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Jeppesen, Lars Bo

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The implications of "user toolkits for innovation"

Lars Bo Jeppesen

Copenhagen Business School
Department of Industrial Economics and Strategy
Howitzvej 60,
DK-2000 Frederiksberg
Denmark
Tel. +45-3815 2948
lbj.ivs@cbs.dk

Centre for Economic and Business Research,
The Danish Ministry of Economic and Business Affairs,
Langelinie Allé 17,
DK-2100 Copenhagen Ø,
Denmark

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Abstract:

Leading firms have begun to offer "user toolkits for innovation". User toolkits are seen as a means to eliminate (costly) iterations of need-related-information between users and producers in the product development process because toolkits allow users to perform need-related aspects of product development themselves (von Hippel, 2001; Thomke and von Hippel, 2002; von Hippel and Katz, 2002).

In this paper we investigate the implications of increasing opportunities for consumer involvement (OCI) in the product development process. What happens when a firm throws over design tasks to consumers? We explore the issue by looking into the relation between user toolkits and firms' need to support their consumers.

A statistical analysis of the OCI-characteristics of 78 computer games products and the intensity of firm support to these products, shows that the higher the OCI, the more a firm will support its consumers. This finding suggests that a portion of the information costs saved (on a reduced number of information iterations between user and producers) may eventually re-emerge as costs in consumer support.

However, what is more important is to determine what the support rates are compensating for. Therefore we proceed to identify a number of important (interrelated) dimensions of the toolkit approach. Apart from the support dimension previously mentioned we find in addition two dimensions that may affect the effectiveness of the toolkit approach: 1) the size of solution space left open to consumers; 2) the pre-existing consumer capabilities for dealing with toolkit-technology.

We conclude by suggesting that interactive consumer learning will positively affect the toolkits approach. In a case, we study the importance of consumer-to-consumer interaction as a means of substituting firms support efforts and conclude that facilitation of such interaction can enhance the outcomes of the toolkit approach.

Keywords: *Innovation; User Toolkits; Consumer Support; Online Communities*

JEL code(s): L21; L23; O31; O32

1. Introduction

Successful product development deals effectively with information costs. A crucial consideration of conventional market research is concerned with how to economize on the acquisition of reliable need-related information that allows product developers to create exactly the products consumers want. Product developers, however, face the problem that need-related information is inherently ambiguous – consumers may not be able to articulate their needs clearly (von Hippel, 1986), or their needs may change as they proceed to use a given product (Rosenberg, 1982).

Von Hippel (1998) argued for an alternative task partitioning between users and producers as a possible way of bypassing information acquisition for product development. The idea has now been concretized in the notion of a "user toolkits for innovation" (von Hippel, 2001; Thomke and von Hippel 2002; von Hippel and Katz, 2002) in which the solution is simply to offer consumers the tools to customize essential parts of products themselves. This leaves some essential problem-solving activities up to consumers, which in turn may call for renewed considerations concerning the organization of new product development.

Observations indicate that the user toolkit method is not just a matter for interest of researchers: toolkits have for some time been offered by leading firms to their consumers. Examples range from Nestle's ingredients toolkit, enabling chefs of Mexican food to create customized food solutions, to Westwood Studio's software toolkits, permitting computer gamers to design key game features by themselves.

The present paper investigates the implications of toolkits for consumers. What are the implications of letting consumers do some of the job? Can we expect consumers to be capable of the design related problem solving needed and of handling the new tools? What are the important dimensions of the toolkit approach and how are they interrelated? As researchers paint a positive prospect of the toolkit approach, there is a need to answer these questions.

The paper deals with the relation between toolkit use and the amount of support and supervision that firms provide their consumers with. An analysis of the relationship between products grouped on the basis of their opportunities for

consumer involvement (OCI) characteristic and the factual amount of support that consumers receive in these product groups is carried out on the basis of 78 observations from the computer games industry. The results show that higher support rates are experienced in consumer groups that have toolkits. This result suggests that some of the "savings" on information costs in the product development department achieved by the toolkit method will eventually reemerge as costs in consumer support.

However, the aim of this paper is not to argue about the actual costs of the support observed, but to discuss what the support and supervision rates allocated to toolkits users are in fact compensating for. Along these lines I will argue that whereas it might be possible to equip consumers with toolkits, it is not, at least not at the outset, likely that they are endowed with the appropriate design capabilities needed to handle the new tools and to undertake complex innovation tasks. Learning is needed in the consumer domain before customization processes can take off. One source of learning is the training that toolkit providers offer via their support and supervision. An alternative (and attractive) source of learning for toolkit use is one that takes place on a consumer-to-consumer basis. Observations and experiences from the computer games industry illuminate some potentially effective solutions to the need for consumer learning, and outline how an important dynamic can be added to the toolkit approach that improves its usefulness

2. The information problem of modern product development

To solve a problem, needed information and problem solving capabilities must be brought together – virtually or physically at a single locus. To the product developer, the identification of users needs is an essential undertaking, which however, is constrained by some essential costs of acquiring the relevant information. Product developers will soon face the problem that users locally hold an essential, but rather sticky portion of information required for product development. Von Hippel (1994) defines "sticky information" as "the information that is costly to acquire, transfer,

and use in a new location". The degree of stickiness is defined as the incremental expenditure required to transfer a certain unit of information to a specified locus in a form that is useable to the information seeker. When this cost is low information stickiness is low; when it is high stickiness is high (ibid.). High information stickiness may be due to the attributes of information itself, such as the way in which information is encoded (Nelson 1982, Pavitt 1987, Rosenberg, 1982); alternatively it may be a function of the absorptive capacity of information seekers (Cohen and Levinthal, 1990). For both these interconnected reasons users' need-related information is frequently highly sticky, which means that the information called upon by product developers can only be swapped at high costs. Adding to those costs is the fact that user's needs will typically change during the use process; issues will appear that the user did not realize prior to use (Rosenberg, 1982), thus requiring several information iterations between consumers and product developers during development processes before a satisfactory product concept can be reached.

Furthermore, a general trend toward more heterogeneous consumer needs on important markets makes product development increasingly difficult (von Hippel, 2001). Recent research (Franke and von Hippel, 2002) concerning this issue concludes that as a consequence of lacking methods to deal with need-heterogeneity about 50% of the total variation in consumer needs will typically be left unaddressed in with-in segment variation.

2.1. Consumers' role in product development: Pros and cons of different approaches
There are various ways for firms to approach the problem of dealing with need-related information for product development. A generic feature of any product development approach is the degree to which and way in which consumers are involved. In the following section, different approaches and their pros and cons are outlined. I have listed the approaches according to their degree of OCI:[1]

Listening to consumers: a weak form of consumer involvement

The weakest form of OCI limits the role of the consumer in product development to being a simple information provider who delivers feedback voluntarily or when asked to do so by market researchers. In this approach the more a company knows about a specific consumer need, the better the possibilities of satisfying those needs. Various sub-methods pertain to the conventional "listening to consumers approach". The approach covers a number of highly diffused methods, which lie at the heart of conventional market research approaches to product development (in which the firm must be the proactive part in collecting need-related-information). From the perspective of the firm, listening to complaints may make it possible for the firm to approximate a more appropriate product or service. Collecting consumer complaint data is a common practice in many companies. Research has focused on processes to handle complaints (Tax, Brown, and Chandrashekaran 1998; Fornell and Westbrook 1984; Resnick and Harmon 1983), the customers' experience (Smith, Bolton, and Wagner 1999; Hansen, Powers and Swan 1997), and the relationship to important business outcomes (Richins 1983). Further, interviews and focus group approaches fall within this category: these methods are often used in practice and have received a considerable amount of research attention (Greenbaum 1998; Holstein and Gubrium 1995). They are most often used to understand consumers' expectations and to determine consumers' views on the importance of particular product attributes. Sophisticated market researchers employ them at the end of surveys to add insight into quantitative results (Woodruff and Gardial 1996). With more complex product offerings, focus groups are used to gain an in-depth evaluation of these offerings (Krueger 1994). Focus groups are often used to validate internally generated product ideas, and are occasionally used at the idea generation stage just after the prototype stage.

The crucial question here is one of the costs versus the utility of the information gained through these methods. The utility of such methods depends on the analyst's ability to accurately and completely condense from the interview data

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[1] In the remainder of this paper we shall deal explicitly with the users, who are consumers. Therefore

the attributes which consumers feel are important in the products or what it is precisely they want to express by their complaints etc. The methods suffer from the sticky information problem: the expenditure required to transfer a given unit of information from one place to another in a form useable for the information seeker is high. Listening to consumers may simply be too costly and the surveys do not usually elicit enough response or information - factors, which may help explain why these research techniques are often abandoned (Day, 1994).

Interaction with advanced users: a moderate form of consumer involvement

Moving towards increasing OCI, we identify the "interaction with advanced users approach". Advanced users include "lead users" who are defined as being "users whose present strong needs will become general in the market place months or years in the future" (von Hippel, 1986) and "expert testers" who are those that typically are able to spots errors and mistakes in prototypes during testing. The key characteristics of these users are interest in and, frequent use of the developer's products. They are frequently dedicated individuals who make extensive use of the product in question and are familiar with its features. The value for product developers of interacting with advanced lead users and expert testers has been highlighted by Herstatt and von Hippel (1992): advanced users' focused set of characteristics and their frequent use of the product, and their deep and active information processing makes their experience particularly meaningful for product developers in terms of discovering potential product performance and to make product improvements before the product is launched. Advanced users will recognize benefits, shortcomings and problems faster and more accurately than mainstream consumers. They may thus serve as valuable trial and error testers and solution generators throughout the phases of product development. Interacting with advanced users allows the product developer to get a contact to users who deliver more reliable information to product development. The advanced user idea generation approach is similar to the conventional listening to

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we shall mainly employ the latter notion.

consumer approach in principle, but differs in that it lets users generate the solutions rather than letting "in-house product developers" do it.

The critical cost of this approach is the difficulty of identifying truly advanced users who are willing to participate actively. Another problem reported by Olson and Bakke (2001) that appears internally in the product developer firm is that developers have a tendency to abandon the method because they perceive results of user interaction as being too ambiguous or overly simplistic.

User toolkits for innovation: a strong form of consumer involvement

While information iterations and boundary spanning between product developers and consumers impose significant costs on the two approaches outlined above, these processes can to a certain extent be eliminated in the strongest method for OCI – "user toolkits for innovation". Recent work by von Hippel (2001), Thomke and von Hippel (2002), and von Hippel and Katz (2002) suggest user toolkits for innovation as a solution to the stickiness problem. The objective of the user toolkit approach is to facilitate consumers in carrying out certain need related tasks (often design work) themselves by equipping them with design tools.

The user toolkits method is built around the idea of a new task partitioning of product development that co-locates problem solving tasks with sticky need-related information in the consumer setting. Thus, the intention is obviously not to reduce stickiness itself, but instead to eliminate the need for information transfer and iterations throughout the development process by out-sourcing tasks of product development to consumers. According to the authors, toolkits should divide tasks so that consumers primarily carry out tasks related to the core areas of development that involve their sticky information. Typically consumers do not know what they want from the beginning of the design process and can therefore not articulate their needs to a given manufacturer. Letting them carry out essential design-by-trial-and-error processes - from applying a solution in the use setting till a satisfactory solution is achieved – avoids the costly iteration and speeds up the process by which consumers can alter product concepts as their wants change.

Approach	*Initial info location*	*Main problem-solving location*	*Main cost for firm*
OCI-Weak (Listening to c.)	User	Firm	Boundary spanning, Sourcing/interpreting need-related info.
OCI-Moderate (Adv. User involv.)	User	Firm	Boundary spanning, Locating and bringing users in
OCI-Strong (toolkit)	User	User	Toolkit design, handing out toolkit ?

Table 1.

As illustrated in Table 1, both the first (listening to consumer) and the second (interaction with advanced users) approach have separate locations of need-related information and the problem-solving locus of product development. In contrast, the toolkit method co-locates essential information with problem-solving activities in the user domain. This leaves the consumer with the opportunity to carry out design work. In the remaining part of this paper, I shall focus on the role of support and supervision needed for each of the three different approaches.

The application of a toolkit in a real business context can be illustrated by the example of Westwood Studios – a leading developer of computer games. Westwood Studios is an example of a firm that moved between OCI-categories; from primarily using conventional market research methods in the early 1990s the firm began to employ interaction with advanced users approach in mid-1990s. At the beginning of the year 2001 the firm introduced its first toolkit to consumers. The toolkit now offered by Westwood Studios is a software editor that allows computer game aficionados to build new graphic environments (e.g. maps and missions) to their game. Nowadays Westwood Studio's consumers do detailed design works and engage in weeklong innovation endeavors that, according to managers at Westwood, yield valuable content to the product. How toolkits make sense in direct economic term is also illustrated by this case. Consumer-generated content has in several instances had a sufficiently high quality as to substitute Westwood Studio's own product development efforts, and provided a low cost but high quality input to the firm's

products. With their toolkits, consumers carry out labor-intensive design work that traditionally has been done in-house by computer game manufactures. For example, when a manufacturer develops a new computer game map in-house by employing a professional art designer, (who on average earns 59.612$ per year[2] and typically spends ten days to create a high quality map) Westwood Studio's labor costs of creating single quality map can be calculated to roughly 2980 US$. Consumers frequently make maps that reach levels of "professional" quality. Westwood Studios have chosen to continuously have 8-12 consumer made maps available for download at their website side by side with an equally number professionally made maps. In the online consumer environments attached to Westwood's products several hundreds map-extensions circulate among consumers. According to managers at Westwood the outcomes of toolkit use (maps) and the circulation of those outcomes extends the product lifetime – computer games can simply stay popular longer when additional product content that adds to the consumption experience is turned out on a continuing basis[3].

3. The role of support and supervision

Anyone who has struggled with a balky computer, French cuisine, or databases for airline schedules understands the importance of being compensated in some way for one's lack of abilities – at least in the initial stages of the use process. Further, the balkier or the more complex the computer, the cookery adventure, or the travel database, the more compensation will typically be required for one's activity to reach a satisfactory result.

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[2] http://www.gamasutra.com/features/20010831/survey_01.htm
[3] The toolkits described in this paper should not be confused with current mass-customization tools available to consumers. A typical mass-customization tool is one such as Nike's iD allowing customization of sports shoes. Here consumers face a palette of limited choices (colors, logos etc.) that restrict them to combine any lace color with any heel color, thus only permitting the consumer to construct a limited number of designs. Toolkits of the nature described in this paper, allow consumers a solution space in which designs are not only produced in a combinatorial act, but rather in a creative work processes similar to art design. In Appendix 1 Westwood's toolkit is briefly illustrated.

Support and supervision are the labels given to various forms of assistance that firms offer their customers to help them optimize their skills so that they gain maximum value from their products or services. There are various ways for firms to support their consumers. Characteristic types of support include installing, documentation, maintenance, and repair services, user training, and equipment upgrade (Goffin, 2001). The term "service" normally refers to maintenance and repair issues, whereas the broader term support and supervision also covers issues such as user training (Clark, 1988). Good support and supervision, such as toll-free hotline help and advice play a key role in achieving customer satisfaction it is argued by Lele and Sheth (1988). Furthermore, it may provide firms with a competitive advantage, and it can be a major source of revenues (Pittiglio and Hoole, 1987). Benham, Delaney, and Luzi, (1993) emphasize that in addition to good design tools and standards, which may foster good programming practices the role of end-user support was crucial to the outcome of end-user computing. This latter point is somewhat substantiated by Guimaraes (1997) who finds that support and training is crucial to successful end-user computing[4], and by Bostrom et. al. (1990) and Compeau (2002) who stress more qualitative aspects of end-user software training for achieving successful outcomes in that field.

Support and supervision may thus seem to be relevant considerations at least in situations where consumers face complex tasks, and it might seem reasonable to expect that transferring problem-solving tasks to consumers will have some consequences for consumer support. The following section presents an analysis of the relationship between the degree of opportunities for consumer involvement and rates of support and supervision, and tests the proposition:

> *The more involved consumers get in problem solving activities*
> *(the higher the OCI), the higher the need for support.*

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[4] Guimaraes (1997) advocate for the establishment of "Information centers".

4. Research methodology

4.1. Research setting and sampling procedure

The research was carried out on the basis of data obtained on computer games and their related online communities in which support functions are carried out. The entire set of data was acquired from online sources – either from computer games developers' or computer game publishers' virtual communities. The data were collected over a period of two weeks in April 2002. A list of PC computer games released in the year 2001 was obtained at the game site Gamespy.com (covering 95% of all commercially released computer games). We chose 94 out of a total of 262 PC game products for further analysis. Of those, data were not available on 16 occasions, leaving us with 78 observations.

Firm support and supervision to consumers is a key function of the online communities. The support and supervision available to consumers in this industry is almost exclusively channeled though the virtual communities. When firm personnel communicate with consumers in these communities, they almost always do so to support and supervise consumers.

The computer games industry is chosen for the reason that it allows us to observe factual support rates and to establish and confine the limits of discrete groups of the OCI variable in a relatively straightforward manner. Via the online communities, most firms in the industry habitually have a segment of their consumers involved in some way that falls into the OCI spectrum described, ranging from "weak to strong involvement of consumers". Thus, here we could identify the various OCI-levels on which consumers are involved in connection with product development, and measure the rate of support and supervision given from firms to consumers in each case.

4.2. The variables

Support and supervision (dependent variable): Connected to each observation, a value for the actual rate of support and supervision that firms offer to each of the products' in their virtual communities could be determined. The degree of support and supervision that is allocated to each product's consumers was determined by calculating the rate of the firm's employees share of messaging on the firm's virtual community (moderators, support staff etc.) divided by the total rate of messages generated by both consumers and firm personnel in that community. Thus, firm provided consumer support = firm messages / total amount of messages.

OCI, degree of opportunities for consumer involvement. The 78 observed entities were broken down I nto three categories according to their OCI characteristics. The sample comprises data that describes the character of the product in terms of the opportunities that it offers consumers for involvement. The degree to which the product is open to OCI was rated on a three-point scale with 1 being low OCI and 3 being a high degree of OCI. The concrete measures are as follows:

Operationalization:

1 = (weak involvement): A product for which the opportunity for consumer involvement is non-existent or weak. For example, a product for which no software editors, and no debugging/testing is open to the consumer. Consumers may often have the chance to communicate their opinion openly in the online community.

2 = (moderate involvement): Consumers are not allowed to rework or extend features, but are offered the opportunity to systematically report bugs and test beta versions.

3 = (strong involvement): Products that offer toolkits (software editors), allowing consumers to rework or extend certain features of the original product[5].

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[5] The most common function of "computer games toolkits" are such as described in the case of Westwood Studios - software editors that allow the consumer to make new "maps", which add customized new challenges to the game.

Table 2. Descriptive statistics for the set of variables (n = 78)

Variable	Number of firms	% of total sample
1. (No or weak involvement opportunity)	33	42.3
2. (Moderate involvement)	18	23.1
3. (Strong involvement (toolkits))	27	34.6

Table 2 displays descriptive statistics for the variable OCI. It can be observed from the table that approximately 42 percent of the sample offer no or low OCI to their consumers, 23 percent invite consumers to become moderately involved, while 35 percent offer a high opportunity for consumer involvement by making toolkits available.

Two regression models were constructed:

Model (i)

The first model (n = 46) comprises only products which all have an active support function established in their online community. Only the firms that have set up a support function staff (such as technical support or moderation) that is active messages in the online community are included in this model. We then measure the actual level of support and supervision given to each product OCI.

Model (ii)

As an addition to the first model we created a second model. The second model (n = 78) also comprises products for which firm have no established support or supervision functions. Thus, firms that have an online community, but no support and supervision function, or firms, that do not have an online community available are included in this model. Firm online communities, which exhibit no established framework for support and supervision, are in this model set to zero support activity.

5. Results

Table 3 below shows the outcome of Model (i). High levels of OCI correspond with high levels of support and supervision as the p-value (0.027) indicates with a 5% level of significance.

Table 3: Regression results explaining firms' share of support (total postings)

| | Model (i) excluding no domain Adj. R^2=0.11 (n = 46) | | | Model (ii) including no domain Adj. R^2=0.25 (n = 78) | | |
Variable	Estimate	t-value	p-value	Estimate	t-value	p-value
Intercept	-0.0016	-0.031	0.976	-0.044	-1.98	0.052
Cons. Involv.	0.046	2.30	0.027	0.051	4.53	0.000
Domain (dum.)	0.0047	-0.157	0.876	0.027	1.24	0.229

The outcome of Model (ii) also strongly sustains the hypothesis that support and supervision rates correlate to products that offer more opportunities for consumer involvement with a p-value 0.0001 (significance on a 1% level).

A dummy was introduced in both models, which controls whether the location of the support function at either computer games developer firms or at computer game publisher firms would affect the result. Could the support rates observed be explained by who (publisher or developer) carries out the support rather than by the levels of OCI? The answer was no. The dummy did not significantly affect the overall results.

5.1. Interpretation:

The results of our analysis back the hypothesis: *the more involved (the higher the OCI) consumers get in problem solving activities the higher the need for support.* The outcome of the analysis shows that consumers using toolkits will tend to be more supported than less involved consumers. This suggests that toolkits may not necessarily be successfully employed without considerations of how to compensate consumers with support. It means that the toolkit approach does not only reduce cost related to acquiring sticky

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information for product development ventures; in addition it entails costs of supervising consumers.

I chose to interpret the support provided as a sign of consumers being involved "over their head". Consumer support and supervision rates correlate with stronger OCI is a sign of consumers not being appropriately equipped with the capabilities to take on specific problem-solving tasks that relate to the use of the new tools. Consumers may wish to exploit more of the possibilities available in the toolkit, but do not know how to do so. Consumers may not understand the limits to their own capacity, or may simply not be able to handle the tool.

6. The important dimensions of the toolkit approach

There is a set of three important and interrelated dimensions affecting the toolkit approach that a toolkit provider should bear in mind: the size of the solution space left open to consumers; the level of consumers' design capabilities; and the rates of support that consumers have access to.

Solution space

The solution space is set by the toolkit provider who determines the set of functions over which consumers have control. In other words, the size of solution space determines the amount of freedom that consumers have for their creations. When solution space is large, toolkit use will tend to be more complex, because there will be more functions to master, and there will be more decisions to make for a given consumer on which functions to employ in a given situation. A solution to a given problem will tend to be hidden among a great number of alternatives when solution space is large.

Consumer design capabilities

The consumer design capability signifies how effective a consumer is at dealing with a given toolkit. The existing consumer design capability is thus the embedded level of consumer excellence determining what consumers are able to do and refers to relevant experience, knowledge, and hence the problem-solving capacity that a given

consumer possesses for dealing with specific tools. Consumer design capability enhances the consumer's chances of locating an appropriate solution to a given problem or choosing the right function, or combination of functions, in the "toolkit menu".

Support

Support is – as noted previously – seen as the way the toolkit provider can choose to compensate consumers when they are not capable of dealing with the tools that have been provided to them or with the projects that they have become involved in through toolkit use. Support should also be interpreted as an important element of user training through which consumer design capabilities are upgraded.

The three dimensions of the toolkit approach are interrelated. Imagine for example that a firm chooses to increases the solution space left open to consumers. This will give the consumer more freedom to do his designs. However, increasing the solution space (making the toolkit more complex) will increase the requirements placed on consumer design capabilities and/or on their substitute, namely, support and supervision. The successful employment of toolkits thus requires the consideration of key tradeoffs. How complex can the tasks in which consumers are involved into be? What are the benefits of letting consumer carry out tasks? How much is one's firm willing to invest in support functions? Should toolkits be designed to fit the capability level of the lowest common denominator or should they aim at the advanced user segment? Since toolkits are specific to a given product, these tradeoffs will be so too. How tradeoffs are made clearly affects the quality and quantity of possible outcomes and the need for support and supervision. If toolkits place great demands on consumer design capabilities (which at least at the outset, must be expected to be scarce), outcomes will be fewer, but probably of a higher quality. If, on the other hand, toolkits are intended to capture less capable individuals the outcomes will not be as sophisticated, but the quantity of outcomes may be great because fewer potential toolkits users will be excluded from using the toolkit. The relationship between the complexity of the toolkit and the consumer design

capabilities is important to the support question. One may imagine a toolkit provider who wants to involve his consumers in highly complex tasks immediately after the toolkit is released. He then creates a highly advanced toolkit but must be aware that support is needed (at least at the beginning) to initiate consumers. The alternative would be to launch a toolkit with a limited solution space to save on support costs and then expect consumers to work out solutions on their own. This, however, will possibly give rise to a slower progress of consumer abilities, which means that the toolkit provider must wait longer for sophisticated outcomes to appear.

7. Consumer learning effects

The situations described above are held static, while our problem is in reality a dynamic one that may be affected by consumer learning processes. Learning processes in the consumer domain are important because over time they may reduce the need for support and supervision, allow consumers take on more tricky tasks, and improve outcomes designed by toolkits.

In fact, a certain amount of the support that has been observed in this paper may mainly relate to "getting consumers over the capability entry barriers to toolkit use". In other words, consumers need to learn (or get taught) a few tricks before they can be left alone to do their design work.

We know from earlier studies that "learning by doing" and "learning by using" play important roles for the quality of user driven innovations (see von Hippel 1994; Rosenberg, 1982), but in addition, there are currently important efforts and progress within some practical fields to exploit the dynamics of interactive learning among consumers. Instead of relying on progress in toolkit use via learning by doing of a solitary toolkit user, we shall here point to a new form of organizing consumer learning that may have a significant (positive) impact on the future of the toolkit approach to product development.

Most firms in the computer games industry have - as we mentioned previously - established online communities that favor interactive consumer-to-consumer

learning. Thus, a community of consumers, all sharing the same specific toolkit can now communicate on a global scale. Within this context, less capable consumers may learn tricks from fellow consumers who already sit with solutions to problems and thus upgrade their capabilities. This may again pave the way for more sophisticated outcomes and may possibly diminish the amount of support required from firm personnel, because this function is now partly carried out on a consumer-to-consumer basis. As the consumers of a given product share a product specific tool in common with their numerous fellow community goers, there is scope for rapid trial and error problem solving and diffusion "best practice toolkit use". When such consumer–to-consumer learning synergies take off there is a scope for high quality outcomes of toolkit use. The following section presents a case study of Westwood Studios' online community. The study aims at determining the sources of support in the context where a toolkit provider offers an online community that enables interaction between the firm and consumers, and among consumers.

8. Firm's support versus consumer-to-consumer support

8.1 Background

To measure the rates of support and supervision available from the toolkit providers and through the consumer-to-consumer interactions respectively, we have explored the function of the Final Alert Online Community (henceforth FAOC). The community gets its name from Westwood's toolkit - the software editor Final Alert – and is Westwood Studio's site for discussion and co-operation concerning map-making with the editor. This particular site is one of four subdivisions constituting the overall community connected to the popular series of computer games called "Command and Conquer - Red Alert and Yuri's Revenge". Westwood Studios inaugurated FAOC on June 8, 2001, simultaneously with the release of their very first editor. Through the community, Westwood could now support novice mapmakers, monitor ongoing mapmaker-to-mapmaker interactions, and make sure that consumers would have a place to discuss toolkit related issues. We acquired the

web log of FAOC, which allowed us to study the entire set of firm-consumer and consumer-to-consumer interactions throughout the period starting June 8 until November 23, 2001. In that interval the community accumulated 801 members who generated 2,530 discussion topics, which in total produced 18,875 messages. This particular case is interesting because it illustrates a situation in which firm support to consumers is low, but where the production of quality consumer creations (new maps) produced with the Final Alert editor is still high[6]. As one of Westwood's online community managers explains: "the community [FAOC] has been very self-contained".

Figure 1 below shows the distribution of community goers in FAOC according to their activity. It specifies that a minor segment of community goers are responsible for the largest share of messages in the FAOC.
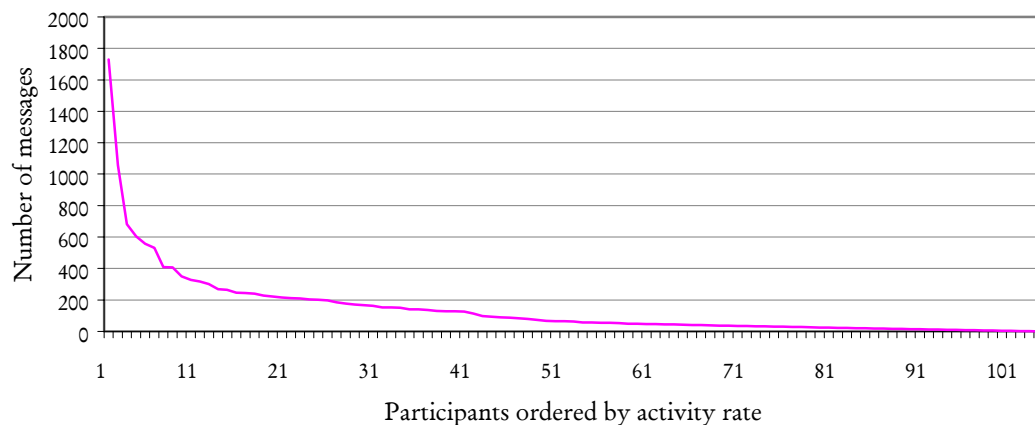

Figure 1. FAOC community goers (top 105) ordered by activity (messages posted) (June 8 - November 23, 2001)

A group of only 6 members contributes with the share of messages that alone constitutes the upper quartile of the total number of messages in FAOC. Each quartile contains 4718 messages.

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[6] Westwood Studio's community is located in the lower part of the sample with regard to firm support. Westwood Studio's overall community is placed as no.6 (counted from below) out of 27 with a firm share of messaging on only a total of 3,8%. The average rate of firm messaging on firms' own is 12.9%. The top scorer-firm in the sample has a share of support of 39,5% (see appendix 2).

Quartiles	Q.1.	Q.2.	Q.3.	Q.4.
Messages pr. community goer	1-41	42-197	198-532	533-
No. of community goers	736	40	19	6

Table 4. **Quartiles of FAOC**

8.2 Firm Support

Westwood employs three so-called on-line community managers who carry out various duties attached to the Command and Conquer game universe. Two of them divide their work hours between several different work functions related to a number of Westwood's (Command and Conquer Series) online communities but are not specialized in toolkit issues, while one "official toolkit supporter" (henceforth OTS) devotes on average 10 hours a week explicitly to supporting toolkit users in FAOC. Thus, apart from Westwood's investment in toolkit development[7], an auxiliary investment to support toolkit users has been made. Within the period studied, the OTS at FAOC contributed with 297 support messages that entered into 256 discussion topics, meaning that he had supplied comments to more than 1 out of 10 discussion topics (10,1%). This made him the top 12 poster in the community.

A typical discussion in a FAOC interaction in which the OTS participates is outlined below.

```
Topic: nukes, weather…
Subzero46 (community goer): How do you make nukes, and weather
randomly appear around the map? I know how to make them strike at a
given time and place, but how about a random time and place.Also how
do u make an attacker get attacked? E.g put a trigger on a building
so if someone destroys the building thier base gets nuked. I can
make it so the shroud comes back, but it happens to everyone, not
just the attacker. Help Please.
```

[7] A private "lead user" - a 16-year-old game aficionado from Germany named "Matthew" - carried out the initial development of the Final Alert editor. Matthew later finished the editor in co-operation with Westwood's engineers. Westwood encountered Matthew in their online community. They subsequently contracted him to work with Westwood to improve the device. When the editor and the FAOC were launched Matthew was employed as Westwood's official toolkit supporter.

```
Shadow454 (community goer): You aren't the only one with this
question.I have a map created with FA 0.98 ver 4 of Oklahoma
City...and it needs random severe weather to go with it.
Matthew (OTS): Use 51 Random delay... as event instead of event 13.
You might try around with making the trigger repeatable (if the
weather effect then keeps appearing, try making a workaround with
local variables
```

Above, a community goer (Subzero46) poses a question then, a bit of noise is created from a fellow community goer (Shadow454) and finally, the OTS steps in with what we shall label a "solution-oriented answer". In the remaining part of this paper we shall employ solution-oriented answers as our proxy for support. Solution-oriented answers are those answers that are directly valid for solving a given problem. Solution-oriented answering is the incarnation of the OTS's function. However, as the remainder of the paper illustrates, such solution-oriented answers may stem from sources other than an OTS.

8.3. Consumer-to-consumer support

In the following sections we have tried to approximate the importance of consumer-to-consumer support relative to the support provided by the firm. To do so we have generated a random-sample containing 493 messages from the entire number of messages contained in Westwood/FAOC's web log. In order to employ solution-oriented answers as a proxy for support we obviously need to be able to determine 1) the rates of answers versus questions, and 2) the rates of solution-oriented contributions versus other types of contributions. Furthermore, we want to investigate how question-answers ratios and solution-oriented answer ratios are distributed over the population of community goers, in order to identify to whom - if anyone - support roles can be ascribed.

Questions versus answers

We were able in a relatively straightforward manner to determine whether a certain message should be categorized as either a question or an answer. At the FAOC a typical information seeker posts a question because he does not know how to deal

with a certain aspect of the toolkit, and the respondent is a fellow community goer who tries to assist him in solving the problem. Each topic posted in the community usually receives several answers (of which several are often inappropriate). We found in the sample that 306 of the messages (62%) were answers, whereas the rest were questions, statements, or other types of contributions.

Who answers and who asks?

Figure 3 gives an indication of which community goers ask and which answer questions. It appears that community goers who ask questions are found in overall less active group (those with only few messages in Quartile 1), while those who tend to generate answers are found in the overall most active group, Quartile 4. Community goers in Quartile 4 (those with the most messages accumulated per person) answer more often and ask less often than community goers in any of the other quartiles.
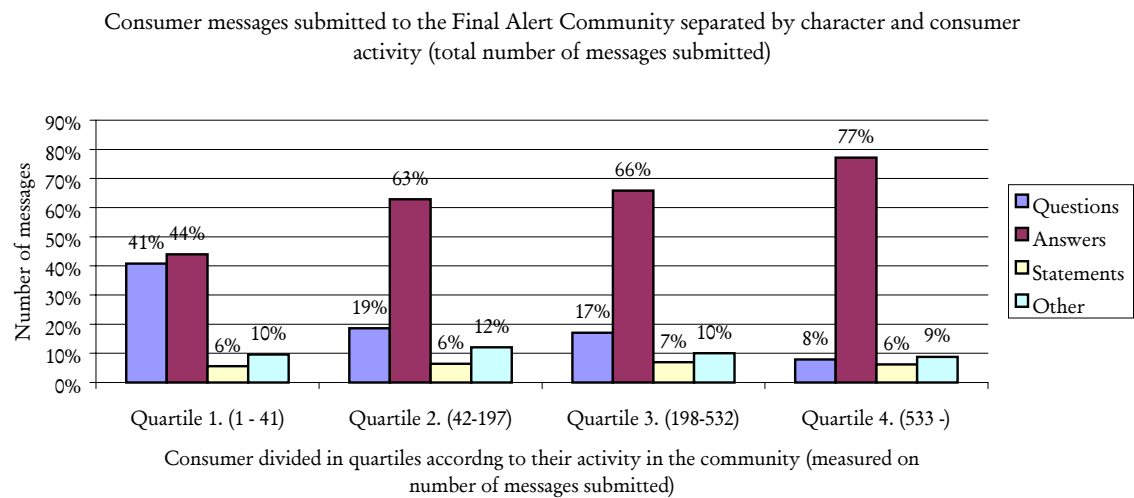
Consumer messages submitted to the Final Alert Community separated by character and consumer activity (total number of messages submitted)

Figure 3[8]

The interpretation of Figure 3 is that a large number of individuals (Quartile 1) only enters the community to ask for help a few times, and that there is an increasing

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[8] Observations in each quartile: Quartile 1. (n=125); Quartile 2. (n=124); Quartile 3. (n=129); Quartile 4. (n=114).

tendency towards answering as we approach the quartiles of the more active community goers.

Solution-oriented answering

How targeted a given message is for toolkit-related problem-solving purposes will obviously also be of major importance to the support question. In the FAOC context it is clear that although the community objective is rather narrow a large share of messages cannot be classified as a direct means of supporting problem solving.

To assess the validity of consumer's messages for support purposes we had to rely on individuals with the relevant experience from the actual field of study. Therefore, we contacted (by e-mail) five of the most experienced community goers from FAOC. We got positive responses from four. Using an e-mail questionnaire respondents were first asked to categorize 12 selected messages according their perceived usefulness for map-making related problem solving. This pilot study was done to determine whether or not community goers shared similar viewpoints on the issue. The question was stated as follows: *"Please browse through the following replies and indicate (samples are taken from the WW/FA2-forum) with either 1, 2, or 3 how useful you would find them for mapmaking purposes if you were an average FA2 user; 1=Very useful; 2=Perhaps useful (do not help me directly, but gives me hint in the right direction); 3=Not useful".* In eleven of the twelve examples, the respondents' categorizations corresponded with each other. In one example did the respondents disagree; thus, they can be said to share a common view on the valuation of messages for map-making purposes. After assuring this, respondents were asked to evaluate the 306 answers previously isolated on the basis of the criteria already established.

In total, we found 99 solution-oriented answers in our sample of 493 messages that were to be regarded as focal answers – that is to say, support. It means that approximately 20% of the total number of messages on the FAOC can be classified as support. Of the total number of answers (306) provided by consumers, roughly 32% were solution-oriented answers that potentially substitutes the firm's own support efforts. This signifies that a given information seeker in FAOC will on average find

that approximately 1/3 of the answer given to his questions will be of use to him as support.

Results; how much is consumer-to-consumer support worth and which consumers provide support?

The first row of Table 5 below shows that the solution-oriented answers mainly originate from the quartile in which people, per person, are the most active in terms of posting messages to FAOC. The second row displays the share of solution-oriented answers, which are found in each of the quartiles. The third row shows the number of solution-oriented answers in each segment when extrapolating the shares of solution-oriented answers to the entire number of messages on FAOC (18,875). The fourth row displays the average number of solution-oriented answers emitted per member in our study period; 736 individuals in Quartile 1 emitted 264 solution-oriented answers, 40 individuals in Quartile 2 produced 533 solution-oriented answers etc. The fifth row shows the number of times that consumers' solution-oriented answers can substitute the OTS's activity.

	Quartile 1.	Quartile 2.	Quartile 3.	Quartile 4.
1. Distribution of solution-orient. answers	5,1%	16,2%	36,4%	42,4%
2. Share of solution-orient. answers vs. other messages	4,0%	12,9%	27,9%	36,8%
3. No. of solution-orient. answers when extrapol.	264	533	1392	1821
4. Avg. no. of solution-orient answer pr. com. goer	0,36	13,33	73,26	303,5
5. No. times substituting OTS value (297)	0,64	2,05	4,43	5,85

Table 5.

On the basis of Table 5 (row 1) we can now note that 42,4% of the consumer support originate from a segment of only 6 community goers (Quartile 4) out of a total number of 801 members. Further, by including Quartile 3 we find that approximately 79% of the support provided by consumers to consumers originates from only 25 individuals. We also infer (row 5) that solution-oriented answers originating from consumers are able to substitute the OTS several times; most

important are the community goers of Quartile 4 who jointly are able to substitute the OTS-support by almost 6 times.

8.4. Outcome of the case study

1. The study of Westwood Studio's online community FAOC indicates that approximately 1/3 of the answers provided by consumers to consumers were valid as support that potentially compensates the OTS employed by the firm.

2. 20% of the sample's messages were solution-oriented answers. Extrapolating this result to the entire amount of messages (18,875), we find that a total of 3964 messages would count as consumer–to-consumer support. This suggests that the overall consumer-to-consumer interaction in FAOC accounted for more than 13 times the OTS-support provided by Westwood Studios, or more than 3 standard full-time employees (working 45 hours a week)[9].

3. On the basis of the study we can also specify that the support ratio (support/all messages) of the most active community goers substantially exceeds the support ratio arising from the least active community goers. We can observe that that least active community goers tend to ask questions while the highly active segment comprise those who answer the greatest number of questions and give the most qualified feedback. In connection with this point, it is important to note that the consumer support provided is crucially dependent on an extremely tiny fraction of dedicated community goers. Jointly, 6 individuals (in Quartile 4) account for a share of support that is roughly 6 times the OTS-support, and we may thus infer that each of these individuals, in terms of providing support, can be compared with the OTS employed by Westwood Studios.

Thus, the main reason why FAOC "has been very self-contained", as explained by a Westwood online community manager, must be ascribed to the support offered by certain core community goers from this community.

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[9] However, one should note that a supportive community goer is never a perfect replacement of a firm OTS. The OTS typically has access to firm information (such as source-code), which a community goer does not have.

9. Conclusion

We started by sketching out two well-known market research methods for product development: the conventional method of "listening to consumers" and the "interaction-with-advanced-users approach". Both methods may suffer from high information acquisition costs. Currently, an alternative approach is emerging: – "user toolkits for innovation", which offers a high degree of opportunities for consumer involvement (OCI) in the product development process. As not much is yet known about its implications, we argued that there is a need for studies in this field.

It was hypothesized that, as do the two former methods, the user toolkit for innovation would also generate some information related costs. Our intuition was that transferring design work to consumer as the toolkit method prescribes would require more support by firms than the other approaches. The intuition was sustained: the analysis shows that firms, which offer higher levels of opportunities for consumer involvement allocate more support to their consumers.

It was argued that support is only one of several important interrelated dimensions that determine the effectiveness of user toolkits for innovation. Additional dimensions are: 1) consumers' design capabilities; 2) the size of solution space left open to consumers. Support is a sign of lacking consumer design capabilities. When the solution space is enlarged, the need for either more support or enhanced consumer design capabilities appears. This means that when a manufacturer wants his consumer to produce better outcomes with the toolkit, a need for support may arise (which prevails at least until consumers acquire the necessary design capabilities).

The situation will be affected by consumer learning processes; establishing interaction in communities and consumer-to-consumer help functions is here seen as a possible way for firms to unburden themselves in terms of support and to create condition for better toolkits use. We set out to investigate to what extent consumer-to-consumer interaction in an online community could compensate firm-support efforts, and found in the case investigated that consumers to a great extent are able to

support each other. However, the case study also showed that such consumer-to-consumer support depends on a small segment of dedicated and extremely active consumers. The small core of community goers willingly support inexperienced novices who only pass by to ask a few questions.

In sum, communities that facilitate consumer-to-consumer interaction as illustrated in this example seem to be good news for the toolkit approach, in that communities allow firms to out-source certain duties to consumers. One can choose to interpret the consumer-to-consumer dynamics as a means for firms to reduce support costs, or simply regard it as "surplus support" that serves as training through which consumers learn how to handle the toolkit better – a process through which the outcomes that can be achieved with the toolkits is enhanced. Seen in relation to a firm strategy in which the aim of using toolkits is to enlarge the amount of quality content available to consumers, the findings described in this case study may be of major importance. Whether the organizational innovation of toolkit-user communities discussed throughout this paper will also prove constructive in other, more tangible settings, such as, for chefs of Mexican food remains an open question that is relevant for future research.

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Appendix 1

The FinalAlert2 editor; a 2D editor build by a lead user – "Matthew" and later acquired and re-developed by Westwood Studios in co-operation with Matthew. The editor is compatible with two games in the Command and Conquer Series created by Westwood Studios.
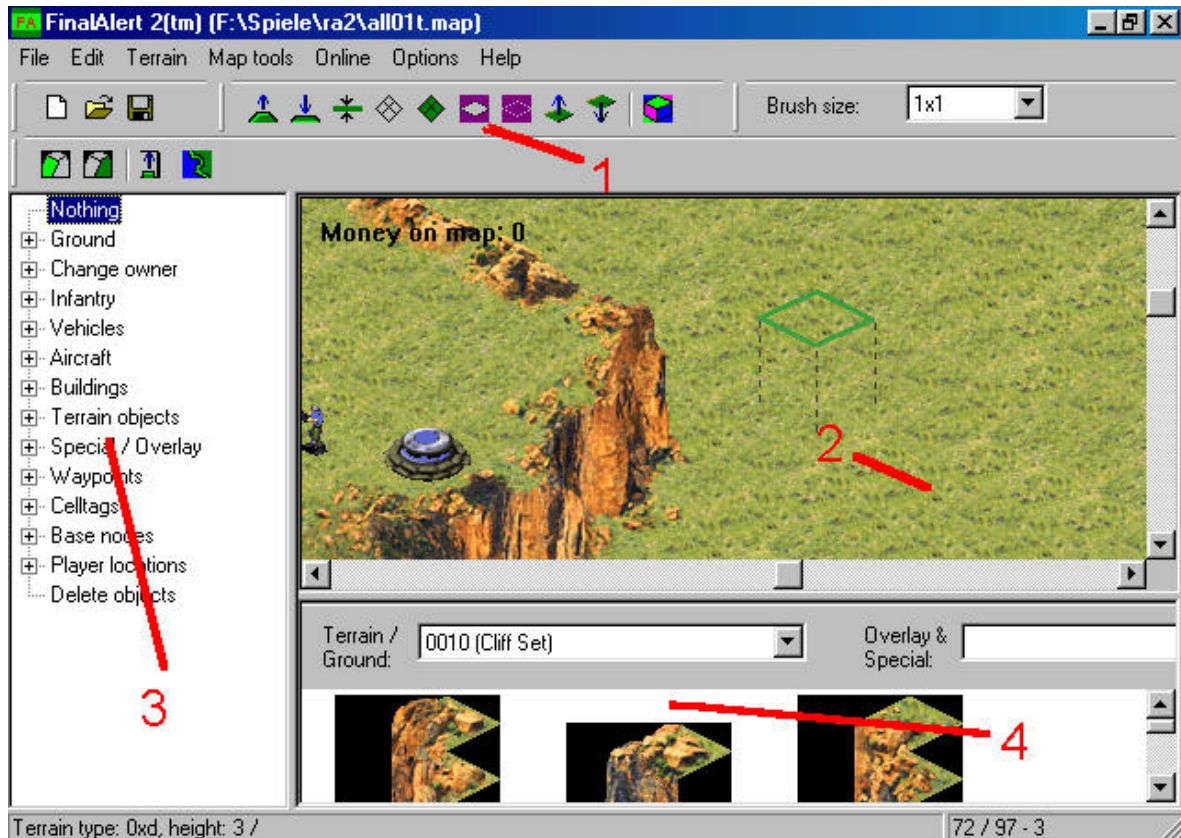
Source: Westwood Studio's tutorials for FA2 Editor.

Appendix 2

A look at the sample of 27 toolkit providing computer games firms (firms providing OCI = 3) shows that – despite a large within segment variation – firms' share of messaging (support) in the online communities generally only constitutes a minor fraction of the total messaging within this context. The average message share by firm's personnel is 12,9%, meaning that consumers generally generate the major share of messaging in these contexts.
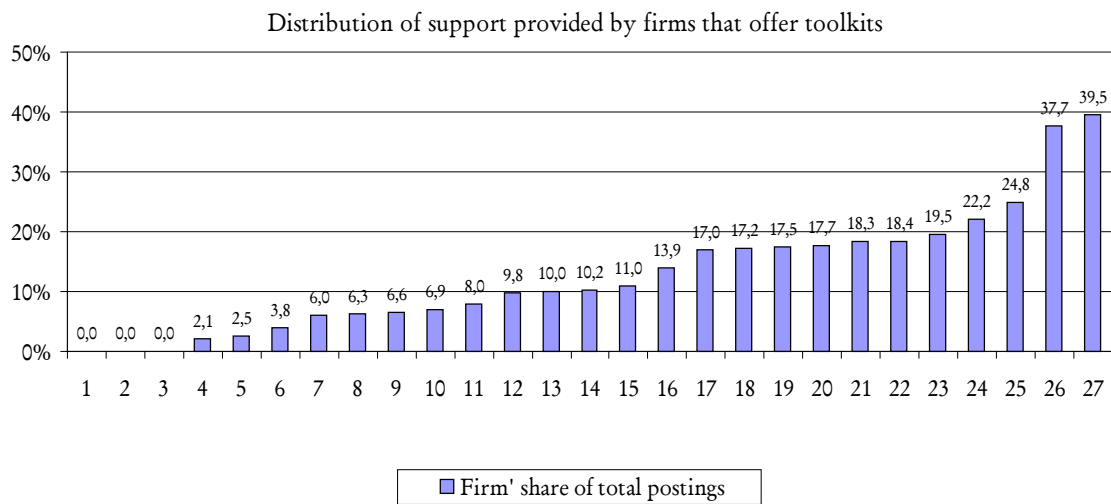
Distribution of support provided by firms that offer toolkits

Firm' share of total postings

Figure A. Toolkit providing computer games firms' share of messaging in their own online communities.

Appendix 3

Examples of message in each category (messages from FAOC sample)

"Very useful"
1) Common question this,and yes it can be done easily with triggers,there are several really good threads on this subject if you use the search option.However quick method. Place a waypoint close to a building say an army tent for example.Next make a trigger civilian,standard but not disabled.Event 0: building destroyed by any team.Action 0:create crate at,give the waypoint as the parametre and as for the crate theres a long list in one of the foremention threads,make the crate 0,which is money.Next return to your map and select the tent,in the pop-up box where it says tag,select and input your trigger,there your done.Now when the tent is destroyed the crate will appear,hope this helps.

2) I don't have the editor open in front of me so I don't have the event/action numbers available... so bear with me.Use the "celltag entered" action and attach the trigger to the structure. You don't need to make a celltag since the structure will act as a celltag, and if it's destroyed then the "celltag" won't exist anymore. For house number, use "-1" and it will work for anybody.Crate values:0=Money1=Unit2=HealBase3=Cloak4=Explosion5=Napalm6=Money7=Darkn ess8=Reveal9=Armor10=Speed11=Firepower12=ICBM13=???
(TS?14=Veteran15=??? (TS?16=Gas17=Tiberium18=??? (TS?For examples, see the WW mappack map "Arena.mmx" (look at and my map "Gem Pit".As for your other question, the INI editing you would do is:CrateBeneath=yesCrateBeneathIsMoney=yes (if you want it to be moneyThis can be seen in Gem Pit as well."CarriesCrate" is a key used for Vehicles I believe.

"Perhaps useful"
1) One of the maps in the project I'm working on has 122 waypoints in it and no problems encountered..don't know what the problem could be

2) Tiberian Sun did the same thing. No units can attack while in transit in a tunnel. It gets really dumb when opposing units enter the tunnel from either end, since they go past each other without fighting. Also once a unit is moving through a tunnel it must complete the move, it can't stop, or abort and turn back. Personally I was glad when the tunnels didn't appear in RA2.

"Not useful"
1) Hey guys, thanks for all the replies and not flaming me... After spending so much time on the board I was getting ready for replies of STOOPID NEWB' I feel warm and fuzzy now Well, I've gotten that problem out of the way... now I'm working on lighting... I tried to make a late evening map... but I'm rambling.Anyway, thanks for the help

2) RV, must've been from the master, huh?Lol, I give you all the props in the world, dude!

3) AHH. Good job on the map.