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Innovation and new product development pose a number of challenges for a company, demanding critical thinking and decision making towards a conscious and purposeful search for innovation opportunities. This paper identifies the potential sources of innovation in the European Assistive Technology industry and proposes a conceptual model for incremental innovation, on the basis of the *Rehabilitation Technology product taxonomy*, an existing methodological tool for analysing products. Both tools can be used to assess innovation opportunities and improve the potential of this industry to adopt innovation-oriented policies.

Keywords

Innovation, Assistive Technology market, technological synergies, product taxonomy, innovation adoptiveness potential.

INTRODUCTION

The term and the phenomenon "innovation" has been extensively researched in the relevant literature and many writers have attempted to resolve the confusion which exists about the proper definition of the term. Two of the definitions found in the literature, which are particularly relevant in the context of this paper, are by Peter F. Drucker "*Innovation is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth*" (Drucker,1991); and by R. Rosenfeld & J C Servo "*Innovation = Conception + Invention + Exploitation*" (Resenfeld, et. al., 1991).

Despite the distinctive and frequently opposing implications of such definitions, they all converge to conclude that innovation means change. Change, in this context, may be perceived either as conditions for innovation or consequences of innovation. Moreover, such change may be incremental or radical, evolutionary or revolutionary, enabling or disabling and can have different effects upon producers and users. Change, seen as a condition for innovation, is synonymous with innovation sources and may be realised as an act of genius, as a new process, as (population) social changes (usually in attitude, purchasing behaviour, etc) or industry and market changes. On the other hand, change seen as the result of innovation, means new exploitable resources and potentially new wealth, with corresponding opportunities and consequences for the innovator and imitators¹, in the short, medium and long run.

¹ It is important to note that the benefits of innovation are rarely appropriated by the innovator. In industries such as the European Assistive Technology industry, where new technologies are embodied, imitators are key players.

With respect to the European Assistive Technology market, it is argued that innovation sources may be additionally realised as a conscious action for changing the process and/or product of service delivery, its interaction with other institutions, actors, care-recipients and care-givers. More specifically, it has been argued that this industry is characterised by the interaction between seven market elements, namely *research, development, production, trade, service delivery, procurement* and *usage* (Stephanidis et. al., 1993). Consequently, innovation may be triggered by activities in different market elements, such as:

- institutional changes in the way a product or service is provided (i.e. shift from centralised to decentralised organisation, responsibility and decision making);
- change in procurement policy which may lead to state or local government subsidy for a new product;
- technology factors (i.e. the evolution of digital networks) resulting form conscious search and development effort;
- non-technology factors (Smith et. al., 1993) which determine demand (i.e. ageing);
- accompanying measures such as the introduction of standards or other complementary innovation-support activities.

Consequently, the notion of innovation in the European Assistive Technology industry encompasses both *social* innovation and *industrial* innovation. Furthermore, it seems that for industrial innovation to be generated and diffused, it requires *a-priory* action towards social innovation. This is evidenced in a number of recent studies investigating significant innovations in care for the elderly (Kraan et. al., 1991) and the diffusion of alarm telephones in Finland (TIDE-CORE, 1994)². In the former case, institutional changes in personal care services in conjunction with changes in welfare systems introduced the infrastructure for innovative application of new technology in delivering care to the elderly (Kraan et. al., 1991). In the latter case, the econometric study of alarm telephones service diffusion at national and municipal levels (Vernardakis et al., 1995), verified the boom of the industry following the introduction of legislation and an increase in demand.

Regarding the European Rehabilitation Technology market is very limited and predetermined in type and direction [3]. A recent study revealed that the European Rehabilitation Technology sector, as a recipient of technical innovation, is not well-adapted at present, because existing Rehabilitation Technology actors³ lack certain characteristics which are critical for innovation. These are :

- (a) *existing European Rehabilitation Technology actors are not calculated risk takers;*
- (b) *they seldom follow proactive strategies; on the contrary, they tend to simply react , thus always be latedly trying to catch up with main-stream technological advances [21];*

² This study has been carried out in the context of the TIDE-CORE project, where the authors are developing an econometric model of alarm telephones service diffusion at national and municipal levels.

³ A Rehabilitation Technology actor in this context may refer to public/private organisations, large/small commercial firms, research and development institutes, user organisations and/or other institutional settings, and in general actors which are located in one or more of the seven market elements of the European Rehabilitation market.

- (c) *top management commitment to innovate is frequently limited since the majority of the companies possess an opportunistic attitude towards this market and lack strategic objectives;*
- (d) *existing Rehabilitation Technology actors cannot freely react to consumer needs and requirements because the latter are filtered by intermediary organisations and through third party interventions;*
- (e) *existing Rehabilitation Technology actors are not aware of non Rehabilitation Technology technological developments and fields of technology which could be transferred for the benefit of the end users;*
- (f) *non Rehabilitation Technology actors who may be interested to enter the field are not aware of the opportunities offered by it.*

Consequently, it could be argued that, while some innovations arise from within the Rehabilitation Technology sector, the majority are located externally in other sectors (i.e. the computer industry) resulting from uneven developments in basic and emerging technologies [22]. The latter type of innovations have frequently been both enabling (promoting integration and reducing further discrimination of disabled and elderly people), as well as disabling for some segments of the population of disabled and elderly people. For example, with the advent of Graphical User Interfaces, which is an innovation generated within the computer industry, a large proportion of the population of disabled and elderly people, namely the blind and partially sighted, were further discriminated against access to information. On the other hand, recent advances in Multimedia and Human-Computer Interfaces have suggested and enabled alternative methods for tackling a wide range of problems associated with the education of children with special needs and the cognitive impaired [4].

In both cases, the European Rehabilitation Technology market has not been quick to exploit the opportunities arising from externally generated innovations. It becomes apparent therefore, that appropriate mechanisms are required to induce the generated innovations into the Rehabilitation Technology sector, turning it into an effective technology recipient sector. In short, the normative perspective adopted by this paper is the requirement for tools to improve the innovation adoptiveness potential of the European Rehabilitation Technology market, thus creating a pattern which may facilitate systematic and pro-active search procedures towards the industrial exploitation of innovation opportunities.

STATEMENT OF THE PROBLEM

In all cases, the European Assistive Technology market has not been quick to exploit the opportunities arising from externally generated innovations. A typical example is the transistor which took decades to be incorporated into commercial products such as hearing aids and navigational instruments. One point of view regarding the reasons why innovation in this industry is limited and predetermined in type and direction has recently been expressed in (Stephanidis et. al. 1994a). There, it was argued that due to the lack of linkages with other high-technology sectors and the lack of pathways for technological diffusion, the industry is neither a producer of new technology nor a good recipient of technology. Thus, industrial innovation is not well served.

Consequently, the normative perspective adopted by this paper is the requirement for tools to improve the *innovation adoptiveness potential* of the European Assistive Technology industry so as to create a new pattern which may facilitate more systematic and proactive search procedures towards *incremental innovation*.

MOTIVATION AND RATIONALE

The rationale in addressing the innovation adoptiveness potential of the European Assistive Technology industry is two-fold. First is the "permanent revolution" or *changes in technology system* type of innovation (Freeman, 1987) which is currently progressing in leading sectors, such as the Information Technology and Telecommunications (IT&T) industry, and which is continuously creating "spill-overs" into all the other industrial sectors. Second is the nature of the European Assistive Technology industry, as a recipient of technical innovations, which seems to require organisational and social changes of a far-reaching effect in order to realise gains resulting from such changes in technology system. On the other hand, the emphasis on incremental innovation in Assistive Technology originates from the widely held belief that future research and development in this field should follow a "need-driven" and multi-disciplinary protocol (Stephanidis et. al., 1995; Ballabio, 1992).

In his taxonomy of technical change, Freeman (Freeman, 1987) specifies four categories: incremental innovations; radical innovations; changes of technology system; and changes in techno-economic paradigm. He states:

"Incremental innovations occur more or less continuously in any industry or service activity although at different rates in different industries, depending upon a combination of demand pressures and technological opportunities. Although many incremental innovations may result in recent times from organised research and development programmes, these innovations may often occur, not so much as the result of any deliberate research and development activity, but as the outcome of inventions and improvements suggested by engineers and others directly engaged in the production process, or as a result of initiatives and proposals by the users."

From the above, it follows that any activity aiming at incremental innovation should be characterised by a conscious and purposeful search for encapsulating the user needs and requirements (demand pressures in Freeman's terminology) and existing technological opportunities. At present, existing producers in the European Assistive Technology industry face a two-fold problem. First, they lack detailed knowledge of and fail to respond directly to end user needs and requirements, mainly because the latter are filtered through third party interventions (Stephanidis et. al., 1994b). As a result, what surfaces is *revealed* rather than *actual* demand pressures. On the other hand, due to their under financing conditions and very small size, these companies do not possess the required understanding of existing technological opportunities. In other words, they lack the means to identify promising new technologies and their potential in specific Assistive Technology sectors, thus failing to locate and subsequently exploit innovation opportunities.

It therefore stands to argue, that a critical condition towards the achievement of incremental innovation in the Assistive Technology field, is for Assistive Technology companies to be provided with the incentives to innovate. This implies that the prevailing European Assistive Technology market structure and actor behaviour exhibit clearly the existence of market failure. It is precisely this observation which necessitates the investigation and proposal of appropriate incentives which improve the innovation adoptiveness potential of this industry. The relevance and priority of such incentives usually vary depending on the type of the actors concerned. Moreover, they may take the form of increased financial support to invest in new technologies, appropriate state interventions (at national and EU levels) for the establishment of effective service delivery and technology transfer mechanisms, as well as the availability of formal tools which could guide and target the search of such companies towards innovative solutions and new product development. For example, a large multi-product (and possibly multi-national) company with substantial financial resources, is likely to regard the

absence (or the quality and accuracy) of appropriate information⁴ about end-user requirements, as the most crucial condition for innovation, whereas in the case of SMEs, financing is considered to be a more prominent limiting factor. As a result, the large company may be more interested in incentives towards the development of channels of collaboration with the end users or end user organisations, market information, mechanisms for information exchange, distribution and dissemination, research results, etc. SMEs on the other hand, may value highly increased financing, in order to carry out research and meet the high development and production costs.

The scope of this paper will be confined within the boundaries of the third incentive mentioned above, namely, the requirements for formal tools to assist and guide companies towards the engineering of innovative product lines in the Assistive Technology market.

CONCEPTUAL FRAMEWORK FOR DETERMINING INNOVATIVE RT PRODUCTS

Despite the present, rather unsatisfactory, conditions of the Rehabilitation Technology market in Europe, with respect to innovation, there are still many good reasons why Rehabilitation Technology companies could and should strive for innovation and new product development, all of which are meant to contribute to the broad aims of a company for survival and growth. Moreover, in the light of recent changes in the attitude of society towards people with special needs and emerging technical developments, companies which fail to develop new products may be exposing themselves to considerable risk. Finally, industrial innovation is needed due to the fact that existing products are vulnerable to changing consumer expectations, needs and tastes, new technologies, shortened product life cycles and increased domestic and foreign competition.

The proposed conceptual framework for determining innovative Rehabilitation Technology products should satisfy the following conditions. *First of all, it should be sufficiently expressive to accommodate a relevant subset of the critical issues related to innovation in the Rehabilitation Technology market.* In this context, the framework must possess the required flexibility to enable assessment of existing and possible future product lines and reveal the reasoning behind their relative success. In addition, such a framework should be able to predict the relative potential economic activity (i.e. corresponding market size and rate of growth) of new Rehabilitation Technology products, on the grounds of some distinctive characteristics. *Secondly, the framework should be capable of identifying the entities of the product market (e.g. active actors and/or factors) which, if influenced, may lead to a potential increase of the product's relative economic activity.* Finally, *the framework must be formal to facilitate future research in the field.*

In the paradigm described below, the discussion focuses on the demand-pull (incremental) type of innovation where the underlying technologies have overcome the technology push state, irrespective of whether or not they have been utilised towards a more effective Rehabilitation Technology product development and launch. In particular, given the low propensity of existing actors to innovate and the lack of new technology being produced by this sector, the normative perspective adopted by this paper - that is the intention to design tools to improve the innovation adoptiveness potential of the European Rehabilitation Technology

⁴ In this context, the attributes of information for a particular Assistive Technology actor, are the content and form of the information, the dissemination channel as well as the means for assimilating this information.

market - is justified. This is also consistent with the argument that "the emphasis on the needs of customers rather than a particular technology push characterises the Rehabilitation Technology market as a user-driven market" [11].

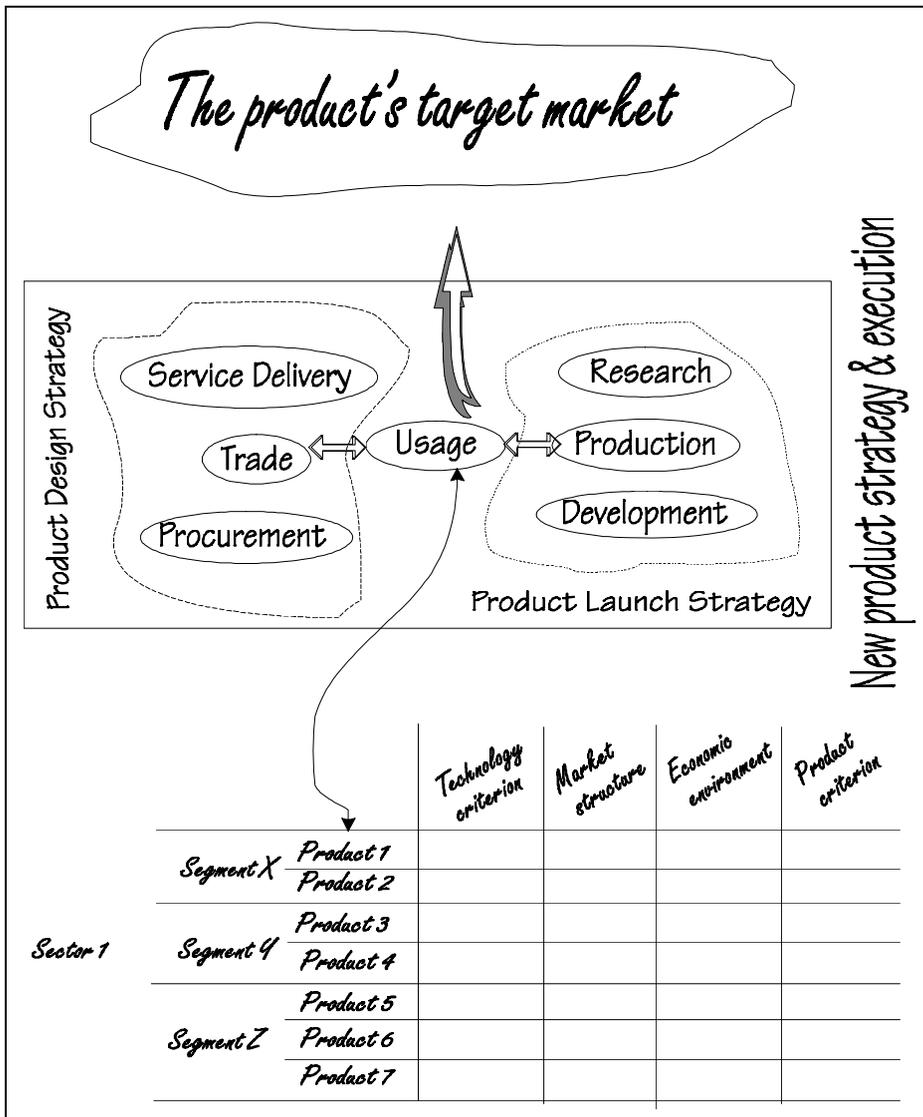


Figure 1 : A model for innovation in the European Rehabilitation Technology market

The diagram of Figure 1 depicts the proposed framework for achieving innovation in the European Rehabilitation Technology market. The primary component of the proposed conceptual framework, takes the form of a taxonomy which consists of a set of four criteria, namely, criteria revealing the economic environment, market structure related criteria, product based criteria and technology related criteria. This set of criteria will be called *the Rehabilitation Technology product taxonomy* and they are depicted in the diagram of Figure 2.

The taxonomy serves the formulation of a new product design and execution strategy by helping towards the identification of the critical issues than may potentially characterise the success or failure of the new product. In what follows, we review the criteria of the taxonomy and discuss its use in formulating the product's design and execution strategy.

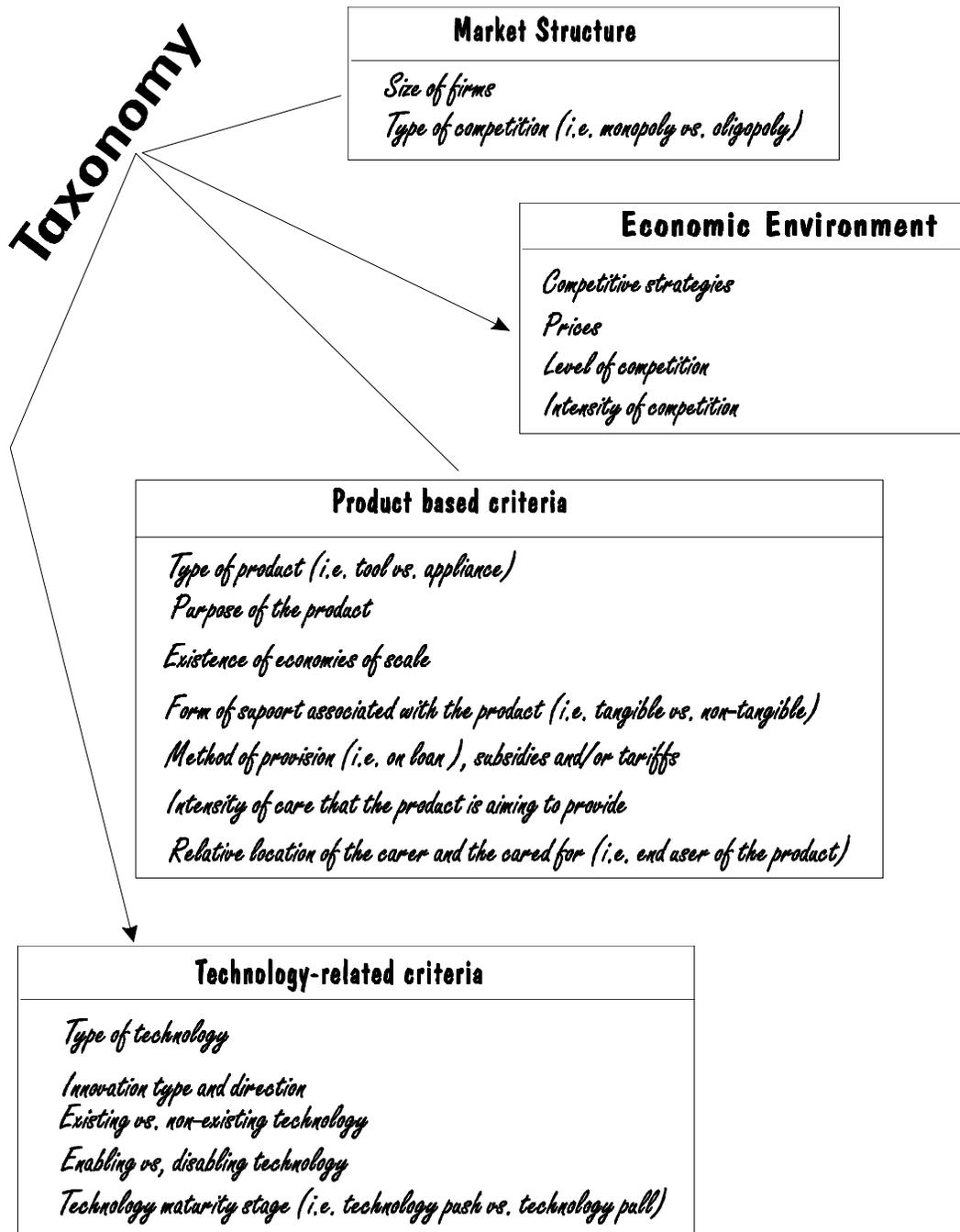


Figure 2 : The constructs of the Rehabilitation Technology product taxonomy

(i) **Economic Environment**

In searching for innovation, a critical issue which is frequently ignored or misunderstood is the economic environment which is constituted by factors such as the level and intensity of competition, the level of demand, prices, existence of broad range of consumer groups, dominant competitive strategies, etc. Such factors have considerable influence on the way the company operates. In particular, "innovation by chance" is no longer the principal means by which firms innovate. On the contrary, systematic, pro-active search procedures and technology management are the dominant norm determining the firms innovation strategy. For this kind of

firm, however, certain organisational requirements are necessary, but such requirements are only occasionally found in existing Rehabilitation Technology actors.

Through a careful consideration of the structural characteristics of the Rehabilitation Technology market (i.e. market size, target population characteristics, size and type of competitors, their relevant technological positions and focus, the innovation strategies they pursue, etc.) as well as the type and intensity of competition (e.g. dominant competitive strategies, sources of competitive advantage, projected expenditure on technology, etc.), the company is able to assess its own strengths and weaknesses compared to other Rehabilitation Technology actors. Moreover, the company is able to identify emerging threats, their underlying sources and potential impact, as well as strategic alliances and partnerships for exploiting opportunities for innovation.

(ii) Market structure

In the case that a market exists, identifying the market structure for particular product lines is critical for the manufacturer, as the entire economic activity of the company may depend upon the outcome of this task. Indeed, pricing policy, output levels and costs, are strongly related to the type of the market structure. For example, the Rehabilitation Technology market in Europe is fragmented and oligopolistic in principle. Such a conclusion permits reference to a body of existing knowledge which describes the valid range of courses of action available to the oligopolist, in terms of a set of "models of oligopoly" [6].

On the other hand, product innovation is very often concerned with creating new niche markets. In this case, the market structure does not even exist. Therefore the manufacturer is more concerned with the size of the potential market, ways of maintaining market leadership if imitators enter this niche, etc. The term "first mover advantages" is frequently used to describe the motivation leading to the search to build new markets through product innovation⁵.

Although oligopoly seems to be the prominent market structure in the European Rehabilitation Technology market, there are product markets operating under the conditions of a different market structure. Such markets are usually fragments of a wider market (e.g. product fragmentation or geographical fragmentation), but nevertheless comply to different norms of operation. Moreover, apart from the market structure for a particular product, the intensity of the competition is often a critical factor for the operation of the market. For example, a highly competitive oligopoly operates differently from a less competitive oligopoly. In addition, oligopolies may also differ depending on the prominent competitive strategy (i.e. product differentiation, price, product quality, etc.). Thus, when analysing existing or new product lines, the type of the product's market must be identified and investigated.

(iii) Product-based criteria and significance of present or anticipated future economic activity

In addition to the market structure criteria, the Rehabilitation Technology product taxonomy must be capable of assessing existing product lines in terms of their importance and performance with respect to their relative current and future potential economic activity. In other words, there are products with outstanding potential, others which have reached the saturation stage, and others whose economic activity in relative terms may or may not be

⁵ In the context of the European Rehabilitation Technology market, a critical aspect to be investigated relates to the extent that "first mover advantages" may be (or are) restrained by the role of intermediaries such as service providers and procurement agencies.

significant. Moreover, the assessment of a product's economic activity should take place in the context of various product based criteria such as the product's target market. That covers the scale of the market, the type of product (e.g. tool versus appliance⁶), the existence of economies of scale, barriers to entry, tariffs, subsidies, the consumers' ability to pay, etc.

A product which is currently associated with significant economic activity in relative terms, is wheelchairs. Another product line with considerable future potential is alarm systems. The product taxonomy should be capable of verifying such hypothesis or empirical findings. In other words, it is required to explain why wheelchairs experience such a significant level of economic activity and more importantly, why alarm systems are regarded as a product line of outstanding future potential. To facilitate this, technology based criteria are included.

(iii) *Technology based criteria*

Technology-based criteria characterise the concept of innovation (i.e. process/method innovation versus product innovation), the direction and rate of technological change, technology spin-off effects and finally, the present and future role of technology synergies, etc. Using such technology based criteria allows to justify the argument that alarm systems is a product line with outstanding future potential since it signifies the beginning of a new area of development, that of the smart house and the electronic devices which are required in such an environment. It is therefore important for the Rehabilitation Technology actor to be aware of such innovative tendencies and of the underlying technologies, so that decisions regarding investment in technology and effective market strategies can take place.

Consequently, careful selection and appropriate utilisation of technology is an equally critical issue which should be addressed when seeking for innovation sources. In the European Rehabilitation Technology market, the technological spectrum is wide. It includes traditional Rehabilitation technologies which have been exploited (and characterise the vast majority of present products), Rehabilitation technologies which, as yet, have not been utilised in the Rehabilitation Technology market, and technologies which are not necessarily "dedicated" Rehabilitation technologies, but have reached maturity and can be transferred to the European Rehabilitation Technology market.

The most critical decisions that management usually have to make are what technologies to focus on and where to look for them. In response to this complexity, an increasingly popular proposition is the need for multidisciplinary cross-industry R&D. The search for innovation sources should be planned and targeted so that the company is aware of present-date Rehabilitation technologies, "external" technologies as well as the potentialities arising from technology synergies. It is argued, that such awareness can not be adequately attained unless the company engages in cross-industry R&D. However, given the characteristics of the existing Rehabilitation Technology actors, as identified in the previous sections, cross-industry R&D

⁶ An appliance is a type of product whose underlying technology operates nearly independently of the user and, as a result, the effective use of the product is not controlled by the user; a tool on the other hand is a product whose effective operation is usually dependent on the user. Note that the "tool-appliance" construct can be applied either at the level of the product or at the level of a part or function of a product, with considerable implications for the design and launch strategies of the product. A typical example of a tool is a wheelchair whose effective operation depends solely on its user. On the other hand, an alarm system is regarded as an appliance since its effectiveness is partly dependent on the quality of the Telecommunications services.

although very promising and desirable, may not necessarily be seen, at present, as a realistic proposition, especially for SMEs. However, irrespective of the present feasibility of cross-industry R&D, a Rehabilitation Technology actor needs to critically assess the spectrum of available technologies, regarding:

- a) the relative position of such technologies with respect to the company's committed technological background; for technologies which lie distantly from the company's existing technologies, the associated investment and risk are expected to be higher;
- b) the mission and the strategic goals of the company; relevant considerations, in this context are whether technology is used for cost leadership or as a means for diversification to meet individual customer requirements, etc.;
- c) the characteristics of innovation emerging from the use of this technology (i.e. product versus process innovation);
- d) maturity of technology and its potential impact on the company's customer base and the market as a whole.

It has been pointed out that, in the predominately oligopolistic European Rehabilitation Technology markets, technology is not typically used as a source of competitiveness and competitive advantage, since newcomers' intentions can be overcome through the threat of price war. Moreover, existing Rehabilitation Technology actors are characterised by a low propensity to innovate. At present, the limited innovation which is observed, does not always materialise in a direction desirable for the end-user (i.e. disabled and elderly people). In other words, the emerging products may not meet end user needs and requirements or may be imposing new barriers (e.g. in the form of requirements for substantial technical skill, on behalf of the end user, etc.).

It becomes evident, therefore, that irrespective of the type of technology already in use or technology to be transferred, the Rehabilitation Technology actor should be conscious of the potential danger of further discrimination of the Rehabilitation Technology market customer base, namely disabled and elderly people, as a result of inappropriate introduction and/or use of technology.

Having reviewed the RT product taxonomy, we now turn into the use of this tool in formulating new product design and execution strategy. Opportunities for innovation typically imply new product development. Having identified the most reasonable opportunities for innovation, through a guided and concentrated search (using, amongst other tools, the Rehabilitation Technology product taxonomy), the company formulates and subsequently executes a strategy for the new product. The new product's strategy reflects the platform in which the company intends to exploit a particular opportunity for innovation and consists of the new product's design strategy and the new product's launch strategy.

The new product's design strategy embodies critical design decisions and elevates from the interaction of three market elements, namely, research, development and production.

Product design is critical in the context of the Rehabilitation Technology market because of the multiplicity of the needs and requirements of similar target user groups. It should always be born in mind that such products should embody aspects which result from needs, which although common human needs, are not very strictly separated into primary and secondary needs applying traditional methods. The implication of this on product design is that any successful Rehabilitation Technology product and its perspective user must be permitted to operate as a "system" whose outcome is either the assistance of the user in performing a function or the replacement of this function as effectively as possible. Towards this end, a concept which needs considerable attention during the formulation of the product design

strategy is the "product-user" interface. In fact, it is the most critical design factor and is the least understood [6]. Essentially the user and the product must act as one unit. The product should be designed so that the user's potential is maximised, i.e. the product should not limit user abilities and possibilities. Towards an effective definition of the product-user interface, several criteria embedded within the Rehabilitation Technology product taxonomy could be utilised.

First of all, the "appliance versus tool". Such a construct is directly related to several factors which undermine the evolution of a market as well as the length of the period during which a market is driven by demand pull type of innovation. For example, it could be argued that the effective operation of a wheelchair, which is classed as a tool, lies mainly in the hands of the user, whereas for alarm systems (i.e. an appliance) the end user cannot exercise any control over the effective operation of the product. It is believed that such an assertion has direct consequences for the product's critical strategies; product design strategy and product launch strategy, as briefly described below.

With respect to the evolution of the market of a product which is classed as a tool, research, development and production of the product should be characterised from the distinctive objective of delivering a product which will fit part of the requirements of the final end user/product system. Towards this end, not only does a user need to be trained to use a product, but training is also required for the *effective* use of the product. In the case of certain appliances such as an alarm system, end user's control over the effective operation of the product is not a relevant issue mainly because the effectiveness of the product relies on the effectiveness and quality of service provided by the local Telecommunications providers. As a result, the majority of such users can provide limited feedback to initiate a demand-pull type of innovation. Demand-pull innovations may, nevertheless, be initiated through other end user categories who may be indirectly related with the appliance⁷. As more IT&T technologies are transferred into the European Rehabilitation Technology sector, there is likely to be an increase in the proportion of products which are appliances, as opposed to tools. This is because IT&T innovation tends strongly towards increasing integration and complexity. The design consequences of this trend for end users may be several, but there will certainly be pressure for demand-pull type innovation to be a highly mediated process. But perhaps, the most important implication for the developer and producer of an appliance, especially those which are the result of the application of rapidly changing, high-technologies, is the awareness of the producer and the capacity to adapt and apply new technology to upgrade the product as its expected life cycle is likely to be short. Regarding the product's launch strategy, the tools versus appliance construct enables one to define, amongst other variables, the training and type of support which the end user will require in order to arrive at the best possible use of this product.

Secondly, considering the form of support and the type of care the new product is associated with, may suggest several hints for the design and implementation of a more effective New Product Execution strategy. For example, if the new product is to provide remote care, then innovations in this application domain may cover both innovations allowing care to be provided by someone at a remote site and innovations allowing mobility in care provision. Essentially such innovations should aim to reduce or eliminate the requirement for the carer and the cared-for to be co-located. Consequently, in this application domain developments in

⁷ In the case of an alarm system, another category of end user (which may trigger demand-pull innovations) is the recipient of the client's alarm call, usually located at an alarm processing centre.

telecommunications, coupled with corresponding developments of high quality and robust software, may provide the key underpinning innovations. However, it is also important to note that end-products will increasingly be classed under the category of appliances and, as shown in the previous paragraph, additional considerations may have to be taken into account.

DISCUSSION

In the previous section, it was claimed that the Rehabilitation Technology product taxonomy, as introduced in this paper, provides a conceptual tool which can accommodate many different objectives, all of which contribute to a company's task of gathering knowledge and intelligence. Some of them are briefly elaborated in the following paragraphs.

(a) Product focus and analysis

The taxonomy can be quite useful in analysing a particular product, in terms of its market structure, importance and performance levels, whether or not economies of scale for the particular product exist and what are the underlying technologies. Whether or not innovation is critical to the product success and furthermore the type of innovation (e.g. product innovation, process innovation, supply pull, demand push) can be examined, and the determinants of demand for this product identified. During such an analysis additional important issues are revealed such as the role of the intermediaries, the overall awareness of consumers and professionals relative to a particular product, etc. Moreover, assessing the performance and importance of the product's relative activity will enable an outline of current and future trends in consumers' purchasing behaviour to be made. What technologies need to be employed in the production process will be determined. Product analysis will also highlight the restructuring required to take place in an organisation's workforce to accommodate the introduction of new technologies or a change in the current production methods. Finally, the ability to identify and assess products with outstanding potential is likely to direct the company's research and development activities towards technology sectors which are prominent or will become prominent in the production of the product. Thus, breaking current barriers and introducing new opportunities for both the consumer and the product itself. Hence, from such an analysis, links can be established between technologies and products, application domains and the needs of users within this domain, between manufacturers and areas of specialisation as defined by a particular set of needs or an application domain or even the set of technologies employed.

(b) The Rehabilitation Technology product taxonomy as an evaluative and/or predictive tool

The discussion so far, has focused on the definition of sets of criteria which constitute a framework, the Rehabilitation Technology product taxonomy, for analysing Rehabilitation Technology products and determining critical aspects of innovative Rehabilitation Technology products. However, the scope and implications of such a framework may be substantially extended to facilitate additional aspects (e.g. evaluation and prediction), depending on the subset of criteria which are selected. Thus the Rehabilitation Technology product taxonomy may be appropriately constructed (i.e. choice of criteria) to enable evaluation of a Rehabilitation Technology product as well as prediction of certain aspects of its evolution. In this context, there is a wide range of issues to be addressed:

- *products may be evaluated according to the requirements for training and education of the user as a result of some product based criteria such as the appliance versus tool construct;*
- *evaluation of the outcome of functional assessment and isolation of the cases where professional interest may deviate from the interest of the end-user and the impact this may have on the innovation type and direction;*
- *prediction of innovative Rehabilitation Technology products and/or attributes of them which may provide opportunities for mass production, accommodating a wider spectrum of needs and end-users (i.e. not necessarily restricted to use by disabled and elderly people), etc.*

Obviously, the above examples are only indicative of the range of relevant issues which could be facilitated by the Rehabilitation Technology product taxonomy. This hidden attribute of the Rehabilitation Technology product taxonomy is one of its strongest characteristics, although it is beyond the scope of this paper to elaborate its implications. However, it should be explicitly stated that depending on the use of the taxonomy (i.e. evaluative versus predictive), there are certain conditions to be met, with respect to the selection of appropriate criteria, in order to guarantee useful and meaningful results. Thus for example, if the taxonomy is to be used as an evaluative tool, then the selected criteria would probably be independent of the analyst's aims/objectives. Whereas, if the taxonomy was to be used as a predictive tool, then the criteria to be selected would probably be dependent on what the analyst is attempting to predict.

Additional aspects which need to be considered when designing the new product-user interface relate to the variability among the individual user preferences in the European Rehabilitation Technology market. This complicates the product-user interface as well as the entire product design strategy. However, for relatively large target groups, general commonalities may be identified and some guidelines applied. However, even for a minimum set of guidelines, a prioritisation may be required, mapping product properties and characteristics to primary and secondary needs of the target population [3]. This has a considerable impact on the design process, since users commonly attempt to satisfy first the set of primary needs and subsequently the secondary needs.

When examining the market's potential for a product, the key notion in the analysis is concentrated on the assessment of the expected significance of the product's relative economic activity. The effect of this information should be explicit since a product which is expected to have significant economic activity as soon as it enters the market, is usually designed and launched differently than the product which has a future potential for significant relative economic activity. In the former case, for example, the manufacturer focuses on the product's present relative advantage as a primary objective for both product design and launch. In the latter case, however, the key objective may be to establish an early market initiative which can potentially and subject to conditions, result in a relative competitive advantage.

Another aspect of this model which must be briefly addressed is the conditions for applying the proposed conceptual model to the Rehabilitation Technology actors. As already pointed out, the Rehabilitation Technology market in Europe is dominated by SMEs while a few large companies operate in certain market sectors. Consequently, the conditions for innovation in each case largely depend on the most critical factor confronting innovation. It could be argued that, given the appropriate legislation acts, the effects of standardisation and the existing policies at national and EC levels, information is the most important condition for innovation regarding non-Rehabilitation Technology companies, irrespective of their size, whereas for SMEs the crucial issues for innovation are information, financing and the ability to carry out research. For

non-Rehabilitation Technology companies such information is, in the first instance, *awareness* of the potentialities and possibilities that exist. In the case of large non-Rehabilitation Technology companies, of special interest are the possible synergies that may exist with technologies that they already possess. Non-Rehabilitation Technology SMEs, on the other hand, may be primarily interested in locating niches in the Rehabilitation Technology market which by its nature offers such opportunities. As regards SMEs already involved in the Rehabilitation Technology market as well as those that may intend to enter it, there is the additional condition, besides awareness, namely financing. Nevertheless, financing by itself is not a sufficient condition for innovation since innovativeness is also attributed to a number of factors related to the nature of that company.

The nature of innovation that seems to be called for in the Rehabilitation Technology market (e.g. engineering, software or hardware) does not appear to be a limiting factor as far as the actual company size is concerned, as is also evidenced by related considerations [12], [13], [14].

SUMMARY AND CONCLUSIONS

This paper has introduced a conceptual framework for determining innovative products in the context of the Rehabilitation Technology market in Europe. The framework comprises a taxonomy which provides a mechanism for concentrating a company's innovation process on the critical issues to be addressed during the conscious and purposeful search for innovation sources. Following this, the use of the taxonomy in formulating the new product design and execution strategy was discussed. Currently, the framework described is being used to examine quantitatively the level of diffusion of alarm telephones at the national and municipal levels in Finland. To this effect, the use of the taxonomy led to the definition of a basic set of hypothesis which are currently being tested towards the construction of an econometric model of diffusion of alarm telephones.

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