A Circle of Uncertainties:  
Dilemmas of User Involvement in Highly Dynamic Innovation Processes  
Evidence from Case Studies in E-Commerce  

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Abstract

This chapter considers the potential for user involvement, focusing specifically on highly dynamic innovation processes and taking into account not only local dynamics of interaction between designers and users but also dynamics on the societal level. It is argued that certain preconditions and assumptions generally presupposed by approaches to user involvement are not necessarily fulfilled, because scenarios of use may change quite radically and because design and use phases proceed side by side, not successively. This is shown by analyzing the evolution of scenarios of use guiding the design work of two companies producing software for e-marketplaces as well as the activities of two customers of these companies. The situation found in these case studies can be described as a circle of uncertainties, where neither technologies, user groups nor scenarios of use are a reliable basis for a development process. Starting from this circle of uncertainties, three different design strategies are identified, which imply three different strategies to align technologies and users’ needs.

Introduction

The inadequacy of many technologies in relation to users’ needs and interests is a widespread phenomenon. This has been shown by technology studies and participatory design approaches as well as by the day-to-day experience of many users. A possible outcome of this mismatch are technologies which are never really used. Alternatively, it may result in technologies which could simply be better, but are nevertheless used by willing and docile users who are sufficiently interested in whatever the technology enables them to do. Thirdly, this mismatch may result in technologies which users must cope with whether they like it or not, because they
have no choice—a typical situation in workplace environments. Finally, difficulties may arise in the longer term when early decisions create path dependencies, yet at later stages new forms of use would be preferred which are, however, no longer feasible because they cannot be realized with the existing system and a radical system change is not possible. Therefore an enhancement of the integration of user orientation into the design process is highly desirable and the involvement of users throughout the design process is often advocated. Furthermore, it is claimed that users should be involved in early stages of the design process, when technologies are not yet stabilized, so that they may exert their influence at a point when the most important decisions have yet to be taken (Floyd 1994; Greenbaum & Kyng 1991; Ornetzeder 2001; Rautenberg et al. 1994; Roßnagel 1999; Schuler & Namioka 1993).

Nevertheless, in this chapter I am going to point out that there are limits and dilemmas concerning the possibilities of user involvement when it comes to the design of innovative technologies in a highly dynamic innovation field, that is when concepts of how and by whom an innovative technology is going to be used are changing rapidly and radically. On the one hand, a low level of stabilization makes the involvement of users especially promising, because the impact of their involvement may be quite high. This very instability, however, leads to a dilemma that can be summarized as a circle of uncertainties. At the point when an innovative technology is quite malleable, the future users are often not yet well determined, relevant user groups may change over time, user requirements may evolve and also scenarios of use—concepts about how a technology will be used—are not stable. This creates difficulties for an effective mode of user involvement. These dilemmas become apparent if we do not limit our focus to a specific technology design project. This is typically just one step in a larger societal innovation process. That is to say, an innovation process comprises a succession of variants and social dynamics reaching beyond the local interactions of designers and users in a specific project.

The notion of innovative technologies refers to technologies\(^8\) which are either not yet fully realized or which may be realized in a technical sense or even used by some, but which are not yet part of established social structures, especially stable use patterns. I am not referring to design processes which aim to modify a well-established technology or to adapt it to a specific context.

The field of e-commerce in 1997–2000 is a typical example. E-commerce attracted great hopes and expectations concerning its economic potential in general. Yet it was not clear what would be the most promising scenarios of use. Furthermore, the scenarios considered as most promising at one time were changing rapidly. The term e-commerce subsumes applications and practices that enable information, communication and transactions among companies, retailers, consumers and public authorities via electronic networks, especially the Internet. E-marketplaces, that is virtual 'places' where a number of suppliers and potential customers can 'meet', collect information, communicate and to some extent also conduct transactions, represent a specific form of e-commerce. In the years 1997–2000 the socio-technical innovation of e-commerce, and more specifically e-marketplaces, was undergoing a process of societal appropriation. Basic technologies and applications existed—and were evolving quite rapidly—but individual and societal practices of use were only just emerging.\(^3\)

In the following I will first look at different approaches to user involvement and consider the presumptions or preconditions from which they start. I will then present two case studies on e-marketplace applications. I will analyze the evolution of scenarios guiding the design processes of two software companies and the underlying processes. Furthermore, the scenarios guiding the activities of two customers of these companies are also considered. Scenarios guiding software design were changing rapidly and in part radically. In addition, customer scenarios had not stabilized. The processes underlying the evolution of the scenarios included local processes, such as the interaction of designers and users, as also processes on the societal level. The following section describes the dilemmas or limits for user involvement deriving from this dynamics that can be summarized as a circle of uncertainties. Finally I will present possible strategies for dealing with this circle of uncertainties, which imply three different strategies to align technologies and users' needs.
Designers, producers and other actors taking part in the realization of a technology typically have more or less concrete conceptions of how and by whom it will be used. As will be shown, these conceptions are highly relevant not only for the shaping of the systems, but also for the possibilities of involving users in the process of development and realization. I will use the concept of a scenario of use to denote these conceptions. A scenario of use describes the functions of a technology and the possible contexts in which it may be used as well as the expected behaviour—that is the roles—of users. Furthermore, but not necessarily, it includes conceptions about who will occupy these roles. The differentiation between roles and role-takers is necessary, since designers may have quite an explicit idea about how a technology could or should be used, yet a rather vague idea of who will be going to use it. This differentiation is also expressed by the terms use model and user models.

Considering the concrete actors on the user side, I distinguish between customers and users. Customer refers to the actors that—as a company—make use of the software in question and that are in a customer relationship to the software companies that are at the centre of the following two case studies. User refers to actors using the respective software or e-marketplace directly. Typically the users consist of a number of different groups, since a specific e-marketplace or a scenario of use does not necessarily comprise just one user role, but quite often a number of different user roles, for example suppliers and buyers, which may be associated with different user groups.

Approaches to User Involvement: Presumptions and Limitations

There are a number of presumptions or preconditions on which approaches to user involvement rely. These are in part specific for different approaches. I will give a short overview of a number of important approaches to user involvement in technology design and their specific presumptions. In the following we will see how these presumptions may become problematic.

A common form of user involvement are approaches that try to enhance usability (Aktrich 1998; Degele 1995; Dumas & Redish 1999; George 1996; Rosson & Carroll 2002, 227 ff.; Woollgar 1991). A central element of these approaches are tests with future users or people considered to be representative of future users. A central purpose is to create technologies which are easy to use. The scenarios of use, use models and user models are generally presupposed and are not part of the test.

Approaches to participatory design aim at a more thorough involvement of users in the design process than just occasional tests (Berg 1998; Greenbaum & Kyng 1991; Pasch 1994; Schuler & Namioka 1993). Future users should be involved early in the design process and have a say in the concrete definition of the use model. Yet the general outline of the scenario of use is presupposed, at least the purpose of the system to be developed and especially the user model. Otherwise it would not be possible to decide who are the relevant potential users to be involved. Since most of the participatory design studies were conducted in workplace environments focusing on the design of individual and not standardized technologies, these preconditions were generally present.

Evolutionary approaches to user involvement take into account the fact that users do not necessarily have precise requirements from the outset. Rather, requirements and practices of use for new technologies have to evolve in practical experience with these technologies. These approaches advocate development models which are based on a succession of alternating design and use phases, which allow the participating users to gain experience with the new technologies in practical use settings and to feed back these experiences in the next cycle of the design process (Floyd et al. 1990; Monse & Weyer 1999; Pasch 1994; Rautenberg et al. 1994). Evolutionary approaches presuppose as well that the relevant user groups to be involved are known or at least clearly circumscribed. Similar to participatory design approaches in general, adaptations to the use model are provided for, but not changes of the complete context of use.

A more open form of user involvement is experiments or pilot projects where a new technology is tested over a certain period of time on a larger scale. Here the use model and the users are not necessarily clearly
circumscribed and processes of social appropriation on a local level may start (Hoogma & Schot 2001; Hoogma et al. 2002). Yet the technology to be tested under more or less realistic conditions has to be well defined.

In relation to highly dynamic innovation processes these approaches share some important shortcomings: they take into account only local dynamics of design, user requirements and practices and the interaction of both, while larger societal dynamics of innovation processes are not considered. Similarly, the focus is limited to a number of design and use phases as part of a single development process which finally leads to a stabilized system. A succession of variants as part of a larger innovation process is not considered.

If larger innovation processes encompassing societal dynamics relevant for the design as well as the user side are considered, a more complex dynamic picture is revealed. Appropriation processes are not limited to individual users or small user groups who must integrate new technologies into their habits and routines and establish new use patterns. On a societal level, processes of appropriation and social learning take place, which lead to the emergence of common practices, meanings, norms, rules of behaviour and institutions (Egyedi, van Lieshout & Bijker 2001; Heidenreich 1998; Kubicek & Schmid 1996; Silverstone & Hirsch 1992; Sørensen et al. 1996). In the course of appropriation processes ways of use may change. Technology studies considering not only the development but also the societal appropriation of new technologies have shown that the ultimate user groups and scenarios of use are often not those expected in early development phases (Carlson 1992; Flicky 1994; Heintz 1993; Hellige 1993). Furthermore, as will be shown, societal dynamics as to what are considered the most promising scenarios of use, are relevant too. These societal dynamics may not be a problem for user involvement, if users, use and technology change incrementally or if the respective time frames of design phases and the evolution of users and use or promising scenarios differ widely; for example, if modes of use are changing relatively slowly, so that these changes do not affect the life cycle of a specific system. As will be shown in the following case studies, with highly dynamic innovation processes these societal dynamics also become relevant for the local level of specific design processes.

Changing Representations of Use, Users and Technologies: E-Marketplaces

The evolution of scenarios of use underlying the development of e-commerce software in general as well as in the following case studies was highly dynamic. In particular, modifications and further developments did not generate incremental improvements or specifications alone while preserving the overall scenario or basic concept, but led to radical alterations or changes to the scenario as well. These—radical—changes included (ex)changes of the user model as well as of the use model, for example, the expected context of use. Scenarios were changing within months, which was also the case with the software developed and, in part, the users and users’ interests and requirements.

In 2000 two case studies were conducted, which focused on two German firms developing software applications for business-to-business electronic marketplaces, as well as two firms which made use of these software applications. Both software companies faced similar uncertainties resulting from the high dynamics of the e-commerce development at the end of the 1990s. Yet, as we will see, both followed partly diverging strategies of aligning technology and users to cope with this. The customer firms differed in as much as for one, a builders’ merchant, e-commerce had been a central element of its strategy, whereas for the other, a firm producing packaging machines, it was not.

Software company A was founded in 1997. It developed software for electronic marketplaces, but generally did not operate them. It preferred to sell the software packages to others operating the marketplaces and, if necessary, to customize or extend the software according to the requirements of the customer. Software company B was founded in 1998. From the beginning the explicit aim had been the development of software for electronic commerce in the business-to-business field, since at the time a large number of forecasts predicted a large growth market in this sector. The company developed software underlying electronic marketplaces targeted at specific branches of industry like packaging, pulp and paper or telematics. Customer-specific developments were not part of its strategy. In addition, it operated marketplaces based on this software in cooperation with different partners. The first marketplace was targeted at the packaging industry.
Methodologically the case studies were based on qualitative interviews with eight employees of these firms, as well as on publicly available documents. Furthermore, the public debates around e-commerce as represented in newspapers, studies of consulting firms, etc., have been analyzed.

Scenarios in Flux

Designer Scenarios

Software company A started the development of the first software version in 1997/1998 following the scenario of a shopping mall targeted at consumers. This shopping mall scenario—a website bringing together a number of suppliers in contrast to shop scenarios with only one supplier—was inspired by a group of closely connected ‘real-life’ analogies, such as department stores, marketplaces, and shopping malls. In the follow-up version a new, media-specific approach to the problem of getting customers to the offers was developed. One shop and its products could be presented in different e-marketplaces which were interconnected, thereby multiplying with little effort the number of potential customers.

About the time when the second software version was put on the market, the envisaged scenarios and user models were complemented by business-to-business scenarios, which had so far not been considered. A number of variants were developed, which were targeted at reproducing existing trading concepts in the business-to-business field (see Figure 1). These scenarios were integrated into the third, thoroughly revised software version. A first differentiation of the original shopping mall scenario, which was proposed by customers, still followed the consumer-oriented user model. The possibility of centrally managing a number of shops on one platform had been intended originally to present these shops in a common marketplace. Yet it could also be used to host and manage a number of individual shops which are not integrated in one marketplace and to offer the management of these shops as a service to the ‘shopkeepers’.

Based on this hosting scenario a couple of further variants targeted at the business-to-business field were derived. Software company A developed a variety of functions and modules accompanying the basic software, which supported, for example, requests for proposals, order bundling or auctions. These functions were connected to scenarios targeted at wholesale, manufacturers, or franchise companies. Furthermore, they developed a procurement application on the basis of the original marketplace variant. Finally, software company A promoted a further concept: e-business networks. This concept included the interconnection of applications like the ones just presented and the interconnection of procurement and distribution systems in one or several companies.

Each scenario implied different use and user models. The shopping mall scenario, for example, described the interactions between operators of marketplaces, operators of shops and buyers. A wholesale scenario described the interactions between wholesaler staff, suppliers, retailers, business and private customers. The role-takers envisaged for these user roles were different for each scenario.

Figure 1. Differentiation of scenarios of use

A similar evolution of scenarios and software versions had taken place at software company B. Founded about one year later than software company A, it followed a business-to-business approach from the beginning, since at that time business-to-consumer scenarios were no longer considered as highly promising in public debate. The first software version was targeted
at the scenario of an information marketplace, where firms in a certain branch of business could present themselves or easily access sector-specific information. Online transactions were not yet part of the concept. The specific form of the scenario was strongly influenced by the experience and know-how of the parent enterprise of software company B that developed software for the administration of document archives. Furthermore, the designers drew on a number of ‘real-life’ analogies like an industrial park, yellow pages, the organization in sectoral associations or the marketplace itself. In 2000 a new version of the marketplaces was in the development phase or already implemented. The new concept comprised a number of trading scenarios, which in part allowed for online transactions. These included three types of auctions reproducing typical forms of auctions in the industry field, requests for proposals and a multivendor catalogue.13

Designers for both companies anticipated that relevant scenarios would evolve in the future too. However, the technology that was supposed to be the basis of the future scenarios, at least part of it, had to be designed before it was known what these scenarios would look like.

Customer Scenarios

Scenarios were evolving on the user side too. A medium-sized company producing packaging machines was one of the early users of the aforementioned e-marketplace targeted at the packaging industry. This e-marketplace was operated by software company B in cooperation with an advertising agency specialized in the field of packaging. At the beginning the packaging firm was mainly interested in the scenario of the information marketplace, especially the possibility of presenting the company in an environment that enhanced the probability of it being noticed.14 Online transactions were largely not considered as relevant to its activities.14 This changed in the following period. Simple transaction-oriented concepts, such as catalogue-functions, were implemented and further steps like the possibility of ordering spare parts online were envisaged for the future.

One of the customers of software company A was a large builders’ merchant. The firm set up a sales platform based on the software developed by software company A. As a first step a ‘virtual branch network’ was implemented. Customers of the different subsidiaries of the builders’ merchant, predominantly craftspeople, were supposed to place their orders online in the future. A further evolution of the sales platform, for example the extension to a sectoral marketplace open to other actors in the building industry, was envisaged as an option for the future. Yet it was uncertain, whether and when the envisaged options would be implemented and precisely what they would look like.

Processes Underlying the Evolution of Scenarios

After having described the evolution of scenarios guiding the design process in the two software companies, we will take a closer look at the underlying processes of this evolution.

Local Processes of Variation

An important element of the local processes of definition and development of scenarios was processes of specification, differentiation and modification at a local level which gradually led to new variants. The concrete form resulted from the specific knowledge and experience of the actors or the experiences with the last variant, thereby leading to locally specific interpretations of more general scenarios.16 Analogies and metaphors had been an important element, either as a ‘creative tool’, which was interpreted rather freely or as a more rigorous guiding line, when ‘real life’ business processes were to be reproduced or supported. This applies to the generic scenarios of the software companies as well as to the more specific scenarios of the customers, especially the scenario(s) as defined by the builders’ merchant.

The interaction between designers, customers and users played an important role in the construction of generic as well as customer-specific scenarios. Generic scenarios incorporated elements proposed by customers, for example new scenarios of use for existing e-marketplace variants or new modes of use for specific software tools, which were taken up and incorporated in the development of a new software tool. Yet ideas, proposals, demands and experiences of customers and users were treated by both software companies mainly as resources to which one could turn if it seemed appropriate, not as conclusive requirements.
Scenarios guiding the design of specific systems and the design of customer-specific software elements were emerging from the interaction of designers and customers too. The scenario of a virtual branch network, which was the basis of the application developed for the builders’ merchant largely reproduced the existing trading concept of the firm. However, the envisaged extension into a network of marketplaces was suggested by software company A. The actors on the builders’ merchant side participating in the decisions on the scenario of the e-commerce application were not the future users. Feedback from the actual users, for example staff members of the builders’ merchant, was integrated into the design at later stages. Yet these proposals did not concern the overall scenario, but specific features of the software.

However, feedback from users and customers was often not systematically obtained. Strikingly, the core assumptions of the scenarios in particular were in some cases not compared to the real use behaviour by designers and customers: neither the operators of the packaging marketplace nor the head of public relations at the packaging firm had ever checked whether the marketplace had fulfilled its function as a meeting point, that is, whether it had generated new business relationships among the users. Yet this was presented as the central motivation for members to join the marketplace. An explanation could be that precisely the core assumptions of a scenario are considered as self-evident and therefore they are not questioned any more.

Scenario Evolution at the Societal Level

The scenario evolution was not due to processes on the local level alone, but also to dynamics on a societal level. Scenarios which were propagated as highly promising in the societal discourse on e-commerce were taken up by the actors. This resulted to some extent in rather radical re-orientations of the guiding scenarios, for example the change from business-to-consumer to business-to-business scenarios. Using a term which was introduced by Van Lente and Rip: these scenarios which were considered highly promising, not only by individuals but also within social groups, were part of an ‘agenda’ (Van Lente 1993; Van Lente & Rip 1998). If a scenario is part of a relevant agenda it will most probably be taken into account by designers and potential users. Either because the scenario as such is convincing or because the scenario has become self-evident due to its social character. On the other hand, if a scenario is no longer part of an agenda, it will easily be abandoned. This had happened to the ‘shopping mall’ scenario targeted at diffuse consumer groups that had oriented the first design phase of software company A. In 2000 this had already been considered as an economically disappointing intermediate step on the way to the really profitable e-commerce concepts. Following the latest trends in the USA, marketplaces were considered promising only if geared to specific target groups or branches of industry.

As mentioned above, the packaging firm had changed its consideration of transaction-oriented scenarios. This change of mind was at least partly the result of an alignment of the scenario of the packaging firm with scenarios of e-commerce propagated in public discourse. The head of public relations stated in an interview in autumn 2000 that the general trend was moving in this direction and to neglect it would be the same ‘as if one wanted to abolish the car’. This was stated just a few months after a first interview, when online transactions were still presented as being of unclear relevance to the company activities. That is to say that the apparent alignment of scenarios of users and designers in this case is less due to a direct interaction between users and designers but rather to a common orientation to the actual agenda.18

The social expectations as represented in an agenda may also exert a social pressure to meet those expectations. Designers or customers supported or offered scenarios or certain features of a scenario because of the expectations of others, even if they personally had not been convinced that they would be used very much.

At the time of the series of interviews a central feature developed at software company B had been a software module enabling auctions to be held on the e-marketplaces. Whereas the head of the development department showed a firm conviction concerning the overall potential of e-marketplaces, he did not hold auctions to be a particularly promising feature of e-marketplaces in the business-to-business environment in the near future.

Apart from the fact that they are part of it [our portfolio] and we hold them to be an interesting feature, our surveys showed that auctions are something which does not work very well online. It makes no profit. It’s a business model which will take some more time (Head of Development, software company B, 10/2000).
Nevertheless, auctions as a scenario of use were high on the agenda for electronic marketplaces in 2000. Those wanting to comply with the agenda had to offer this feature.19

Others, for example customers or shareholders, would doubt the overall competence of the actor who did not support the latest technology which was considered promising by many or a feature which had become a self-evident part in the ideal image of a new technology. Consequently, the actors had to measure up to these new trends, which were sometimes as unpredictable as the above-mentioned processes at a local level. Since both designers and potential users orientated themselves towards the agenda, an agenda is an important source of indirect coordination between users’ scenarios and designers’ scenarios.

Who are the Users?

Because of the high dynamic of the scenario evolution, not only were the most promising scenarios of use uncertain, but it was also unclear who would be the users. The actual users of already realized e-marketplaces were known in part. Feedback and ideas from these users were taken up in the development process. The question of who would be the future users of the marketplaces or new functionalities, which were in development at a certain point in time, was still rather uncertain. The head of development of software company B stated that it was not possible for the firm to make reliable forecasts about promising markets or customer sectors in one year’s time.

It is difficult for us to make definite estimations for certain markets, a lot relies on trial and error. And also all the others (…) nobody acts differently in our field. I wouldn’t believe anybody who said that they were calculating via a scientific marketing procedure what the composition of customers will look like in one year’s time (Head of Development, software company B, 6/2000).

Furthermore, the scenarios of use underlying software design were to a large extent dominated by use models, whereas user models were often rather diffuse or uncertain. Designers described the typical roles users were supposed to occupy in these scenarios. The question of who would finally occupy these roles was, however, quite often not specified. This

applied especially to standardized elements of the technology. But also in the case of components which were produced for specific customers, not all future role-takers for all relevant user-roles were well defined.

A scenario of use does not necessarily comprise just one user role, but quite often a number of different user roles (see above), which are often associated with different user groups. Use models and user models are only loosely linked. Typically use models guiding software design were defined with certain user groups in mind. For example, software company A had envisaged certain industry branches, hardware and software retailers, pharmaceuticals, car manufacturers or the building industry, as potential customers for the wholesale scenario and internet service providers and mutual savings banks as customers for the hosting scenario. But sometimes the envisaged groups turned out to be less interested than anticipated, whereas others showed more interest than expected. That is to say that once the roles are defined with certain role-takers in mind and inscribed into the technology, these roles or use models are sometimes detached from the original user models. Other user models were then envisaged which could also fulfill these roles. In other cases user models were differentiated or extended, because certain subgroups of the envisaged user groups turned out to behave differently or new unexpected user groups appeared. However, the use model was not affected by this.

Furthermore, user models were defined in more concrete terms for the roles of users who were supposed to enter into a customer relationship with software company A. For other user roles, for instance operators of shops or buyers in the shopping mall scenario, no specific user models were defined.

Circle of Uncertainties: Limits and Dilemmas for User Involvement and Strategies for Coping

When considering the dynamics of the evolution of scenarios, software and e-marketplaces as well as the appropriation and learning processes we find that some of the preconditions of participatory design approaches are not fulfilled.
Limits to the Involvement of Future User Groups and Representatives of Future Users

The involvement of users in the strict sense of the word means that people are involved who are or who will be actually using the technology in question. This assumption is a basis of many participatory design approaches that have predominantly focused on the design of individual software applications for organizations. However, as has just been shown, the future users of the software, and partly also of specific e-marketplaces in development, were often not clearly defined or were rather uncertain. Sometimes the actual users turned out to be others than those expected.

The involvement of 'real' future users to strengthen the influence of users' interests and users' perspectives and knowledge in the process of technology design is not indispensable. Approaches to user involvement, especially those concentrating on usability aspects, partly rely on the involvement of people who are considered as being representative of the assumed future users. To be considered a suitable representative does not necessarily imply being part of the actual future user group. But if user models are fairly vague, it is difficult to determine who would be representative of future users, since experiences, knowledge and possibly practices and habits should be representative of the real future users. Furthermore, if user involvement is reduced to usability aspects in the case of innovative technologies and uncertain scenarios of use, the outcome is sometimes technologies which are easy to use, but which are never used (Degene 1995; Liddle 1996). This problem can also be seen in the case studies.

Software company B tested the usability of the software tools it developed for managing the marketplaces and the presentations of the members on the basis of the assumption that the future users of these tools would be 'lay people' who were not interested in bothering with html codes. However, the use model as well as the user model underlying the assumption turned out to be largely wrong. Many of the members were not willing to accept these tools because they preferred more individual presentation options. When the tools were used, they were mostly not used by 'lay people' but by professionals. The firms did not manage their presentation in-house as had been expected by software company B, but delegated the task to professional agencies.

Limits of Evolutionary Models and Iterative Design Concepts

Design and Use Phases Revisited

A number of authors who have considered evolving user patterns and scenarios of use that cannot be anticipated sufficiently for innovative technologies proposed (co-)evolutionary models of technology development, use and user participation that tackle the problem of how to match technology and users' requirements via recursive learning processes (Akrich 1998; Callon 1993; 1995; Monse & Weyer 1999, 98; Rammert 2001, 1; Rip & Schot 1999). Accordingly, evolutionary approaches to user involvement advocate iterative procedures of user involvement based on a cycle of alternating design and use phases (Floyd et al. 1990; Pasch 1994; Rauterberg et al. 1994). However, drawing on the case studies presented, I would argue that these models make assumptions which are not necessarily fulfilled.

The assumption of alternating design and use phases is a rather idealized concept. Designers, especially in dynamic technological fields, do not pause while waiting for potential users to adopt and domesticate the latest version. It is empirically not possible to differentiate between separate phases of development and use, since development cycles and relevant phases of use proceed side by side.

When considering the design and appropriation processes in the case studies, we find a number of successive design phases connected to the different software versions. In parallel to these design processes the realization of a number of e-marketplaces took place as well as the establishment of user groups and user practices which had, however, not yet stabilized. Experiences concerning user groups and use patterns that existed when the development of version X of an e-marketplace software was started were referred mainly to version X-2, less to version X-1. The dynamic is more adequately described by the concept of a permanent and parallel co-evolution of technologies, applications and use patterns (Kubicek & Schmid 1996; Williams, Slack & Stewart 2000, 114 f.). Consequently designers cannot rely on stable user groups, demands and user practices, since these evolve. On the other hand, users do not necessarily face stable technologies. This is not only due to successive versions of a certain technology, e.g. a software application. These are for some time at least, quite stable. But if we are
not only referring to a plain software version but to what is actually used—a specific e-marketplace—we find that its concrete form is not only dependent on the underlying software but on the actual and changing behaviour of other users or on changing content.

If development cycles expanded over a relatively short period compared to the time it takes users to evolve new patterns or scenarios themselves, or vice versa, we could say that designers may rely on relatively stable user groups and user requirements or users on relatively stable technologies. With established technologies this may be the case. However, with the case studies presented here it was not.

This is exemplified by the development of software, e-marketplaces and use practices as reported by software company B. Except in the case of the first one, the development phases of the different software versions mostly took less than a year. The technical realization of a specific e-marketplace took about three months. Yet the realization of a specific marketplace, including the establishment of a community of users, took about nine months.

It takes about nine months to establish a community or to absorb an existing community in our e-marketplaces. This is the only thing that cannot be achieved under pressure. It is possible to develop software under pressure (...) but until a community is established or merged with an existing community, until the cooperation with specialized publishers and news providers goes smoothly, nine months must be reckoned with (Head of Software Development, software company B, 10/2000).

The establishment of a community is not the end of the development of use practices. The establishment of institutionalized use practices and the integration of new business processes in the existing technical and social structures usually takes much longer.

Dynamics

As long as real users exist—even if they might be users of the penultimate version of the technology in question—or potential users are identified, these may be involved in the development process. Some concepts of recursive learning processes, particularly those underlying evolutionary approaches to user involvement, implicitly or explicitly assume that, via several cycles, designer and user scenarios come closer and may be stabilized (Floyd et al. 1990; Monse & Weyer 1999; Pasch 1994; Rauterberg et al. 1994). An approximation to users’ conceptions is most likely if these are changing relatively slowly. Even if the scenarios and requirements of the involved users or potential users might not be the ultimate requirements, they may at least lead step by step closer to convergence. However, if elements on both sides change—designers’ conceptions, technology, users and users’ conceptions—this is not the only possible outcome. If both sides adapt or react to new elements, ideas and experiences, processes of stabilization on the one hand and the formation of new scenarios, technical elements and user patterns on the other are in competition. Any new technology or user pattern may provoke new patterns of use or new scenarios and technologies. The outcomes are then opening processes rather than closure processes and stabilization. This is what we found in the two case studies. The creation of new technological variants, new scenarios of use and new modes of use prevailed over the abandonment of former ones. Stabilization was not yet in sight. This leads to interesting and innovative new technologies and scenarios of use, but it will be rather difficult to anticipate how these will be accepted by future users. Quite importantly, the dynamic was not limited to incremental modifications of the scenarios, but was rather of a radical, non-continuous type. This stands in contrast to established technologies and use practices, for which a lot of effort is necessary to transcend common patterns of scenarios, practices and technologies—sometimes referred to as second-order or double-loop learning (Hoogma & Schot 2001; Hoogma et al. 2002; Schot 2001).

Strategies for Dealing with the Circle of Uncertainties

The case studies were characterized by a highly dynamic co-evolution of technology, applications, modes of use and user groups. A highly dynamic co-evolutionary innovation process leads to a dilemma for approaches to user involvement in design processes that can be summarized as a circle of uncertainties. At the point when an innovative technology is quite malleable, the future users have often not yet been determined, relevant user groups may change over time, user requirements may evolve and also scenarios of use are not stable.
Figure 2. Circle of Uncertainties

If at least one variable was determined, this could serve as a starting point for deducing the other two variables, possibly in a gradual evolutionary way. This is for example assumed by many participatory design approaches starting from a given set of users.

If this condition is not fulfilled from the outset the dilemma may be tackled via three strategies. Each strategy is based on the explicit decision to delimit one of the variables and thereby to reduce the given uncertainty at will. Accordingly, each strategy carries specific risks of failure. Each strategy allows for specific strategies of user orientation. Which strategy is appropriate is partly connected to specific prerequisites, for example the user and use models.

The first strategy is based on the decision to start from a specific use model and to shape the technology accordingly, hoping that there will be users who consider the scenario appropriate for their needs. Designers will hardly build a use model without an idea of who the potential users may be. Nevertheless, as shown in the last section, the user models may be rather vague or may change, while the use model is kept. Drawing on a term coined by Biervert et al. (1994) I will call this strategy 'selection of users'. In this case a possible strategy for user involvement would be usability tests with representatives of users who take the use model as given.

The second strategy starts from a specific group of users. This strategy includes the development of standardized technology targeted at a clearly circumscribed group of potential users reflecting the specific requirements of this group or a customer-specific technology development. Here it is possible to involve users or user representatives in the design process. Designers and user representatives may then develop appropriate scenarios, and specific requirements of this user group may be ascertained. Customer-specific developments are rather costly and therefore only appropriate for some possible user groups. For designers the development of standardized technology implies the risk that the targeted market turns out not to be as rewarding as expected. For example, because e-commerce or a specific type of e-marketplace is not widely taken up in the target group. Even if designers concentrate on already existing customers or markets this is no guarantee for success, if the most promising user groups and markets change over time (Bower & Christensen 1995).

The third strategy starts with the technology, while keeping user and use models fairly flexible. This applies to the development of standardized technology which is not targeted at very specific user groups or to the development of modules and elements. Different user groups may implement these elements in different ways for different scenarios of use. With dynamic and open technology fields this strategy might even be a more promising approach to user-oriented technologies than user-centred and participatory design. The approach of 'building in' ever more user and context specific requirements concentrates on the design phase while neglecting the use phase and the possibility for users to adapt these systems (Williams, Slack & Stewart 2000, 111, 116 ff.). With this strategy users are 'involved' in the shaping of the technology in the use phase(s). Furthermore, an involvement of users in the design is possible either in the form of usability tests or through the adoption of unexpected modes of use that are created by users in follow-up design phases.

The three strategies are ideal types which do not completely exclude each other. This is exemplified in the case studies. Software company A followed a combination of strategy three, with elements of one and two.
Software company B followed a combination of three and one. Quite importantly, the appropriateness of strategies is dependent on the scenario and the user groups.

Both software companies had followed the recent, dynamic development of the e-commerce field and were very much aware of the uncertainties connected to the future scenarios, user groups and technologies. Both companies tried to keep the core technologies flexible. When software company A revised the third version of the basic software it sought to keep it highly open and flexible, in the hope that it would still be competitive in three to five years’ time. Then further developments could be reduced to complementing modules and customer-specific elements. Since the company could not anticipate at that stage what would be the most promising scenarios, users and user requirements in the future, flexibility and openness were the only strategy to prepare for future requirements. The same could be said for software company B.

As for the strategy to align the scenarios and the technology with actual users, the two companies followed diverging strategies. Software company B relied predominantly on the first scenario-centred strategy of a ‘selection of users’. The software development was guided by the scenario and then appropriate user groups were identified. In cooperation with partners from different branches, it looked at whether these branches would represent appropriate user groups, that is to say whether it could identify appropriate role-takers for the different user roles. The opposite strategy of customizing the software to the requirements of specific users was avoided as far as possible.

However, this was a central strategy for software company B. ‘Selection of users’ was an element of its strategy too, since in some cases new role-takers had to be found for roles which were originally expected to be taken by others. Yet once customers were found, a second design phase followed. The basic software was customized to the individual requirements and complemented by specific elements.

The different strategies were targeted at different use models and, accordingly, different types of customers. Software company B focused on medium-sized companies, such as the aforementioned producer of packaging machines, which considered e-commerce an interesting new business feature, but not a core element of its business strategy. Consequently, the company would not have been willing to spend large sums on individual software developments. The builders’ merchant on the other hand had planned to make e-commerce a central element of its future business strategy and was therefore willing to incur high costs.

Conclusion

User involvement and, more generally, the interaction between designers and users is a highly relevant element of innovation processes, as has been seen in the case studies presented here. However, for highly dynamic innovation processes user involvement is no guarantee for eventually generating user-appropriate technologies, that is technologies that are useful, usable and used. The difficulties and complexities encountered with highly dynamic innovation processes can be interpreted as deriving from a highly dynamic co-evolutionary process. In evolutionary terms user involvement approaches aim to integrate the future selection environment into the design or variation process. However, if the selection environment is co-evolving with the variation process as well as other processes, especially innovation dynamics at the societal level, the future selection environment is difficult to anticipate and stabilization and alignment is not the only possible outcome.

The situation is similar to the problem discussed by Collingridge (1980, 25), that future impacts of innovative technologies are often uncertain or cannot be anticipated at all. He proposes that in this case maintaining a high degree of flexibility and openness for future revisions is a more adequate strategy than concentrating on one promising option. The situation here is possibly even more complex, because it is not only the impacts that are unknown, but also the future form of the technology as such, as well as the users and modes of use. Nevertheless, regardless of whether designers start from a scenario, a specific user group or a technological function, it is probably as important to maintain possibilities for future revisions as to adapt the technology or system very precisely to the scenario, the user group or the specific function. It is probably not
possible—and maybe not even necessary—to follow this strategy for the whole life cycle of an innovation, if we assume that integration into societal structures and stabilization is eventually to be expected. Yet in the case of inherently malleable information technologies the possibility of applying this strategy is quite favourable.

References


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Notes

1 I would like to thank Bernhard Truffer, Jochen Markard and Dieter Rothenberger for their critical discussion of the paper, as well as the participants of the Summer Academy 2001 at DLsberg for their comments on an earlier version of the paper.

2 When using the term 'technologies' I am implicitly referring to artifacts which would be better described as socio-technical systems or constellations, for example specific e-marketplaces. For ease of reading I prefer to use the term 'technology'.

3 The dynamic is indicated by the number of business-to-business e-marketplaces operated in Germany. In autumn 1999, 34 business-to-business e-marketplaces existed, half of them had been founded only that year. In the middle of 2000 the number had risen to 133 marketplaces, at the beginning of 2001 to 216 (Bertelsmann Research 1999; 2000; 2001).

4 So far the concept of scenarios of use or user representations has been applied predominately in studies on the shaping of technology (Akrich 1992b; Hofmann 1997; McLaughlin 2001; Rommes 2001; Schot & de la Bruhze 2003).

5 This concept draws on the concept of a scenario, script or socio-technical network as has been developed by Akrich, Latour and Callon (Akrich 1992a; 1992b; Callon 1986; 1993; 1995; Latour 1992). However, the concept of a scenario of use as it is applied here differs in some aspects from the concept of a scenario or script as applied by the authors mentioned. Firstly, it clearly denotes only scenarios on the conceptual level, whereas materialized scripts as already 'inscribed' in the technology are not subsumed. Secondly, the concept of roles and role-takers is less understood as an analogy of a film script (Akrich 1992a) or a text written by some and read by others (Woolgar 1991). Rather it draws on a sociological, interactionist understanding of roles and the concept of typification as introduced by Schutz (1967). Besides scenarios of use, which are most important in this chapter, we may also consider 'scenarios' encompassing not only users but also other groups involved in the functioning of a socio-technical system, for example the roles and role-takers responsible for the maintenance of a system. For a more detailed discussion of the concept see Konrad (2004).

6 Here I refer to a narrow conception of usability approaches. User-centred design approaches, including the analysis of user tasks and user requirements, are also considered as part of usability approaches, particularly in recent usability concepts (Hammond, Gross & Wessen 2002; Rosson & Carroll 2002, 1 f.). What is said of participatory design approaches in the next paragraph applies to a broader conception of usability approaches.

7 However, since the 1980s or early 1990s, when many participatory design approaches were developed, the importance of everyday users and of standardized technologies in general has increased in the field of information technologies. With the spread of open networks this is still more the case, as the internet users are ever more difficult to identify and to locate.

8 The importance of local social appropriation processes relying greatly on direct interaction among users is described by Truffer, Harms and Wachter (2000) and Hoogma and Schot (2001).

9 These are specifically important for media-type technologies supporting communication or transactions, where common practices and understandings are particularly essential for the functioning of a system (Kubicek & Schmid 1998). The relevance of common practices and rules of behaviour for e-commerce is indicated by the fact that a lack of common business practices was mentioned most often as an obstacle for e-commerce in two representative surveys among German companies in 1997 and 2000 (Müller & Schoder 1999; Straub & Schoder 2000).

10 For a more thorough and detailed analysis see Konrad (2001; 2004).

11 The first marketplace had to be operated by software company A as a demonstration project since they had no customers yet.

12 Nevertheless, in some cases these were necessary to obtain important customers.

13 In addition to the scenarios of use, the concept of the designer-customer relationship also changed. The first customers who wanted to present their company in a marketplace were offered a package of software tools to manage their presentation. Around the turn of the year 1999/2000 a new business model was presented as highly promising in public debates: application service providing (ASP). This means that customers rent software, which is located on specific servers accessible via the internet, paying a monthly or yearly fee. This business model had not been envisaged before by software company B. While not directly affecting the scenario of use, this business model implies a higher degree of standardization of the software and therefore also the user model.

14 At a more concrete level, the conception of how the information marketplace should look, as presented by the head of public relations of the packaging firm, differed from those of software company B in a couple of aspects (see Konrad 2004).

15 To speak of the company scenario in general is a simplification, because different subsidiaries and different departments of the company favoured diverging scenarios. However, the general argument here—the evolution of user scenarios—is unaffected by this.

16 For a theoretical analysis of the evolution of new scenarios of use drawing on the concepts of typification of Alfred Schutz and schemes of Jean Piaget, see Konrad (2004).

17 A similar argument is made by Williams, Slack and Stewart (2000, 134) concerning the mutual reinforcement of suppliers’ visions and presumptions concerning technology and users. However, these mutual reinforcement mechanisms are not limited to supplier arenas, but, as shown in the following, may also comprise actors on the user side. If we consider the mutual reinforcement concerning more general concepts, such as promising technologies, application domains and scenarios of use, the coordinating role of these shared concepts, or agendas, for innovation processes may then expand to actors as heterogeneous as developers, policy makers and regulators, venture capitalists, researchers and consultants.

18 Furthermore, learning or cognitive appropriation processes at the individual level or the local level of the packaging firm were probably also relevant in this case.

19 This is probably not an isolated case. In a representative survey among 1,300 German companies in 2000, 54% of all participating companies which already had a website or planned to set one up in the following year stated that for competitive reasons they would have to offer e-commerce even if this would not generate any relevant turnover (Straub & Schoder 2000). Furthermore, the target which was most frequently achieved was an improvement of the company image. Moreover, from the fact that only a quarter of the companies operating a website...
stated that they had developed an explicit internet strategy it can be deduced that most of the companies were simply jumping on the bandwagon when they developed an internet presence.

This dynamic of a development trajectory which, via a number of design and use cycles, may either lead to convergence and irreversibility or to a recurrent reorientation of the trajectory is described in a model by Callon (1993, 1995). The (in)stability of these coordination processes most probably also depends on the actors' expectations. If designers expect a stabilization of technologies, users and modes of use, they will be more likely to take into account the requirements of users, because they expect these to be the future requirements too. If they consider these requirements, it is more likely that these users will actually be the future users. On the other hand, if designers expect that today's requirements will be of little relevance in the future, they are instead looking for new variants for new user groups.

The notion of a circle of uncertainties in the context of innovation processes has been used by Rammert (2001, 6) in a more general sense.

See the critique of Collingridge's strategy by Rip, Misa and Schot (1995, 7).