

## INTERMEDIARIES, USERS AND SOCIAL LEARNING IN TECHNOLOGICAL INNOVATION

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This paper explores the role of intermediaries in the development and appropriation of new technologies. We focus on intermediaries that facilitate user innovation, and the linking of user innovation into supply side activities. We review findings on intermediaries in some of our studies and other available literature to build a framework to explore of how intermediaries work in making innovation happen. We make sense of these processes by taking a long-term view of the dynamics of technology and market development using the social learning in technological innovation (SLTI) framework. Our primary concern is with innovation intermediaries and their core roles of configuring, facilitating and brokering technologies, uses and relationships in uncertain and emerging markets. We show the range of positions and influence they have along the supply-use axis in a number of different innovation contexts, and how they are able to bridge the user-developer innovation domains. Equipped with these insights, we explore in more depth how intermediaries affect the shape of new information and communication technologies and the importance of identifying and nurturing the user-side intermediaries that are crucial to innovation success.

*Keywords:* Intermediaries; social learning; innovation; users.

### Introduction

Innovation around the Internet in the last few years has stimulated considerable interest in the role of users and user-communities in innovation processes. These currents have resonated with ideas such as “open innovation” among networks of innovating firms. As the research community is trying to come to terms with these

emerging trends, we argue that it can very usefully learn from earlier work on ICT-innovation, the role of users in innovation and the activities of intermediaries in linking of users into supply-side innovation.

There is a huge range of intermediate actors working in between the developers of technologies and their eventual users who do not fit in to conventionally opposed categories such as “producer” and “consumer” or “developer” and “user”. These intermediaries include retailers, media companies, telecom platform operators, advertising agencies, market research agencies, distributors and management consultancies.<sup>1</sup> (Bessant and Rush, 1995; Howells, 2006). These actors are key players in what new sociology of markets (Callon, 1998; MacKenzie, 2006) calls an “economy of qualities” by which the needs and desires of consumers are shaped and products adjusted (Callon *et al.*, 2002). This shaping — say between the early demos of pop-music artist and the song in the stereos of his eventual audience — in many ways constitutes technology through packaging, distributing, assembling, quality assurance and testing and branding. Likewise, the “consumer” is shaped by intermediary actors involved in segmenting, persuading, selling, advising, studying and regulating the consumption and in doing so, creating attachment to consumed items, for instance to a branded juice bottle coming from particular orange grove. Instead of an “invisible hand”, it is these very tangible networks that are recently raised to the fore as being able to shape, respond to and maintain seemingly abstract characteristics such as styles and tastes (Hennion, 1989; Callon *et al.*, 2002).

However, innovation studies are particularly interested in new types of products and novel uses, and not just rather stabilised markets and products such as orange juice and pop-music. The complexity of intermediation in innovation networks tends to be underestimated by both practitioners and socio-economic research alike (Stewart, 2007). A major problem with knitting together these networks is that the players involved often have very little previous contact with and understanding of the situations of other players in a nascent market. This can be especially acute between technology developers and the eventual customers and users of the systems. In such uncertain markets, intermediaries play a crucial role, but the mechanisms and contexts of their mediation can be fragile and difficult to predict (Russell and Williams, 2002; Hyysalo, 2004; Williams *et al.*, 2005).

In this paper, we focus on these types of settings and actors we term *innovation intermediaries*: actors who create spaces and opportunities for appropriation and generation of *emerging* technical or cultural products by others who might be

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<sup>1</sup>And equally venture capitalists, lawyers, trade associations, promotional agencies, export agencies, standards agencies, regulatory agencies and so on.

described as developers and users. The aim of this paper is to give a framework for addressing the question on how new markets and networks are formed between suppliers and users in the development and implementation of new technologies, at times when existing intermediary institutions may not have relevant expertise or interest. We do this by reviewing the literature on intermediaries and an illustrative review of some of our case studies.

We proceed by first giving some background on how innovation intermediaries are currently understood, and then outline our social learning in technological innovation (SLTI) approach that highlights the importance of use and innovation by users in multi-cycle, multi-level innovation processes. We then map some of the typical intermediaries operating between supply and use, discuss the roles intermediaries play in the shaping of new technology and how they are in turn shaped. In the final sections of the paper, we use SLTI insights on the crucial differences that are in user-involvement in a range of innovation contexts and discuss what this entails for the role and identification of intermediaries. We emphasise how the emergence of appropriate intermediaries is in itself a key part of the overall socio-technical innovation process and user involvement. We equally stress how some of the crucial intermediaries tend to occupy a fragile position that requires nurturing and protection.

### **Innovation Intermediaries**

Innovation intermediaries can be identified by their engagement in activities in which they gather, develop, control and disseminate knowledge, collect and disseminate financial, technical and institutional resources such as the support of users and sponsors, and attempt to regulate uses, developments, participation and the actions of others in the innovation networks. The extent to which they do this depends on their own access to resources and their connections in the “constellation” of actors associated with a particular project or emerging market. These intermediaries can be organisations, or individuals grounded in an institutional, technical and often physical context that facilitates their activities. They attempt to configure the users, the context, the technology and the “content”, *but they do not, and cannot define and control use or the technology*. Two crucial features of the environment that innovation intermediaries engage with are: (1) the unpredictability of technological change, market organisation and user uptake and (2) an absence of existing linkages between potential users and suppliers that need to be created in order or innovation to occur and be sustained.

Research on intermediary organisations in innovation such as consultants and other technology brokers has been developed since the early 1990s (Bessant and

Rush, 1995; Hargadon and Sutton, 1997).<sup>2</sup> During this period, models of innovation were rapidly changing from fairly linear ones to ones emphasising uncertainty, shifts and the complex interactions between multiple actors that comprised the iterative series of developments jointly resulting in innovation (Freeman, 1979; Kline and Rosenberg, 1986; Williams and Edge, 1996; Van de Ven *et al.*, 1999). The changes in the models were spurred by the growing body of findings about user initiated innovation (e.g., Pavitt, 1984; von Hippel, 1988) and the continued innovation in use (e.g., Rosenberg, 1982; Gardiner and Rothwell, 1985). Analyses of the then relatively new and rapidly evolving fields of robotics and computerised manufacturing technology showed that the talk of diffusion of generic systems matched poorly with the extensive adaptations and further developments done by adopter organisations (Fleck, 1988; 1994; Bessant and Rush, 1995). In short, when the producer company lost its position as the privileged source of innovation, it became urgent to understand how the knowledge from a range of actors flowed into the innovation process.

Consequently, the activities and roles of various intermediary organisations such as consultancies, state development agencies etc., have received attention in various literatures, including innovation management (e.g., Hargadon and Sutton, 1997; McEvily and Zaheer, 1999), literature on innovation systems (e.g., Stankiewicz, 1995) and science and technology studies (Procter and Williams, 1996; Van der Meulen and Rip, 1998; Callon *et al.*, 2002). This interest has also been spurred by the development and growth of knowledge intensive business services (KIBS) that play important intermediary roles (Howells, 2006). Diffusion studies have stressed the importance of change agents and opinion leaders in the diffusion of innovations (Attewell, 1992; Rogers, 2003), and emphasise the work these actors do in tailoring and adjusting the innovation to different audiences and promoting re-inventions that make it more appealing for each particular audience (Rogers, 2003). From a more generic perspective, social network studies have also begun to show the importance of network “bridgers” in not only transferring knowledge across structural holes in networks, but as an important source of innovation themselves (Burt, 2004).

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<sup>2</sup>We chose to use the concept of intermediary as it has become an established term in the literatures on innovation and organisational studies (e.g., Bessant and Rush, 1995; Howells, 2006) and deployed also in science and technology studies (e.g., Hennion, 1989). Throughout our discussion, we emphasize how these intermediaries change intent, meaning and form of technology through their acts of mediating it between various actors. In this capacity, they are mediators in a sense described by Latour (2005), who uses the term intermediary to denote actors who do not change knowledge or object that simply flows through it. This discrepancy in usage between certain actor network literature and most other literature is unfortunate but there is not much that can be done about it anymore.

However, to our knowledge there are few studies and frameworks that address in detail the whole range of intermediaries and intermediation that transform technologies, uses and qualities in both use and development domains, and explicate the bridges and gaps that exist in different *ecologies of intermediation* between design and uses. National innovation systems literature aims at this (Lundvall and Johansson, 1994; Stankiewicz, 1995), but only at a fairly coarse granularity, and without analysis of the detailed processes of the learning economy and the substance of this learning (Miettinen, 2002; Stewart and Williams, 2005).

We thus turn to the SLTI framework that allows us to explore in more detailed fashion the dynamics through which intermediaries affect ICT innovation in different socio-economic contexts and constellations of actors with different capabilities, commitments, cultures and contexts (Williams *et al.*, 2005). The framework directly addresses situations of high uncertainties and information asymmetries involved in “choosing” or “creating” the right intermediaries for inventive technologies or new groups of users. There is simply more at stake than enabling or preventing the technology from diffusing from suppliers to users.

### **Social Learning in Technological Innovation**

SLTI is a relatively recent approach developed out of the tradition of “social shaping of technology” approach (Williams and Edge, 1996; MacKenzie and Wajcman, 1999) by combining it with insights from other research fields.<sup>3</sup> The development of new technology is characterised as an uncertain process, characterised by complexity, contingency and choice (Williams and Edge, 1996). It places particular design episodes within multiple, overlapping cycles of development and implementation (Rip *et al.*, 1995), focusing on understanding the coupling between technological and social change, and the difficult and contested processes of learning that are integral to innovation.

This analytical framework is socio-technical, and accounts for both technological innovation, and the processes of negotiation and interaction that occur between diverse networks of players attempting to make technologies work — “fitting them into the pre-existing heterogenous network of machines, systems, routines and culture” (Sørensen, 1996).

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<sup>3</sup>SLTI draws on a range of research fields: cultural studies of artefacts and marketing, engaging with the consumption of goods and services; innovation studies stressing non-linear and heterogeneous innovation processes; and work on organisational learning and the reflexive activities of players in the innovation process.

Many contemporary technologies, particularly ICTs, are not discrete self-contained systems, but “configurations”, consisting of layers of components, systems, applications and content, bringing with them partially formed routines, concepts of users and uses, rules for use and other non-technical features. Fitting the existing and the new together involves often long and drawn out relationship building and stop-start processes of institutional learning and forgetting that occur across a constantly changing network of actors.

To understand these processes, the SLTI approach draws together a range of generic mechanisms in which we see learning-through-innovating occurring: learning-by-doing and using in the often trial-and-error processes of appropriating new technologies (Arrow, 1962; Rosenberg, 1982); learning-by-interacting (Lundvall, 1988; Cornish, 1997), as new technologies bring diverse networks of players together; and learning-by-regulating (Sørensen, 1996), as particular players attempt to assert their power through non-technical rules and regulations shaping the “rules of the game” from everyday use to state policy. These processes — and more detailed learning dynamics within them — not only shape technology, but can have a dramatic effect on the structure of the innovating network, the constitution of the organisations involved, and the identities of the actors (Hasu, 2001; Russell and Williams, 2002; Hyysalo, 2006). Many of these actors and institutions are end and intermediate users, and other societal actors such as governmental and non-commercial institutions. SLTI stresses the importance of giving more detailed accounts of how these actors play key roles in innovation in the long term.

The SLTI approach is thus not a narrowly cognitive, social or modelling process, and the term “social learning” is used in a very different way to its usage in education and social psychology such as that of Bandura (1977). In the socio-technical usage, social learning denotes the *reflexive* yet often negotiated, complex and “political” processes in transforming environment, instrumentation and work, that reach beyond single groups of actors. This usage also differs from more generic conceptions of social learning in evolutionary economics (e.g., Wolfe and Gertler, 2002), where learning tends to be taken as an explanatory term for growth in learning economy (Lundvall and Johansson, 1994) without its micro-scale mechanisms and social dynamics being examined (von Hippel and Tyre, 1995; Miettinen, 2002).

Central to the innovation processes identified in SLTI are the creation and evolution of *representations of users and uses*, and their *translation* into technological designs and social actions. These processes are fundamental in shaping design and relationships in the constellation of actors. Far from being solely an up-front “user needs and requirements capture” process conducted by designers, creation of these representations continues throughout multiple generations of product development. The “user” is a complex idea: on the one hand, it is a category used by engineers and developers to refer to those who may eventually use their systems, and on the other

hand, it can refer to a range of other individuals and institutions, imagined and real, some of which begin to develop various kinds of engagement with a technology over time.

There are many different “users”: intermediate users, end users and proxy users, all of whom can play more or less active roles in articulating their own requirements, and in the creative process. The ability and willingness of developers to engage with these users, and for users to engage creatively with developers is thus central to success, but often extraordinarily difficult. We use the term intermediate users to refer to a particular sort of *intermediary organisations* that adopts a technology for their customers or employees (but generally involving a relatively few individuals within that organisation). Examples are mobile phone operators, banks, retailers who sell a service based on a technological system to end users, and any firm adopting a system to be used by their employees. A subset of these are innovative “content developers” or content service providers, for example, a service provider such as a broadcaster or publisher offers both a delivery platform and added content for end users. These organisations can be seen as supply-side or demand side within an evolving market according to the particular case and particular point in the innovation and implementation process.

Studies of innovation clearly show that there is a whole range of innovation activities that take part on the user side, particular in early moments of technological change and adoption. Even with comparatively stable technologies and use situations, there can still be innovation by users. Thus, the SLTI approach highlights that many activities and situations that are not conventionally included in the definition

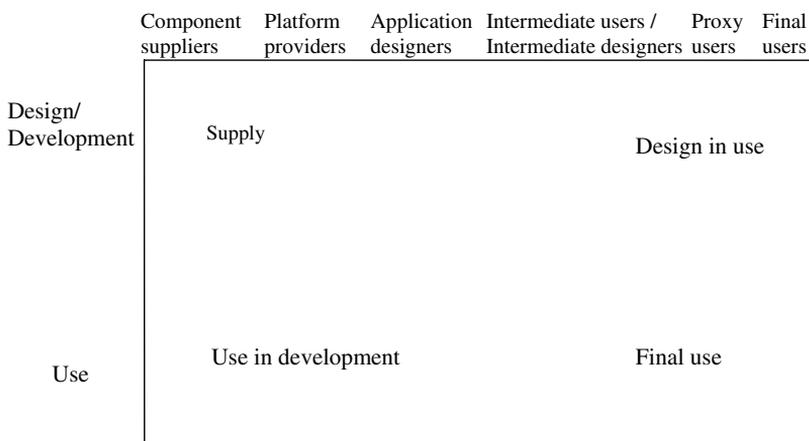


Fig. 1. To account for the users in innovation we need to clarify how they are positioned between primary supply organisations and primary user organisations of a given technology as well as in regards to developing and using (adapted from Williams *et al.*, 2005).

of innovation, are in fact important moments in innovation cycles. This conceptualisation of the role of users in the innovation processes involves moving the focus of innovation studies from the supply-side towards the demand-side. In particular, we need to examine how constellations of players, intermediaries and intermediate and final users, constitute the demand side in the early stages of innovation. This includes examining how they develop uses for technologies and their role in feeding back their experience, practice and innovation to the supply side over multiple long-term innovation cycles.

### Mapping Intermediaries Between Supply and Use

Howells (2006) describes the range of different players that mediate various aspects of innovation. Bessant and Rush (1995) go further by elaborating how the range of consultants between suppliers and users of automated manufacturing technology (AMT) each had somewhat different competencies, motives, pricing, clientele and the niche that they occupied in this innovation context. None covered the range and depth of functions that met the needs in emerging areas of innovation. In a similar fashion, Hargadon and Sutton (1997) show how the knowledge-brokering role and industry position of design consultancy IDEO changed as it accumulated more know-how about different industries.

Before moving deeper into the intricacies in the positioning of various intermediaries, let us tentatively sketch some typical intermediaries and their position between supply and use.

Figure 2 illustrates the differences in profiles and in consequent mediating capacity of intermediaries. Some intermediaries, such as maintenance organisations and

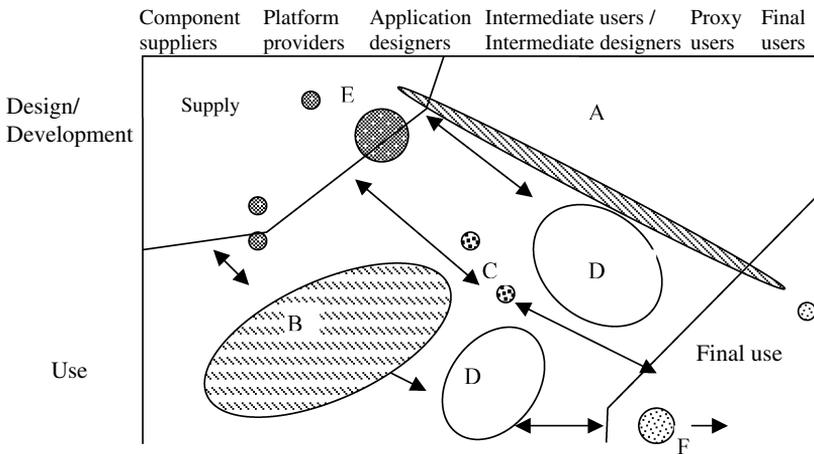


Fig. 2. The niches of some common types of intermediaries between supply and final use.

technicians, have long “reach” between supply and use but may be fairly limited in terms of content they cover. (in the figure marked by A). As we found in our study of a health monitoring technology for the elderly (Hyysalo, 2004), technicians can have direct contacts with developers, intermediate users, other supplier representatives as well as end users, but their mandate, interest and expertise remains limited to reporting and fixing technical shortcomings and technical assembly, thus leaving aside questions of marketing, instructing, learning, new uses etc. The “width” of their mediation thus tends to remain narrow, unless their task description gets expanded to include other tasks such as user-training, as happened at one point in the case studied (Hyysalo, 2006).

An example of a broad width but substantially shorter reach into both use and supply side would be retailers (in the figure marked by D) and Telecoms operators (in the figure marked by B). Such actors exercise competence and power over multiple technologies and several key aspects of technology such as pricing, distribution channels, marketing, branding, feedback from other intermediaries and end users etc. Yet another sort of intermediaries are market research and usability consultants (in the figure marked by C), that accumulate, refine and transfer (second order) information both about products as well as of their usages. The most studied type of intermediaries are various supply-side industry consultants (in the figure marked by E), who may play central roles in augmenting innovation at supply end and passing inter-industry insight. These include engineering and business consultancies, public research agencies, industry contractors, accreditation agencies etc. (e.g., Bessant and Rush, 1995; Van der Maulen and Rip, 1998; Howells, 2006).

Intermediaries at the supply-side business to business environment tend to be more numerous, visible and formal than those close to the end-users of consumer goods. Amongst the use-side intermediaries (marked by F in the figure) those involved in buying and the paying for new technology are relatively more visible than those that help people use, fix, maintain and update their technologies. The latter are often less formal and may perform their work as peer favours or sidejobs to their formal work. As a consequence, it is these intermediaries that are particularly systematically neglected or underestimated. It is indicative that discussions of such peoples as “local experts” (Stewart, 2007), “technology mediators” (Okamura *et al.*, 1994) or “tailors” (Trigg and Bodger, 1994) remain absent from technology management volumes that abound with literature on product champions, business angels etc., at the supply end.<sup>4</sup>

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<sup>4</sup>Although they have attracted more attention in marketing around opinion leaders, word of mouth and viral marketing (Stewart, 2007).

The asymmetric distribution of knowledge amongst actors has the result that people and organisations that hold intermediary positions tend to accumulate increasing amounts of the kind of knowledge that flows in from their various clients and projects, whereas other actors do not. The net result is that less central actors (such as new supplier entrants, end users) face difficulty in assessing the landscape, position of different actors within it as well as the means at the disposal of those actors to hinder or enable the prospering of new technology. In fact, such structural holes and knowledge asymmetries are crucial in the existence of the very niche of many actors, and we return to discuss this theme in more depth below (Burt, 2004).

What our diagrams let us articulate is that there is a range of “short and fat” intermediaries whose high breath but short reach allows linking fairly homogeneous actors that are already quite close to each other in the supply network, or in user communities. There are also “long and thin” intermediaries that have high reach in linking users and suppliers through specialising in a particular service, but consequently only limited breath of mediation. However, it appears to be quite hard to be a “long and fat intermediary” with both broad scope and long reach. Certain large-scale retail organisations (such as Wall-Mart) show that this is possible in mediating incremental innovation, but in more uncertain and evolving markets examples known to us are few and debatable. The reason may be simple. Intermediaries are boundary spanners conveying delicate, sticky knowledge, conducting negotiations that need trust, setting rules of use that require legitimacy and configuring technologies and so on all of which requires specialist knowledge. It may be hard to scale up these capabilities up in both breadth and range given that real-life intermediation is a fluid and delicate phenomenon.<sup>5</sup>

In general, what the early innovation studies accounts of intermediaries largely failed to address was that established intermediaries can also be roadblocks, and expensive and intransigent gatekeepers, with services, repertoires of knowledge and activities, that can *fail* the innovation process in a range of ways.<sup>6</sup> Let us illustrate this with an example in the area of video games for girls and women. The established industry of games publishers and events, magazines aimed at existing market for these products is almost wholly devoted to promoting particular range of game genres to a young male market. For a firm which identified a market for “girl games” and is able to engage with potential users in the design of attractive products, these intermediaries are not a resource but a hindrance, and necessitate re-casting

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<sup>5</sup>Thanks to Robin Williams for this formulation.

<sup>6</sup>In contrast, other work from evolutionary economics and related perspectives has discussed the way in which innovation systems may operate as a selection environment, weeding out challengers that do not fit with the established technology regime (e.g., Nelson and Winter, 1977; Dosi, 1982; Rip and Kemp, 1998).

the products and making new connections to non-traditional intermediaries — such as general retailers, museums and TV broadcasters. And also in real life such a shift proved necessary for success (Stewart, 2004).

## What Do Intermediaries Do in Social Learning?

Perhaps the clearest way to approach the range of activities in which intermediaries are involved is to first look at some taxonomies that exist in the literature (Bessant and Rush, 1995; Hargadon and Sutton, 1997; Howells, 2006). Howells suggested 10 functions for innovation intermediaries, even though he admits that individual intermediaries seldom play separate functional roles, but contribute and develop a range of different activities important in innovation. In a similar vein, Bessant and Rush (1995) list six bridging activities through which consultants bridge suppliers and their customers. These activities develop not just through working on one-off projects, but by developing long-term capabilities of the individual firms, and of the market as a whole. These consultants tend not to work only on a triad basis but are generally involved in several relationships.

These typologies of functions and activities of intermediaries approximate the generic terrain of intermediaries. However, as Bessant and Rush point out, there is work to be done in charting the roles that intermediaries play within these functions and activities.<sup>7</sup> All these intermediary roles involve knowledge creation, translation

Table 1. Functions and activities of intermediaries.

Intermediary functions (Howells, 2006)	Bridging activities (Bessant and Rush, 1995)
1. Foresight and diagnostics	1. Articulation of needs, selection of options
2. Scanning and information processing	2. Identification of needs, selection training
3. Knowledge processing and (re)combination	3. Creation of business cases
4. Gatekeeping and brokering	4. Communications, development
5. Testing and validation	5. Education, links to external info
6. Accreditation	6. Project management, managing external resources, organisational development
7. Validation and regulation	
8. Protecting the results	
9. Commercialisation	
10. Evaluation of outcomes	

<sup>7</sup>Bessant and Rush (1995) identify four generic roles, those of transfer of knowledge, sharing knowledge across user community, acting as brokering to a range of suppliers and diagnostic/innovation role in trying to identify what end users actually want.

and dissemination. They are all also about making a connection between memory/experience and future visions, and instantiating these two in current actions of the people whose actions are mediated by them. When we try to differentiate fundamentally different facets in the actions of intermediaries, three distinct roles in social learning become salient: facilitating, configuring and brokering. These more generic roles are better applicable to the range of intermediaries in social learning processes between supply and use. We anchor our discussion at the intermediary roles that cybercafés played in the mid-1990s when the Internet was relatively new — characteristically user-end intermediation (Stewart, 2000).<sup>8</sup>

### **Facilitating**

Facilitating can be described as providing opportunities to others, by educating, gathering and distributing resources, influencing regulations and setting local rules. Facilitation involves “creating spaces” of various types: social (communities, networks), knowledge (skills and know-how resources), cultural (positive images), physical (a place or equipment), economic (providing funds), and regulatory (creating rules to guide activities and reduce uncertainty). In the case of cybercafés, the role of cybercafés and their managers as facilitators is clear (Stewart, 2004). The cafe is a convenient and open, friendly physical space, conveniently located, with an informal atmosphere, in which the managers had developed based on their initial concept of users and uses. They provide the computers and software, and the training and advice that is needed to use it. The expertise and knowledge that they supply to the users is as important as the actual technology. They take the headache out of computer use, and create a flexible environment where people can work, play or learn at their own discretion. Training and informal support and the creation of an atmosphere that encourages interchange between users are important facilitation devices. Another important facilitation role is running trials that generate new interactions between users and suppliers, and importantly, make the activities and results visible in wider to outside actors. Of course, the cybercafe is a literal space, but we have seen a huge growth in industry-user fora, user and industry networking groups, conferences and seminar series, various government and private funds for experimentation and interaction, and creation of regulatory spaces providing temporary protection from regulations and rules usually applied in a particular environment.

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<sup>8</sup>Cybercafe and Internet centre innovators took computers and the Internet out of offices and homes, and put them into a new context, introducing them to new users and providing a new setting for existing users. What was considered at the time a fleeting and unimportant configuration of the technology involved considerable local service innovation, and has since become an extremely popular and successful service model.

## Configuring

The creation of the space that facilitates appropriation by others and influencing the perceptions and goals of sponsors and users involves active processes of *configuration*. This includes configuring technology, often in a minor way; creating and configuring content; setting rules and regulations on use and usage, prioritising uses, the goals and form of projects, and the goals and expectations of other members of a network. Configuration is not only technical but also symbolic: intermediaries provide an interpretation of the product, the meanings that people give to a technology, but they also listen to users, sponsors and suppliers and attempt to modify the project to reflect their interpretations.

The managers and owners of the cybercafes in the cases did not invent the cybercafe — computers in cafes were not a new idea at the time of this study. However, they had to make decisions about what a cybercafe was, what was relevant to them and their business, and to their customers. This business model led to the configuration of the space, rules of use, configuration of computers, and policy on what users to encourage or discourage. This included the appropriate types of uses: games, the Internet, office service etc., for their café and clientele (Laegran and Stewart, 2003). However, this was not necessarily a one-off configuration: it changed rapidly as customers introduced their own ideas of what a cybercafe should be, bring practices in from outside, and evolving them from within. Some cafe managers really took on board the need for constant re-configuration and experimentation while others evolved a much more stable model, with little space for user-led change. The cafes also attempted to configure their customers' usage of the cafe through information, training, and informal learning, and introduce new users, for example by running classes for women or older people. By encouraging new uses and new users, they are, of course, encouraging people to spend more time in the cafe, but also making sure that they can appeal to more people, and help customers diversify their use. Of course, in order to do these types of activities intermediaries such as cybercafés and their managers have to gain legitimacy, but this can be self-fulfilling if their configuration activities are successful.

## Brokering

The third activity of intermediaries in social learning processes is brokering. For example, intermediaries act to raise support for the appropriation process from sponsors and suppliers. They set themselves up to represent appropriating individuals and institutions, and negotiate on their behalf. Intermediaries need to broker entry of new sponsors or suppliers into their project in order to defend the space they have helped to create, and make sure that they increase their access to resources and knowledge and can maintain influence over rules and practices. Some of the

brokering activities can be around the features and functionalities of new technologies, directly communicating needs and requirements of users and the possibilities and conditions of change of the suppliers.

In the cybercafes case, the manager of one community cybercafe had a strong role as a broker. The cafe came about as a result of his relationship with the funding council, the local community groups, sponsoring companies and local and national politicians. The project was rather outside the mainstream community project, and certainly not a business for which he could get a bank loan for, so his negotiation with sponsors, as suppliers of equipment, money, prestige was the only way to make it happen.

Brokering is certainly one of the most direct ways that intermediaries can bring users and suppliers together, but as this example shows it is equally important in bringing other important actors into the local innovation network, and maintaining their commitment and interest, while at the same time communicating the importance of the particular innovative process to their interests. One of the key balancing acts they have to manage is maintaining the openness of their facilitation activities in the face of the brokering activities: after all brokering is rather a heterogeneous bridging position than representing a particular interest.

In the case of the cybercafes, one set of intermediaries — the managers — were involved in all three processes, and similar functions, such as training, all played a role in them. While many intermediaries may focus on type of activity, particularly in stable environments, the dynamic and unpredictable nature of innovation can lead them to conduct all three. Intermediaries that are likely to be most successful can enter into and balance different activities without constraining the innovative activities of their clients, be they adopters or suppliers. The affinities between the intermediation by cybercafés and their managers in early 1990s and present day bounded socio-technical experiments such as living labs are noteworthy.

### **Pre-Domestication, Power Games and Fragile Intermediaries**

There is a range of ways which intermediaries influence *the evolving shape of technology*. First, when “local experts” and “tailors” do work of brokering, facilitating and configuring, they prefer certain options and suppress others in their effort to cater a system that is practically useful and usable for the particular user or organisation as was evident in both cybercafé and health-monitoring cases. In turn, this work tends to rely on other intermediaries, such as the products of service and technology suppliers, specialist magazines, web-pages etc., and eventually translates into supplier offerings. By doing so, intermediaries are engaged in *pre-domestication* — influencing what would be an appropriate target for the ongoing development of technology, what could be the appropriate goals and motives for using it, and making

technology appropriable in their practice. This ordering of a potential development arena can grant them a position for informal learning by regulating (cf. Sørensen, 1996).

While flagging the importance of enriching and shaping of the technological offer, power and influence issues need to be recognised. Enrolling other players means selling the technology to them. Distributors, operators etc., have their own perception of user needs, and have different interests and incentives than the supplier or end users in promoting some products and not others, in pricing, branding and in aligning products. The technology thus gets framed for intermediary audiences in addition to its assumed final consumers. The product, especially widely distributed content products like games or books, has to be first sold to intermediaries such as a distributor to ever reach the final consumer. Making technological products or services appeal to intermediary audiences affects it beyond sales arguments or other “wrapping” and tends to cut into features, functionalities and look of the product. For instance, in games development small companies view the publishers as their primary customers, and anticipate their selection processes alongside (or even instead of) that of end-gamers. The assumed norms and extrapolations over previous behaviour of key institutionalised intermediaries thus channel design already before it ever reaches them directly (Kalhama, 2003; Eskelinen, 2005).

Intermediaries often work hard to make themselves obligatory points of passage (Latour, 1987). Commercial firms may do this as the basis of their business model (Burt, 2004), but other intermediaries, such as trade associations or user groups may also do this in an attempt to established a strong bargaining position for their members. In the domain of IT for example, the Gartner Group has established a key role in setting up expectations for the future of a software application sector, becoming guardians of community knowledge and thus a key mediator in shaping the behaviour of suppliers and users (Pollock and Williams, 2008). However, it is a delicate balance — they must remain accountable to those they service and represent.

The above dynamics get more complex through the uncertainty regarding markets and users’ preferences for new technology prior to its actual usage (Hyysalo, 2003; Williams *et al.*, 2005). The need for or effects of different framings of technology are not readily visible at the outset to any of the parties. Images of users and customers become “currency” that is proffered and sold to establish and contest business cases (Nicoll, 2000). Indeed, the ability of intermediaries to cut the cake is dependent on how convincingly they can argue their importance and hence, their vision of the user and the buyer. This is not unlike the way intermediaries offer assembly and maintenance services that convince the users of images of a technology that is too cumbersome or impossible for users to handle themselves.

It is common to use a range of more-or-less publicly available (often grey literature) sources such as newspaper headings and consultancy reports as “external” legitimizing devices for arguing the case for one’s own technology and vision about the own and user domain development, as well as doing one’s best to influence them. However, because these images circle and contest one another, “real user data” such as that from usability studies tends to be “hard currency” (Nicoll, 2000) in comparison to market studies and other inferred proxies. Various trials, pilots and demonstrations become instrumental for different parties arguing their case and relevance.

By the same token, it needs to be underlined that some potentially very useful intermediaries operate under rather adverse conditions, as their mediator roles hinge upon corporate policies and reward structures that have a bearing upon what roles people can take on. Research on two formal roles, sales teams and technical support staff is illustrative. Williams and Proctor (1998) found that IT support staff had the closest ongoing relationship with users, and clearest awareness of problems, and knowledge of on-the-ground innovations in use. However, these were also the people most distant from the future product designers within the supply sector. In the same token, the sales people were seen as bridges to developers, but mostly talked with purchase people, and not with end users. Also the incentives for conveying information to product development tend to be lacking: sales teams are rewarded on the basis of the deals they close, not on the potentially helpful R&D information they may glean from customers. Reward structures that would encourage side bets relevant to social learning may also prove rather difficult to set in place without undermining the effectiveness of sales-based structures.

This tangle gets more tricky when the sales are handled by different organisations: getting such sales staff to sell a conceptually new product is one thing, getting them to do this in a desired manner is another. In the health-monitoring case, the supplier continuously struggled to ensure that the various sales peoples had adequate understanding of their product, targeted preferred customer segments, did not make inadequate sales promises and transferred more needy customers to supplier’s sales people who had sufficient expertise. Even more formidable problems persisted in getting them to glean and pass on information about customers (Hyysalo, 2004). In the words of the company president:

*“Since [our new customer support and maintenance person] started, it has turned out that our retailers, partners, and assemblers haven’t really provided us with information about how the device works in actual use. Neither do they always know how the device should function . . . Here is the one employment that has most effectively paid for itself” (Interview with the company president 17.9.2001).*

This quote also introduces another issue: intermediary roles are often carried by individuals. While established intermediary organisations can institutionalise intermediary actions, in new areas these are likely to be vested in individuals who have expertise and bridging links into other areas of activity, gathered by earlier career moves, or through some other personal contacts and experience. The person talked about in the quote above had held a range of similar roles in maintenance, training and marketing in several other companies in safety-phone business for over 10 years. Our further interviews revealed that over a two decades there had been (just) three people who had remained in the safety phone technology business by circulating between different suppliers in sales, assembly and maintenance and management posts. These three had become the living repositories of the accumulated learning on how to best deploy and hold in operation over 50,000 systems and various new kinds of entrants to this clientele. (Hyysalo *et al.*, 2003).<sup>9</sup>

One of the reasons to emphasise *social* and *learning* in technological innovation lies in the need for actors to participate in the ongoing circulation between development and use. Intermediaries are continuously forced to learn about, filter, translate and reflect on information, products and practices of other actors to remain relevant and thus in existence. An important part of this learning is about how to relate and manipulate as well as how to dominate and control other actors around them. But how this ecology is set up can differ dramatically depending on the innovation context in question; this sets the relationships between development, use and user-involvement in innovation.

### **Innovation Contexts, Social Learning and Intermediary Roles**

Attending to the variations in innovation spaces is one of the key features of SLTI framework (Williams *et al.*, 2005). There are remarkable differences in the degree of freedom for innovative actors, particularly users, to try out new things, exercise choice, or act reflexively (Bessant, 1991). At one extreme, users remain relatively “passive” with little choice over adoption. This is the much criticised “linear” innovation model, where users appear as consumers of pre-formed technologies, where their only choice is between use and non-use of a technology. Each member of a supply chain can thus be regarded as an intermediary between the preceding and following player, and end users only have contact with the

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<sup>9</sup>We note anecdotally from years of observing specific domains of innovation that such circulation within limited space is common, as individuals move between firms and projects acquiring increasing expertise and knowledge about the domain specific roles inside a supplier organisation, promotional agency, sales of other company, and procurers in a user-side organisation.

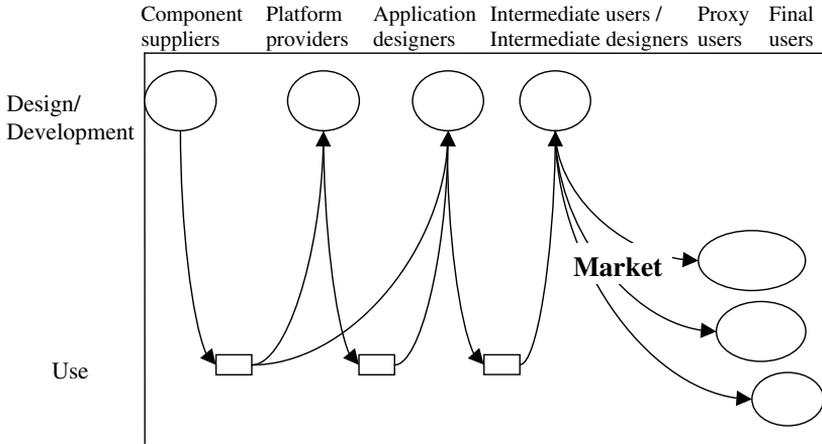


Fig. 3. Pipeline linear development and diffusion (adapted from Williams *et al.*, 2005).

final player in the chain. Suppliers and end users are separated and user preferences and innovations are signalled at arms length through a market back to suppliers. We can display this graphically (Fig. 3, adapted from Williams *et al.*, 2005), which also clarifies that such market signals may not be very clear, and certainly not to the whole market, and invisible to firms deep in the supply network (Fleck, 1988).

The early years of the health-monitoring project 1993–1999 illustrate well the kinds of intermediaries that tend to be involved in mediating between development and use in linear context. Literature on the users’ domain, two market research studies, a design and usability study, pilot-trials and a branding company fed representations of “the user” and appropriate design decisions to the developer company. After the launch of the product, intermediate users such as assembly people from vendors and managers of rest-homes for the elderly became key user-side intermediaries that helped to configure the system and re-configure the associated work practices, facilitated the everyday uses and problems and brokered contacts and information between the everyday usages and suppliers’ ongoing development efforts. The component and platform providers were seemingly bracketed off “behind” the company building the health-monitoring application, but in reality the configuration of the system brought issues around platform and integration with other technologies back in, giving rise to intermediary activities by assemblers and local small vendors (Hyysalo, 2003, 2004) (Fig. 4).

Through a range of case studies done as part of the European *Social learning in Multimedia* project in the late 1990s, Williams *et al.* (2005) distinguish four other modes of user involvement in innovation: the evolutionary “pick and

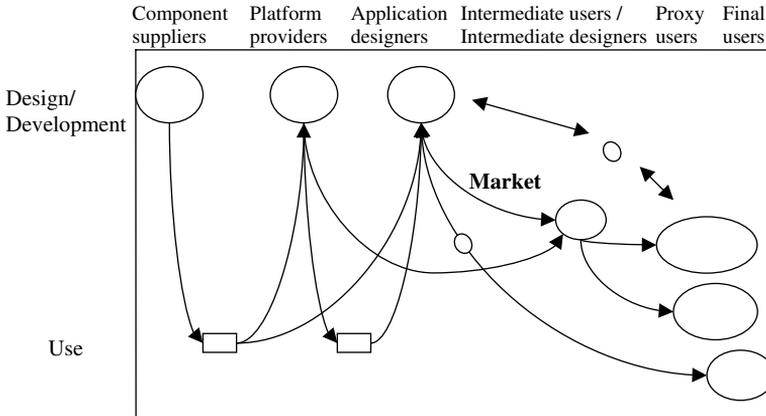


Fig. 4. Intermediaries in linear development and diffusion; the knowledge of the user is mediated significantly by various intermediaries to application developers and user-end intermediaries tend to be involved in configuring and facilitating the usages.

mix” model; user-centred design; the innofusion and appropriation model and a technology experiment.

**Evolutionary pick and mix context**

The “pick and mix” model is closest to the market model, where intermediate and end users are able to pick from a huge range of available generic technologies, and configure them together. This model is characteristic of the current ICT market, where intense competition, flexible standard platforms such as common operating systems and internet protocols, and open programming interfaces and tools make it relatively easy, and very cheap to configure.

Here, we see the emergence of a range of intermediaries that configure technologies and uses, attempting to bridge the “market gap” from suppliers to user and vice versa. The cybercafés illustrate how well in many cases the user-side intermediaries play crucial roles in configuring, brokering and facilitating users, even establishing wholly novel intermediate-design/intermediate-use locations. The tentative depiction of various kinds of intermediaries given in Fig. 1 matches closest the situation in a pick ‘n’ mix context (Fig. 6); the ecology of intermediaries is comprised of multiple types of actors and is likely to vary from one product to another so that different sets of intermediaries are involved in mediating the various platforms, components, content and applications.

In this environment, intermediaries can be very sensitive to end users and often have to respond rapidly to their demands and innovations, but equally, end users can be confused and particular reliant on the work of intermediaries.

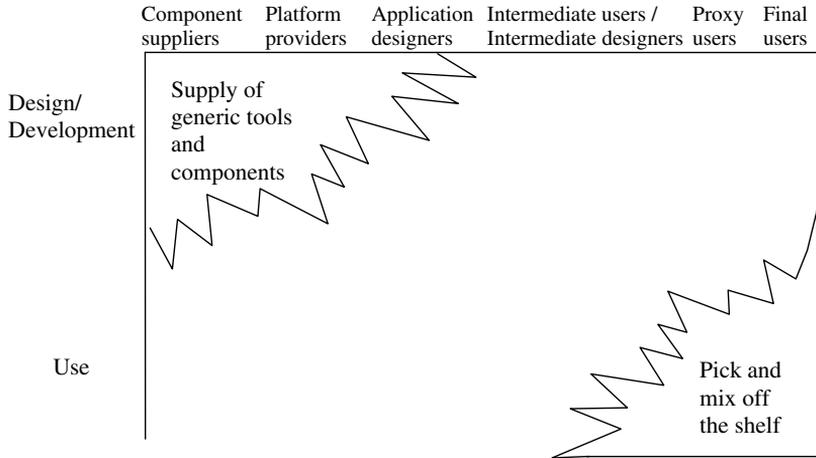


Fig. 5. Pick and mix model where there are large clusters of generic offers at the supply end and the configuration of off-the-shelf components at local user sites. (adapted from Williams *et al.*, 2005).

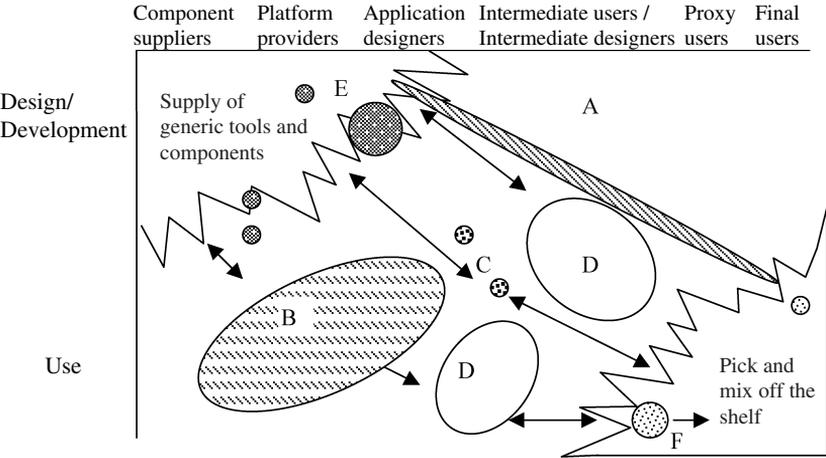


Fig. 6. The niches of some common types of intermediaries illustrated in pick and mix constellation.

**User-centred design**

There are a number of design and development processes that involve users in more active ways. The first of these is user-centred design processes in which end-users — or more correctly “proxy users” who represent eventual users — are put at the centre of design. Detailed studies of users, along with negotiations with proxy or intermediate users of their “needs and requirements” help those creating new technologies or integrating systems to create products and services that closely

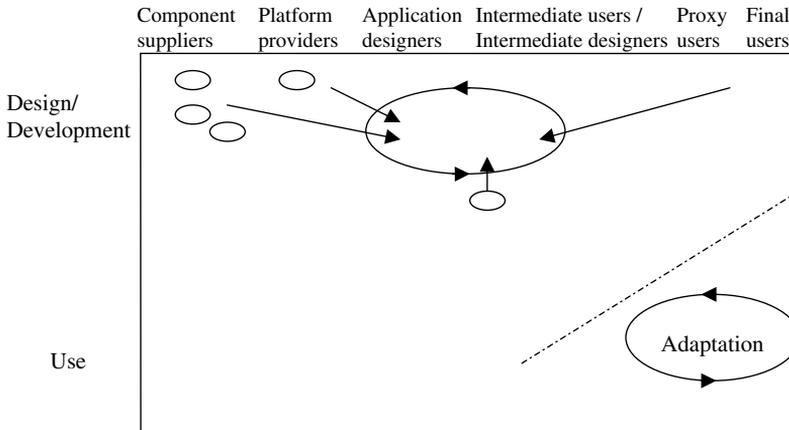


Fig. 7. User-centred design. A more dedicated application is built with the help of proxy users (adapted from Williams *et al.*, 2005).

match the existing culture and activities of specific users (e.g., Norman and Draper, 1986). However, the majority of user-centred design projects focuses on design work prior to market launch and neglects the activities of a range of users in actually getting the “finished” product to work (Stewart and Williams, 2005). It also neglects the processes of “generification” that usually follow specific design, as developers actually try to remove all specific user features to create a generic product suitable for larger markets or adjust it to suit nearby market niches (Pollock *et al.*, 2007). Depicted graphically in Fig. 7, the key issue here is that proxy-user involvement is limited to initial design stages of the innovation and the cross-over between developers and users does not continue as strong after the product has been launched.

An example of user-centred design activities occupying a short periods in a relatively linear innovation process can be found in the health monitoring case in 1995 and again in 2000 when the developers and industrial designers visited user sites, took social scientists onboard to mediate information from users and consulted some users over their design ideas. The presence of these kinds of professional intermediaries for mediating use to design is typical to user-centred design, as is organising it in projects (e.g., in concept design) both in terms of company practice and more academic literature (Preese *et al.*, 2002; Dix *et al.*, 2004; Benyon *et al.*, 2005). In the Fig. 7, this is portrayed by the actor below the design project contributing to it.

### The Technology Experiment/Evolving Co-Design

The Technology Experiment (Fig. 8) is a mode of collaborative innovation that involves a range of players, such as government agencies, intermediate

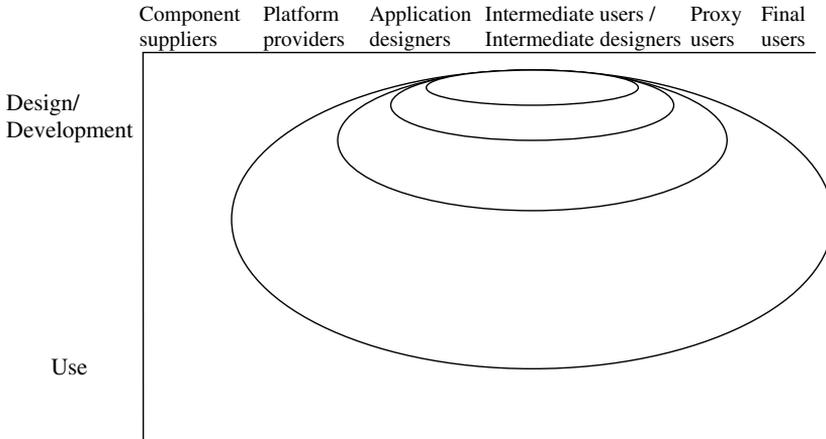


Fig. 8. Technology experiment/evolving co-design project (adapted from Williams *et al.*, 2005).

users, developers and suppliers (Jaeger *et al.*, 2000; Brown *et al.*, 2003), often deliberately constructed into a constituency by certain key players to provide a framework of ideas and resources to shape innovation (Molina, 1995). Here, development of the technology and building the market go hand in hand: these are continuing activities and there is no clear boundary between technology development and diffusion. There can be progressive broadening of the socio-technical constituency of involved players as barriers between technology developers and users are eroded, and the boundaries of the project expanded (Williams *et al.*, 2005). Such a process can be based on co-design between designers and users, comprise an open-source type development or at least temporally involve users fruitfully (Hyysalo and Lehenkari, 2003). The success stories coming from this mode have recently sparked enthusiasm about the potential of user innovation communities, particularly in software, pro-amateurs in sports and user-designers of the gear of some professions such as surgical equipment. (von Hippel, 2005; Leadbeater, 2006). There is also a long history of participatory design initiatives (Greenbaum and Kyng, 1991). However, a technology experiment can also merely verify the chosen technology model negotiated early on in the process. This partly depends on the degree to which core players are open to innovation by users, and the points at which configurations are locked into place (van Leishout *et al.*, 2001; Hoogma *et al.*, 2002).

In the evolving co-design, intermediaries and intermediation between development and use can differ dramatically from the previously discussed innovation contexts. Let us illustrate with a user-initiated design project to build electronic-health record for diabetes professionals where a group of lead-users enrolled an IT company to join their effort. Their collaboration lasted intensively from 1996 to

2002 and through three development rounds (Hyysalo and Lehenkari, 2003). What is striking for us here was the lack of and irrelevance of intermediaries one encounters in other innovation contexts such as market research and probing, marketing and advertisement agencies, usability consultants etc. In effect, the co-located design between users and developers bridged over *the ecological niches of these actors* between development and use. In addition to design knowledge, the users conveyed very exact understanding of the markets, buying dynamics and so and were active in marketing the application. The user-designer community also held great depth and width also in terms of addressing typical user-end intermediary activities: for instance, people in neighbouring hospitals conveyed their expertise to newcomers to the use of the program. Indeed, in evolutionary co-design, informal intermediaries and local experts can be the key intermediaries.

### **Innofusion and domestication**

The final SLTI model draws on two concepts: domestication and innofusion. The “domestication” concept (Silverstone *et al.*, 1992; Lie and Sørensen, 1997) captures the practical, symbolic and cognitive dimensions in the selection, deployment and adaptation of new technologies. The innofusion concept (Fleck, 1988) highlights the technological innovation done in these processes, emphasising that key innovation moments occur in and are controlled by the user environment. The interactions between networks of users and designers are not continuous or controlled, but are constantly changing, as different sets of actors in the constellation of interested parties are temporarily linked. This innovation context differs from user-centred design in that it is in users’ sites, not in prior design where key user involvement occurs and that their innovative inputs can last for years. Innofusion differs from evolutionary co-design in that the relations between producers and users may not be collaborative, purposefully co-ordinated or co-located (Fig. 9).

Examples of innofusion and domestication context can be found in various types of technologies. A recent well-documented case comes from enterprise resource planning systems (ERP) in educational sector (Pollock and Cornford, 2004; Pollock and Williams, 2008). The developer companies made initial customisations to systems built for other sectors. The early customers were involved in further specification of the modules, contents and functionality of the system. Their IT-staff worked further on the system including configuring the package in-site within its myriad of built-in parameters, more extensive customization through re-writing of code, selective appropriation of the package as well as integrating add-on, bolt-on and extension software. Some of these modifications became later incorporated as parts of supplier’s generic package, while some became discarded and kept up only locally. In contrast to this drawn-out innofusion interchange between the supplier

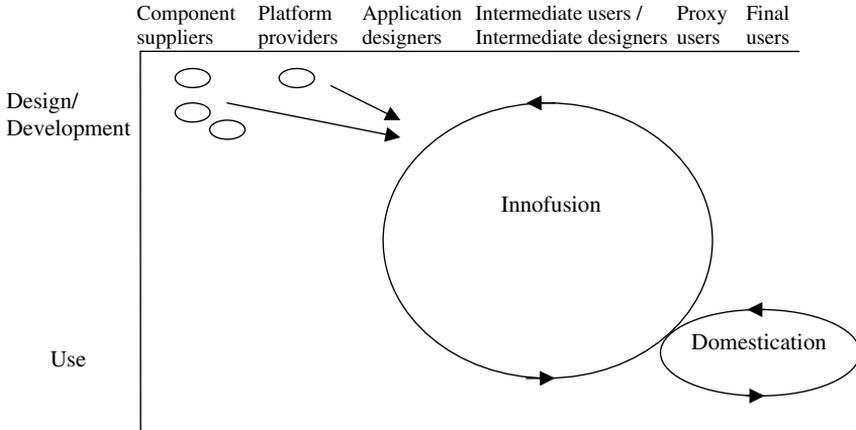


Fig. 9. Innofusion and domestication model (adapted from Williams *et al.*, 2005).

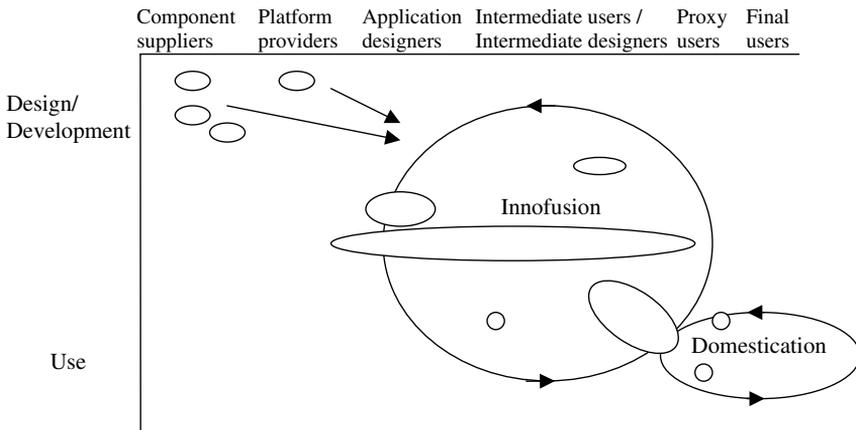


Fig. 10. Intermediaries in Innofusion-domestication context. A range of supplier-dedicated, more independent formal consultants and informal intermediaries tend to be involved.

and early users, many later adopters were effectively confined to more limited domestication in-site having little chance to shape the evolution of the generic system more to their liking (Pollock *et al.*, 2007). Also in this innovation context, a range of intermediaries can be observed (Fig. 10).

There are highly influential industry analysts such as the Gartner Group that actively shape the expectations of the market place, criteria used to select ERP providers, criteria to measure supplier performance etc. (Pollock and Williams, 2008). Closer to the user clients' IT-staff and implementation consultants act as intermediate users that configure the systems, facilitate its usages and broker

information between different groups of people. Local expert users tend to act as user-end intermediaries making the system work, not least through helping to work around the often clunky ERP.

Empirical studies show further that over time a particular project, technology or constituency can move between different innovation contexts, for example, when a technology moves from an exploratory phase to generification for a mass market (Hasu, 2001; Hoogma *et al.*, 2002; Hyysalo and Lehenkari, 2003; Williams *et al.*, 2005; Osterloh and Rota, 2007). For instance, in the diabetes case outlined above, the IT-company withdrew from evolutionary user-involvement in 2001–2002, but later had to engage in innofusion-domestication type further development (Hyysalo, 2006; Miettinen *et al.*, 2008). As these kinds of shifts occur, particular intermediaries can switch between formal and informal roles or some intermediaries can be sidelined in favour of others.

### **Conclusion: Recognising Key Intermediaries and Nurturing Fragile Ones**

Within the context of the user-designer relationship analysis in the design literature, and the supply-side – demand-side approach in innovation studies, we highlight the importance of new intermediaries. These actors emerge to bridge gaps in newly forming networks, facilitate contacts and experimentation by passing knowledge, they act as a store for collective memory, and shape technologies, visions, knowledge and relationships. These activities are central to the social learning that occurs in innovation: the processes of creating new relationships and knowledge that accompanies the creation of new technologies.

The SLTI approach allows bridging research on intermediaries at the appropriation end with the more plentiful literature on supply end intermediaries in innovation and organisation studies. Applying this framework to the study of intermediaries underscores five issues that cut across extant literature as well as our case studies over the years:

(1) *There is an ecology of intermediaries in and between supply and use.* The highly visible supply-side intermediaries such as foresight agencies and management consultants, and the easily identifiable middle-ground agencies such as marketing research and usability consultants tend to overshadow the often more informal yet just as crucial intermediaries at the user-end of the supply-use relation. Intermediate users, local experts and “tailors” facilitate, configure and broker systems, usages and knowledge about systems and their deployments, helping users to domesticate them and suppliers to respond to actual, realised uses.

(2) *Pivotal importance of uncertainty and learning.* When it comes to innovative new products no established line-up, or a smoothly functioning chain of

intermediaries can be assumed, in contrast to stable products such as orange juice or pop-music. One cannot assume that extant intermediaries will be the relevant ones for successful innovation. Gradual adjustment and learning about the appropriate form of the technology, actors to be involved, expectations concerning its use practices, complementary services, delivery models and other support tends to be more important than the effectiveness in carrying out these activities that established intermediaries may have.

(3) *Important differences are due to innovation contexts.* The knowledge and actions needed to bridge supply and use depends greatly upon the nature of the technology in question, but also on the innovation context where the technology develops. Sustained co-design between developers and users can render obsolete the need for in-between niche players such as market researchers and usability specialists that are more likely to hold pivotal importance in the success of innovations developed within linear context.

(4) *Identifying and nurturing best suited intermediaries is the challenge.* Charting the intermediaries related to a particular innovative project is a recognised part of what technology managers do. Where they lack analytical clarity is in charting the ecology of intermediaries to gain a sense of how each key aspect of a given technology and key user segment — the market — becomes mediated. Identifying and finding means to sustain people who perform important mediating roles — inside or outside their formal organisation — tends thus fall by the wayside and, according to our findings, if the benefits or appeal of intermediating some line of technology or in some organisation wane, these people are quite likely to shift location.

(5) *User involvement in innovation has a wide range as does its relationship to and dependency on intermediaries.* Ranging between everyday domestication and massive evolutionary opensource development projects, user involvement in innovation has myriad of forms and outcomes. Some of the practices that get discussed in the literature as user innovation may be better understood as user-end intermediary activities in performing the key intermediary roles we identify: configuring, facilitating and brokering new technology. Moreover, in some innovation contexts hardly anything about users' innovative solutions and practices in using technology is conveyed to technology supply without intermediaries. Yet, in others, direct user-involvement can bridge over the niches typically occupied by for instance market research and usability consultants.

These cross-cutting themes are highly relevant for the presently emerging methods such as Living Labs and various experiments in co-creation as these create new forms of user-involvement and intermediary positions made possible with the current ICT infrastructures and standard platforms. Here too, existing intermediaries

cannot always provide the necessary links to engage potential users in innovation, and new intermediaries need to be found, nurtured or created. One of the challenges remains to avoid making the mistakes of configuring spaces that are dominated by technological considerations and do not allow space for the participation of existing and new intermediaries. There is still considerable work to be done in understanding how intermediaries can be managed at a policy or corporate level, and how they can be prevented from failing.

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