapt the standard product to their needs. Franke and Piller (2002b) show that users who design their own watch are willing to pay almost double for their individual product than for a standard watch.

In general, price premiums which lie fallow in existing markets might be skimmed off successfully by toolkits for user innovation. As flexible manufacturing systems and mass-customizing production methods have enabled the production of individual goods, i.e., custom goods in single-unit quantities, with near mass-production efficiency (Tseng and Jiao 1996, Pine 1993), this opportunity might be very profitable.

It has to be noted, however, that customers also incur specific costs when designing products with toolkits: the one-time costs of obtaining the toolkit and the learning to use it, and the variable costs of actually designing products. Customers trade off the total cost in terms of the time and effort necessary to get exactly what they want with the benefit arising from the individual product created. They will only invest their design effort if the expected benefits exceed the costs (Franke and von Hippel 2002) – in relation to the benefits and costs of the standard products available. This again underlines the importance of user friendliness in the design of the toolkit itself, as it influences both benefits and costs. However, most so-called 'mass-customization sites' (for examples, see www.mass-customization.de) use toolkits which appear to be *very* simple. Here the role of the user is limited to choosing from a few lists of alternatives. It should be clear that this simplicity also limits the users' freedom in design and individualization, and their willingness to pay might reflect this. Therefore, we suggest employing toolkits which generally allow creative effort – even in low-involvement settings.

We reason that in light of basic industry characteristics such as the heterogeneity of needs and custom production possibilities, this approach will not only be limited to B2B markets but it will also be of particular interest in consumer markets. For example, producers of mobiles might allow its customers to design their personal cellular phones. Design freedom might be restricted to hardware, i.e., color, material, size, and weight or users are also given the tools to

adapt software elements to specific preferences. Examples of the latter would be a toolkit for ringer settings, information structure of the menu including short-cuts, or even games that could be created online (i.e., in JAWA), sent to friends, and played either online against others or after download on the user's mobile.[7] But not only durables such as watches, bags, shoes and mobiles can be adapted or individualized by toolkits; incremental innovations in drinks and food might also create benefits for customers. General Mills, for example, is planning to allow customers to create their own breakfast cereals. In the B2B arena, Nestle Food Services has already employed this strategy: They manufacture custom food products according to recipes received from the head chefs of major restaurants and take-out food chains. Due to the particular taste of ingredients and the different cooking conditions in the mass production equipment used in food factories, error-free translation and production of the recipe was simply impossible. The iterative process of finding the right custom food product to match the chef's recipe would take as long as 26 weeks. Employing a new toolkit of pre-component ingredients, chefs can now create the recipe using exactly those ingredients available to Nestle's production facilities. Differences are discovered by the user in a process of learning by doing, and trial-and-error adjustments then allow recipes to be reproduced immediately and precisely by Nestle's factories. Both Nestle and its customers were better off, as custom food development time came down to 3 weeks (von Hippel and Katz 2002).

Furthermore, the toolkit approach is also being applied to media services. The Wall Street Journal, for example, has started to offer individualized information services via the web (www.wsj.com). Under ‘Personal Journal’ the reader is given the ability to design his own newspaper: s/he can tailor news according to his needs and preferences by selecting and defining certain areas of interest (i.e., industries, companies, and topics). The benefit in this case arises from the service that the user saves time and effort as he gets a type of daily paper that precisely fits his requirements without having the need to search or browse for

information needed. This trend can be observed in many fields of new media where information providers offer personalized services complementary to the undifferentiated content. Examples range from journals, newspapers, and magazines (like the Frankfurter Allgemeine Zeitung – www.faz.net, or www.my-newspaper.com who offers personal design of content from many different international sources of information) to new media service providers like MyYahoo (www.yahoo.com).

In conclusion, this mode of exploiting the opportunities presented by toolkits appears to be particularly promising.

Likely Toolkit Entrepreneurs

So far, we have only addressed the question of how the opportunities offered by toolkits for user innovation and design can be exploited by manufacturers. A superficial conclusion would be that the 'customer as innovator and designer' approach might only be a promising tool for existing companies with a portfolio of standard products and with a stock of existing and prospective customers to reveal and realize new business opportunities.

However, toolkits not only constitute entrepreneurial opportunities for existing firms, but also – and in particular – for new ones. Established companies may even face severe problems in integrating the customer into the product development and design process. Outsourcing innovation and design tasks to users by means of toolkits, as Thomke and von Hippel (2002) argue, constitutes a radical change in a company's business model with consequences in strategy and competitive position which are not yet completely understood.

Established companies which consider revealing their solution-related capabilities to their customers may fear the loss of a vital resource. By outsourcing the design task to the general public and equipping any interested customer (or competitor) with the ability to create a new product, a company might lose not only intellectual property, which is usually protected and concealed, but also a part of its value chain. It is obvious that the implementation of a toolkit for user design and innovation would constitute a radical change in a company's business model. Empirical and theoretical insights have generally shown that such disruptive technologies which inevitably change the competitive position of companies are more likely to come from new players instead of traditional firms (Christensen 1997). Established market leaders are almost always too late in adopting these disruptive technologies. Christensen (1997) specifies several reasons for this problem, ranging from cultural and psychological factors (arrogance, bureaucracy, short-term thinking, etc.) to economic aspects (high fixed costs forcing companies to focus on large markets only, reluctance to turn past investments into sunk costs, etc.).

Another stumbling block for established companies is that the entire idea of outsourcing design tasks to users might be refused by management because a toolkit which allows users to create whatever they want – within the toolkit's solution space – also reduces the manufacturer's control over the outcome. The customers' self-designed products might come into conflict with a company's branding strategy and with its intended image. For example, imagine a BMW toolkit employed by users with the ‘wrong’ taste (in the eyes of BMW's marketing staff) to design a pink car with a huge yellow spoiler.

In addition, resistance to exploiting the opportunity of toolkits for user innovation and design might also arise on the micro level. Individual employees and entire departments may feel that their function is being challenged. Specifically, marketing and marketing research

departments may have to face the fact that collecting need-related information by means of costly market research, translating this information into design concepts and production specifications, and iterative acceptance tests (formerly the marketing department's domain) will no longer be necessary once the toolkit works well (Thomke and von Hippel 2002). From their perspective, it might seem sensible to fight off the toolkit approach with various arguments. We suggest that instead of such a defensive and conservative position it would be wiser to think of new functions within the toolkit paradigm. For example, a toolkit has to be developed first, then launched on the market and constantly improved, and information generated by log files also has to be analyzed, etc.

In conclusion, we can say that all these hampering forces lead to the presumption that new ventures might be in the best position to take advantage of this promising opportunity.[8]

New ventures might apply one of two possible strategies: (1) they can enter the arena of manufacturers or (2) they can act as new intermediaries between manufacturers and users.

The first strategy implies that a new venture will see the opportunity presented by toolkits as a means of establishing a market position in competition with existing firms. As the new venture does not have the problems and in-house resistance of established firms, it can easily start with toolkits as an integral part of its business model. If the toolkit works well and the customers accept this new form of interaction, the new firm will be in a comfortable position to draw market share from the former market leaders, who will then be under heavy pressure to react. Apache, for example, has used the toolkit approach in a special open-source software setting. It was able to take a share of 63% in the highly competitive web server software market, leaving established players like Microsoft behind (Netcraft 2002).

On the other hand, starting with complete manufacturing facilities might constitute an unrealistically high investment for a new venture which is constantly suffering from the liabilities of newness and smallness (Bruderl and Schussler 1990).

Therefore, it might be a good idea not to *compete* directly with existing firms, but to *complement* them. Start-ups might find their best position in establishing a new form of intermediary between manufacturers and customers. In this case, they would not need to develop production facilities themselves; instead, they could use the expertise of established manufacturers, which in turn would have the advantage of using the new opportunity without taking high risks. The new intermediary firm would act in its own name and adapt the toolkit to one (or several) established industry manufacturers of the product type in question, who could then produce custom products on their behalf.

This approach specifically makes sense in industries where manufacturers with a high degree of computerization and flexible manufacturing methods are able to 'rent out' parts of their production capacity. Entrepreneurs realizing one such window of opportunity for a certain product category or industry might also benefit from first-mover advantages: Von Hippel and Katz (2002) argue that being first in the market may give a manufacturer a competitive edge, as their user design language might become a standard in the marketplace. In the long run, producer-specific tool sets for a specific product category might give way to customer-specific toolkits. At this point, a parallel can be drawn to the industry evolution model proposed by Abernathy and Utterback (1988). Over time, one dominant design will survive and take the lead. This means that the winning toolkit intermediary would have the chance to obtain a monopoly position in which s/he sets the standard for the entire industry – with many economic advantages. This pattern was observed in the custom integrated circuit industry by von Hippel and Katz (2002).

It must not be forgotten that toolkits themselves also constitute a new market with tremendous growth potential. Companies which are willing to make use of the toolkit idea (be they new ventures or established companies) have no experience with the underlying toolkit. As the toolkit itself is the core communication and interaction tool (as described above), perceived user friendliness and handling will have a significant effect on the success of the underlying venture. Toolkits generally have to perform certain functions, and there are general patterns of user interaction with such toolkits. Therefore, the success factors for toolkits and for the implementation of the customer-as-innovator approach in general are not restricted to certain industries. Subsequently, experience gained in one business can be used successfully in another industry. Only few firms have specialized in developing user-friendly toolkits and related services to date. One example of an early entrepreneur in the toolkit market is Hyve, a company based in Germany, which began specializing in this line of business only two and a half years ago. They offer clients from various industries (e.g., Adidas, Audi, Siemens or Swarovski) a full-service package of virtual customer integration into product development and innovation (www.hyve.de). The market for toolkits is attractive, as it is likely to grow quickly and high prices – usually several hundred thousand dollars – can be charged for turn-key solutions.

Discussion

In this paper, we argue that the toolkit approach offers a variety of promising entrepreneurial opportunities. Thomke and von Hippel (2002) even argue that this kind of outsourcing holds the power to turn markets and entire industries upside down. High-end toolkits allow customers to contribute their innovativeness in a user-friendly manner, and revealed product

innovations might lead to new products for new markets. Low-end toolkits help entrepreneurs reach the ‘dark side’ of seemingly mature markets, which can be skimmed by providing perfect problem solutions in the form of incremental innovations, product adaptations and individualized products. These opportunities might be realized by established companies and new ventures. As discussed above, start-up companies appear to be in a good position to put this idea into practice successfully.

As this field of research is fairly new, it is worth noting that hardly any empirical data is available to support our conclusions at the moment. However, qualitative insights derived from several case studies have shown that the employment of toolkits requires a strong entrepreneurial will and is not without its risks. However, great success has also been reported.

Up to now, empirical insights into toolkit design have been driven by technology and primarily portrayed from an IT perspective. A quantitative investigation of toolkit use from the user's perspective is long overdue. By and large, the customer's perceptions, interaction patterns and levels of satisfaction – as well as problems with toolkit handling and the quantifiable value of individualized products in comparison to standard products – still constitute a ‘black box’ in research to date. In addition, the consequences for business models, strategies, and the development of entire industries have hardly been subjected to empirical analysis.

Therefore, a wide variety of studies will be necessary to explore this fascinating new opportunity offered by new media.

Endnotes

[1] This holds true despite the dramatic crash of the dot.com world. In the early days of internet hype, many illusionary ideas found their way into the markets without realistic feasibility studies. Theoretical explanations of such an overshoot can be drawn, for example, from Abernathy and Utterback (1988).

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[2] In particular, reasons for product failures range from excluding expert consumers from product testing (Schoormans, Ortt, de Bont 1995) to poor customer fit (Shanklin and Ryans 1984) and not understanding the implications of customer expectations (Teas 1994).

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[3] According to Crawford (1979), an average of 35% of new products fail. Cooper (1999) argues that the great majority of new products do not even make it to the market. Those which do make their way still face a failure rate of up to 90%, depending on the industry and the specific company.

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[4] Von Hippel (2002) gives an overview of the fields studied, ranging from computer innovations (Knight, 1963), petroleum processing (Enos, 1962), the semiconductor industry (von Hippel, 1977) to snowboarding and windsurfing (Shah, 2000).

[4] In addition, there are hardly any restrictions with regard to the quality of this information exchange: powerful server-based software, i.e., web-based and media rich computing including high-end virtual prototyping, can be made available to customers by broadband connections at ‘zero time’ (Dahan and Hauser 2001).

[5] In addition, there are hardly any restrictions with regard to the quality of this information exchange: powerful server-based software, i.e., web-based and media rich computing including high-end virtual prototyping, can be made available to customers by broadband connections at ‘zero time’ (Dahan and Hauser 2001).

[6] In economic terms: The cost of design (which includes learning costs) exceeds the expected benefit.

[8] A toolkit can be used by an endless number of prospective customers at the same time. As it can be provided via the Internet users can design prototypes from their homes, run simulations directly at their site, or submit the relevant product information at ‘zero time’ to the

manufacturer who can translate product specifications without further effort into real prototypes. The user in turn is able to test the real prototype and if necessary can make any corrections and further adjustments via the toolkit until a satisfactory product solution is found.

[5] Mansfield (1968) found that the greater the benefit a given user expects to obtain from a new product s/he needs, the greater his investment in obtaining a solution will be.

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[6] It is widely accepted that the field of entrepreneurship is not restricted to the process of establishing new organizations alone (Shane and Venkatamaran 2000, Venkatamaran 1997, Amit, Glosten, and Mueller 1993, and Casson 1982).

[9] It is widely accepted that the field of entrepreneurship is not restricted to the process of establishing new organizations alone (Shane and Venkatamaran 2000, Venkatamaran 1997, Amit, Glosten, and Mueller 1993, and Casson 1982).

[7] A study concerning the potentials of individualization of the mobile telecommunication industry is currently being conducted at the Kellogg School of Management and the Otto Beisheim Graduate School of Management (http://mba4csthesis.whu.edu).

[11] A study concerning the potentials of individualization of the mobile telecommunication industry is currently being conducted at the Kellogg School of Management and the Otto Beisheim Graduate School of Management (http://mba4csthesis.whu.edu).

[12] This trend can be observed in many fields of new media where information providers offer personalized services complementary to the undifferentiated content. Examples range from journals, newspapers, and magazines (like the Frankfurter Allgemeine Zeitung – www.faz.net, or www.my-newspaper.com who offers personal design of content from many different international sources of information) to new media service providers like MyYahoo (www.yahoo.com). It has to noted, however, that these toolkits in use are limited in terms of what they allow users to create and lack one or the other feature of successful toolkits described above.

[8] Strictly logically speaking, the conclusion that new ventures will take the opportunity of this new method as established companies face problems doing so can be criticized. It may theoretically be that new ventures face even bigger problems which we overlook at this point. It can be observed, however, that the majority of existing toolkits do come from smaller industry upstarts. For numerous examples see www.mass-customization.de, www.digichoice.com, or www.egotrend.de.

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