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## **Evolving a regionally based mechanism for the provision of technical knowledge to SMES: Lessons for Policy**

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### **Abstract**

This paper describes and evaluates a pilot project undertaken in the South West of England to develop a computer-based system for facilitating effective technical knowledge transfer to small and medium-sized enterprises (SMEs). It explores the problem of technical knowledge transfer to SMEs focusing in particular on the policy context of this issue. The conceptualisation, development and implementation of the pilot project, called 'e-volve', are described. The failure of the project to develop beyond the pilot period provides the focus for its evaluation. Interview data is collected from system users to identify the main issues affecting the success of the initiative. Key factors concerned with the development of Information Communication Technologies (ICTs) and system membership are highlighted as are a number of institutional and political issues impacting upon the e-volve project. Recommendations relating to both the implementation of technical knowledge systems and associated public policy issues are outlined.

**Keywords: knowledge transfer, technology, SMEs**

## Introduction

The innovative capability of an organisation is contingent not only upon the competence of its human resource, its organisational culture and other internal drivers, but also upon its ability to acquire technical knowledge from external sources. With the progressive shortening of product life cycles throughout the twentieth century, the need to innovate and keep pace with technological developments has become increasingly important to the long term sustainability of many business ventures (Nevens *et al.*, 1990; Cooke and Mayes, 1996), as well as to the economic well-being of regions that rely on such businesses for continued wealth generation. Particularly in markets where competition is intense and where technological progress is rapid, Peter Drucker's (1985) contention that "*every business, to survive, must innovate*" rings ever more true. The need to innovate brings with it the need to acquire the knowledge required for such innovation to occur. Innovation rarely occurs in a vacuum; rather it is sustained through the process of knowledge transfer. Thus amongst companies wishing to maintain or enhance their competitive position within the market-place, the need for timely and appropriate information about available technologies is paramount. This is particularly the case for smaller technology based firms lacking the resources and access to the networks of their larger competitors. The purpose of this paper is to describe and evaluate an initiative developed in the South West of England to facilitate improved access to technical knowledge for technology-based small to medium-sized enterprises (SMEs). Drawing upon extant literature, the paper first describes the problem of technical knowledge transfer to SMEs before exploring the policy context of this issue. The conceptualisation of the 'e-volve' project and its subsequent development to a working pilot project are described. The findings of a

preliminary evaluation of the initiative are presented along with lessons for future policy relating to the support of technical knowledge transfer to SMEs.

### **Technical Knowledge Transfer to SMEs**

A significant body of literature exists relating to the concept of technology transfer and this provides a useful foundation for considering the specific policy problem addressed through this research, i.e. the effective facilitation of technical knowledge transfer to SMEs. Technology transfer can be defined as “*the diffusion of the complex bundle of knowledge which surrounds a level and type of technology*” (Charles and Howells, 1992). Technology transfer is not only the passing of knowledge between ‘inventor’ and ‘innovator’. It plays a critical role in the development of products, processes and services during both the pre-invention phase (including basic research through to development and testing) and the post-invention phase (the subsequent manufacture and marketing of innovations and their diffusion). Thus it involves more than the simple transfer of a tangible product or process technology. For instance, one important aspect of successful transfer is the capability to commercialise new technologies. Nevens *et al.* (1990) argue that companies that lack such capabilities will be ill-placed to develop a competitive advantage over competitors and may even see their existing market position undermined. Thus technological capability is not always enough to succeed in the market place; the existence of the knowledge necessary to take commercial advantage of a particular technology is also critical. Dosi (1985) identifies three categories of technology transfer, highlighting the scope of the process in terms of *what* is transferred:

- *Hardware transfer* - including the transfer of equipment, materials, parts or complete systems;
- *Information transfer* - comprising data, software, relevant documentation, standards and specifications, licences or user guides;
- *Knowledge transfer* – involving less tangible aspects such as an understanding of the origins and potential effects and uses of the technology; the competence to plan, manage and evaluate the technology transfer process; and the ability to adapt and diffuse the technology within the firm.

Thus amongst SMEs wishing to develop their innovative capability, a need exists to be able to identify appropriate technologies (in terms of available hardware and information) and also to acquire the knowledge required to make use of them to the organisation's best advantage. Critically, the ability of SMEs to address this challenge differs from that of larger firms (Balazs, 1996). Within large corporations, the scope of internal activities and the possible existence of in-house research and development capability both provide opportunities for the internal development or intra-firm transfer of technology and associated technical knowledge. In contrast, for smaller firms their relative lack of resources means that in-house R&D is either limited or impractical. As a result, SMEs are generally far more dependent on external sources for both technology and technical advice (Rothwell, 1990; Jones *et al.*, 2000). However, in acquiring technical knowledge, SMEs are typically less well

connected than large firms in terms of their links with Universities and other public research or advisory organisations. This may be for a variety of reasons, such as the actual or perceived costs of collaboration, long lead times (small firms often plan only over the short term, partly in recognition of the competitive advantage provided by relative flexibility), poor access or information about potential technical advice providers, and perhaps the perception of lower relevance of public sector research to smaller firms.

When making decisions about appropriate technologies, smaller firms are also at a clear disadvantage (Balazs, 1996). As well as suffering resource constraints that may limit the technological options available to them, SMEs are generally less aware of technology problems and opportunities as they are only able to draw upon the knowledge of a limited pool of employees. Research indicates that small firms also draw external advice from a more limited range of external sources (Masten *et al.*, 1995; Robertson *et al.*, 1996) making them more susceptible to making poor decisions when acquiring new technology. Bennett and Robson (1999) find that it is the level of personal or institutional trust that determines where firms seek external advice. Their study of 2,474 UK SMEs revealed that relationships with specialist professionals, customers, suppliers and business friends were characterised by high levels of trust and that SMEs consequently tended to limit their search for advice to these sources. However, the study also found that whilst there were relatively low levels of trust in public sector sources of advice, a significant proportion of firms made use of Business Link to access advice. This would appear to suggest a significant role for Business Link in providing a bridge to providers of technical knowledge that small firms can trust (e.g. suppliers and specialist professionals).

Higher Education Institutes (HEIs) are an important source of specialist technical knowledge. Whilst initiatives such as the Teaching Company Scheme and latterly Knowledge Transfer Partnerships have increased activity in this sphere, potential obstacles to transfer need to be carefully managed. A significant obstacle governing the effectiveness of technology transfer relates to goal divergence between knowledge generators and knowledge recipients. Both Burgmeier (1992) and Spann *et al.* (1995) highlight difficulties in HEI-firm and government agency-firm transfers respectively. Both studies come to the same conclusion; that a lack of goal convergence amongst the different groups involved in transfer projects is often at the root of problems experienced. An example of this type of obstacle is highlighted by Burgmeier (1992) who reports the following statement from an industrialist: *“while we are looking for working prototypes, our academic partner may be working towards a paper proving the feasibility of such a prototype”*. Burgmeier (1992) suggests that such cultural differences are best resolved through open and honest communication of individual expectations and goals. Johnson and Tilley (1999) conclude that *“the optimal solution is to find a way to match the needs of both parties”*. This issue highlights a potential role for policy intervention to assist in the definition of technological problems or tasks and the shaping of appropriate relationships to better facilitate the effective transfer of technical knowledge.

The nature of firm networks can also affect the success or otherwise of technical knowledge transfers. Rogers (1983) argues that individuals are less likely to encounter new ideas through highly inter-connected, close-knit networks because those who share the same social grouping tend to possess similar information. Thus

it is weak-tie networks that are more likely to provide new knowledge or information. However, Robertson *et al.* (1996), examining the case of computer-aided production management technology in the UK manufacturing sector, find that whilst weak-tie networks *are* a valuable source of technological information, knowledge diffused through many such networks is often shaped by technology suppliers. Therefore, information from such networks tends to reinforce supplier images of best practice and so does not always lead to firms developing appropriate technological solutions. Thus the nature of inter-firm and firm-supplier network interactions may act as a barrier to the transfer of *appropriate* technologies to organisations. In small firms, where the level of technological expertise required to evaluate alternative technologies may be limited, this is likely to be a particular problem. Once again, these difficulties indicate a role for policy in establishing mechanisms for guiding SMEs towards appropriate technological solutions.

### **The Policy Context of Technical Knowledge Transfer**

At both a regional and a national level, policy agendas at the start of the new millennium highlighted the importance of the technical knowledge transfer issue.

The specific regional need for a system to facilitate knowledge transfer to SMEs in the South West of England was based upon the following observations.

First, the development of the Regional Development Agencies (RDAs) further emphasised the need for a regionally based solution to the problem of knowledge transfer. The RDAs meant that new initiatives were increasingly operating on a wider regional level. The expansion of existing human networks within the South West



region had the potential to bring benefits in terms of the wider range of knowledge available to draw upon in addressing business queries. However, if these benefits were to be effectively passed on to the business user, a means of facilitating and co-ordinating knowledge transfer between the various agencies involved had to be developed.

A second consideration also related to aspects of emerging national government policy at the time. An enhanced knowledge network would go some way towards achieving the government's stated vision of a knowledge-based economy that encourages lifelong learning (DTI White Paper on Competitiveness, 1998). It would also play a role in the realignment of the HE sector towards the development of improved links with industry.

Thirdly, against a backdrop of growing competition at a global level, the need to provide businesses with an *optimal* solution, rather than just an *available* solution, was evident. Research on business networks suggests that the form of such networks can have a considerable impact upon the appropriateness of knowledge. Often, greater benefit arises from wider, loose-knit networks than smaller close-knit networks since the scope for new ideas or solutions being developed within smaller, more familiar networks is constrained (Rogers, 1983). Given that spatially broader networks provide enhanced potential for providing optimal solutions, the development of a knowledge management mechanism operating at a broad regional level was seen as desirable.

Finally, and perhaps most significantly, there was an acute awareness that much of the knowledge held by individuals providing specialist technical support to small firms in the South West was tacit in nature. There was felt to be a strong need to capture this understanding to avoid the potential for loss of knowledge when an individual left his or her organisation.

The concept of a computer-based knowledge network for the provision of technological advice to small businesses is not new. The DTI funded Supernet system provides an example of a previous policy initiative to address the problem of technical knowledge transfer to small firms. Established in 1994, the initiative was conceived as a support system linking SMEs to Supernet 'members'. These members were research and technology focused organisations such as laboratories, Universities and government research bodies. Working through Supernet, Information and Technology Counsellors (ITCs) within Business Link would help to identify the needs of businesses and locate appropriate sources of technical advice. However, due to the low level of enquiries processed through the system, funding for Supernet ceased in 1997, though a reduced facility was maintained by the Business Link Network. Evaluating the system, Bessant (1999) found that the types of enquiry generated through Supernet often did not require the specialist input of national centres of excellence; hence queries were increasingly addressed without reference to members. Such queries were of the type that could be dealt with by ITCs themselves or through sources of local technological expertise. Indeed, Business Links were increasingly seeking to develop networks of Local Service Providers (LSPs) at the time. The subsequent movement towards a more regionally based approach to business support serves to reinforce the conclusion that in addressing

the needs of most SMEs, a nationally-focused model was not appropriate. Furthermore, the low financial returns to members meant that the system was unsustainable.

The key lesson from the experience of Supernet appears to be that, owing to the nature of the institutional framework for supporting SMEs in the UK, regionally based models for technical knowledge transfer are likely to have a greater chance of success.

## **The E-volve System**

### Conceptualisation & Development of e-volve

In recognition of the need for a common, regionally based approach to managing the provision of technical knowledge to small businesses in the South West of England, a pilot scheme for a '*Technical Knowledge Network*' was established during 2000 – 2001. It was formed from a pre-existing informal group called the Technology Transfer Association (TTA), the remit of which is to support the development and transfer of technical knowledge in Devon and Cornwall through closer cooperation between members.

The ultimate aim of the project was to develop a mechanism through which organisations providing business support in the South West region could gain easy access to a managed 'technical knowledge base', enabling them to provide timely and appropriate support for client SMEs. The knowledge management system that emerged as a pilot initiative was called '*e-volve*'. Members of the network using the system were initially drawn from eight organisations including local Universities,

Business Link, the Government Office for the South West, Local Enterprise Agencies and Country and City Councils. The initiative allowed designated individuals from member organisations to act as 'Gatekeepers' to e-volve, using it as a resource to respond to technical queries from SMEs. The Gatekeeper-based system acknowledged that whilst many firms use Business Link as their first port of call for guidance, in fact a range of organisations from Universities to County Council Economic Development Offices field queries from SMEs seeking technical advice. E-volve aimed to ensure a consistent level of service and access to a wide pool of technical knowledge no matter where SMEs accessed the system. All Gatekeepers could search a data-base of queries and solutions relating to technology and innovation issues, make requests for information from other members via an intranet e-mail system and post solutions used by clients to the system, thus ensuring the growth/evolution of the database for future searches. Through e-volve, Gatekeepers would also play a critical role in identifying and articulating the nature of the technical problem faced by an enquiring SME. It was hoped that e-volve would help to ensure that no matter what the point of access, businesses would be relayed through to the best possible source of information. Following a common client management procedure would also remove the frustration suffered by SMEs when being referred to a number of contacts before finding the most appropriate source of advice. A simplified version of the procedure followed by e-volve users is outlined in Figure 1.

[Insert Figure 1 here]

### Pilot Implementation of the e-volve System

During early 2000, with backing from the South West RDA, funding was secured from Business Link, Konver II (EC funding for diversification in heavily defence-dependent areas) and other sources to implement a six month pilot project. A software development company was contracted to develop the e-volve system and an alpha release was tested in time for a beta release in early 2001. Simultaneously, the originating members of e-volve initiated a marketing campaign aimed at broadening the membership of the network on a subscription basis. The purpose was to include other appropriate organisations within the South West RDA region, thereby expanding the knowledge base underlying both the human and database elements of e-volve and also securing contributions to the on-going funding of the system. Beyond the continuing costs of software and hardware improvement and upgrading, the main on-going cost of the system was the management role undertaken by a 'hubmaster' whose job was to respond to system queries and monitor both its use and the status of queries in order to minimise overdue queries.

Following a Gatekeeper training session, e-volve was officially launched. However, a number of issues emerged that halted the further use and development of the system beyond its pilot period.

### **Evaluation of the E-volve System**

The reasons for the failure to secure a future for the e-volve system were evaluated through a series of interviews with users and originators of the pilot system. Data was collected from discussions with two Business Link ITCs, one University member and two members from local government. The interviews were semi-structured in

format and each lasted 30-60 minutes. In all but two cases, interviews were face-to-face and were recorded to facilitate subsequent analysis.

A limitation of the evaluation was that a significant proportion of the original e-volve membership had either retired or left their jobs within the eight founding organisations, thereby restricting the sampling frame for the research. This in itself highlights one of the reasons for the creation of e-volve. Whilst members in some cases acted primarily as well connected gatekeepers to a significant and diverse knowledge base within their employing organisation (this is particularly the case for Universities), many were themselves very knowledgeable about technological opportunities and applications. As such, the loss of these individuals represents a potentially significant loss to the technical knowledge base of the region. Given the short period of the pilot project, the opportunity to capture and make explicit their tacit knowledge was limited.

A preliminary analysis of the interview evidence indicates that from a design and technical perspective, the system that was developed worked well. Users found it intuitive, easy to use and functional in terms of its power and the scope of its capabilities. The database and query system allowed users to save time in searching for technical solutions for clients. Also the human interaction facilitated by the system allowed problems to be more clearly shaped and defined, in turn improving the chance of finding optimal solutions. However, an initial analysis of the interviews highlights three key themes that help to explain the discontinuation of the e-volve project. These relate to developments in the use of information communication technologies (ICTs), network membership issues and institutional/political factors.

## 1. The Use of ICTs

All of the interviewees questioned highlighted the growth in the use of the internet, alongside the development of more effective internet search engines, as a factor inhibiting the progress of the e-volve project. Although by 2004 the internet has become ubiquitous in the workplace, it was only in the late 1990s, when e-volve was being developed, that its use became much more commonplace. Access to ever more sophisticated search engines covering a rapidly expanding resource of information about technical issues provided both SMEs (indirect system users) and e-volve network members (direct system users) with what could be perceived as a 'free' alternative resource for accessing technical knowledge. Whilst this perception could certainly be regarded as ill-founded, the interviewees felt that it nevertheless constrained the demand for e-volve. The fact that the database within the system contained very little data when the pilot was launched was certainly a limitation when this is compared to the abundance of information available via the internet. Arguably, the concept of an evolving database starting from a position of zero base data was flawed and the data created through e-volve's query system should have added to a ready built database of technical knowledge available to users from day one.

Interestingly, three of the interviewees suggested that five years on, e-volve would now be in greater demand. It was felt that the limitations of the internet as a resource for identifying technical solutions had now become apparent, particularly in terms of its sheer size and the difficulty in narrowing down potential solutions towards an optimal solution. Also, the reliability of information on the internet has become an increasingly significant issue. Therefore, the need for an expert-led system that can

diagnose a technical problem or need and quickly identify the key technical knowledge required by client firms is perhaps greater now than ever.

## 2. Membership Issues

In addition to the growth of the internet, some interviewees felt that the membership composition of the e-volve network did not best serve the purpose of the project from the outset. Most of the initial members were drawn from the membership of the TTA and whilst all shared a common interest in issues concerning technical knowledge certain members, such as the City and County Councils, did not deal with a large number of technical queries. Therefore the use of e-volve by these members was very limited. Two interviewees felt that the participation of individuals and organisations more actively involved in innovation and the application of technology was needed in order to provide the driving force behind the system. For example, the South West SMART Club (members are all winners of DTI SMART funding) might provide active input in to any similar initiative alongside ITCs and Universities. Alternatively, other groups involved in projects financed through common funding sources (e.g. Interreg) could be linked together through an e-volve style intranet. This would also mean that the system would not simply be a network of technology generators and intermediaries but would also include technology end-users. One interviewee felt that issues of trust and confidentiality may be an obstacle to the success of any future system of this type due to the requirement to share information and business contacts. However, others asserted that a business culture of collaboration had developed more strongly over the past five years within the high-technology sector and that the trust issue associated with knowledge sharing was not an insurmountable problem.



Overall, the suggestions made by interviewees imply that in relation to the membership of e-volve, the strategy should have been concerned less with breadth and more with focus. This might have encouraged significantly greater use of the system. However, it was perhaps the need to generate funding through subscriptions that drove the project away from such a clear focus.

### 3. Institutional and Political Factors

The most immediate reason why the e-volve project was discontinued related to funding. Although there was an objective to make e-volve self-financing through subscription membership, it was hoped that after the pilot period, the RDA would provide some financial and policy support towards the continued development of the initiative. However, one interviewee identified the development of another knowledge transfer scheme (K4B) focused on the region's Universities as contributing to dissipation in support for e-volve. In addition, ITCs felt that the restructuring of the Business Links and an increased focus on short-term targets for revenue generation within the network (see Lean *et al.*, 1999) reduced the amount of time available to them for more broadly focused initiatives such as e-volve. This is because the objectives of the project, concerned as they were with the development of a knowledge resource, were long term and inputs from members might not always bring their organisation tangible financial benefits.

## **Policy Lessons and Conclusion**

The e-volve initiative demonstrates that whilst the need for effective mechanisms to support technical knowledge transfer to SMEs is great, developing and successfully implementing systems to support knowledge transfer is very challenging, particularly where the partners involved are drawn from a variety of organisational settings. As was the case with Supernet, the fundamental problem affecting e-volve was the failure to achieve sufficient critical mass in terms of use of the system to justify the continuing costs to members and other stakeholders. The difficulty in securing *ongoing* funding for any scheme with significant public sector involvement represents a significant hurdle. This is particularly the case given that the efficacy of a knowledge management system evolves over time, as the information contained within networks and systems grows and develops. In other words, systems may need *time* to succeed. It could however be argued that it is the cost of running such systems, in terms of time and effort required to add to the knowledge base, that is the major obstacle to success. Ultimately, the fact that the user organisations within the e-volve network were not willing to contribute enough funding to enable the continuation of the scheme suggests that the benefits of the scheme were not perceived to exceed the costs involved in being a member.

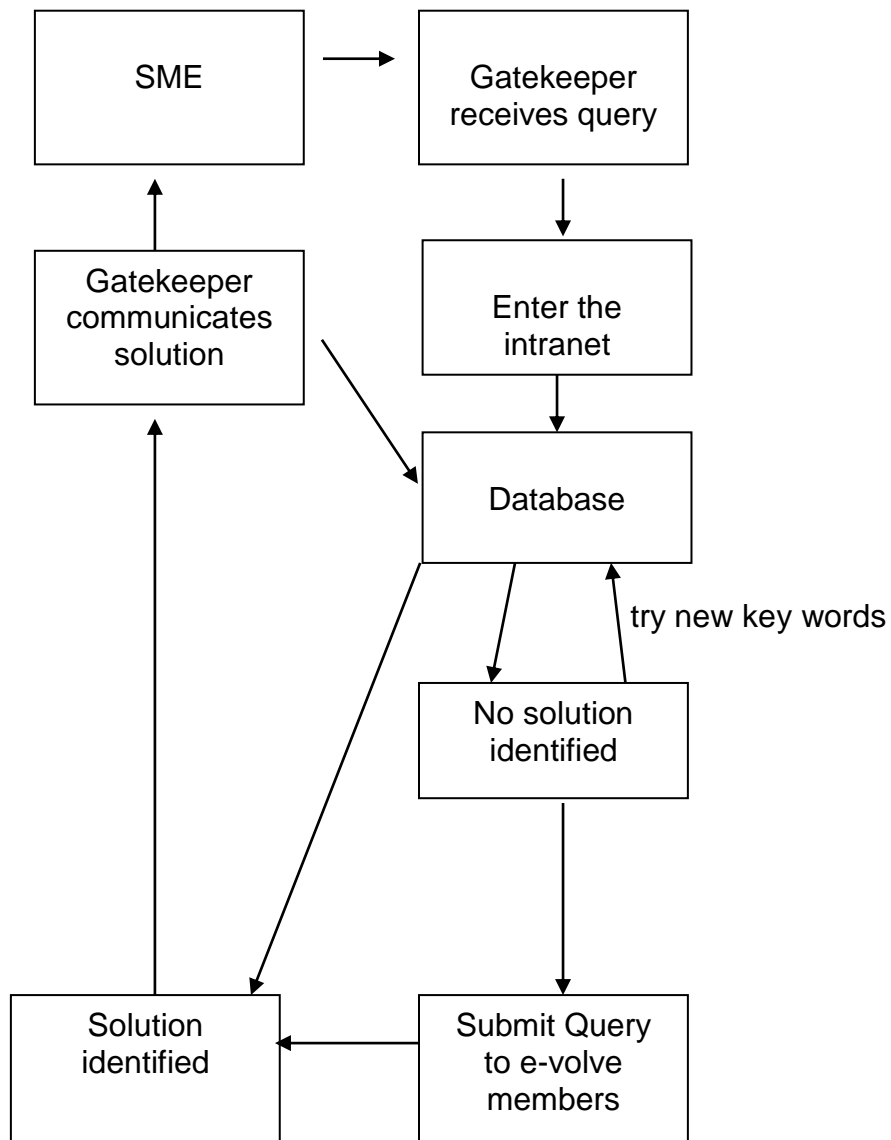
Whilst the current evaluation of e-volve is ongoing, the preliminary results from this study enable some important lessons to be drawn for future policy developments. Firstly, although a key benefit of the evolve database was its ability to expand and build its knowledge base from current queries and user interactions, the incorporation of an existing database of information pertaining to technological solutions would have provided immediate efficacy. Even if this database was unable

to address a significant proportion of user queries, it would almost certainly have encouraged greater initial use of the system and might then have encouraged members to utilise the other features of e-volve, particularly the 'knowledge building' query facility. A second related issue concerns the marketing of the system. Whilst a ready-to-use database might have drawn the initial interest of new members, the significant differentiating feature of e-volve related to the human element of the system. Its capability to facilitate the definition and articulation of a technical problem, generate a range of alternative solutions and then record and store these query outcomes for future database searches remains unique. A failure to market these benefits, particularly relative to the 'free' advice available through the internet, is apparent now that we have greater awareness of the limitations of the internet as a source of technical knowledge. Arguably however, firms and members could only have appreciated these limitations through experiencing them over a period of time. Therefore for e-volve, it might simply have been a case of the right system at the wrong time.

A third lesson emerging from this study is that the success of a technical knowledge transfer initiative requires an alignment of objectives across a range of user groups. The development of performance targets within the Business Link network impacted upon the e-volve project through the realignment of ITC priorities. However, whether the context is the Business Link Network, higher education or local government, organisational objectives are subject to fairly regular change. Whilst change is unavoidable and often desirable, a need exists for 'joined-up policy making' where initiatives span organisational boundaries. Only with the sustained involvement of key stakeholders can projects like e-volve be successful. A final lesson from the

study concerns the membership of e-volve. The interview findings support the view that the focus of membership strategies for similar initiatives should be towards developing an active community of practice with a focus on depth of interest rather than simply breadth. At a regional level, this might best be achieved by way of the active involvement of technology users through cooperation with technology focused funded programmes or business associations.

Figure 1 - Basic E-volve Procedure



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