

# The externalisation of R&D activities and the growing market of product development services

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Several authors in recent years have discussed the observed trend towards the externalisation of (part of) the firm's R&D activities. As a consequence of this trend, several companies have been created that provide the innovators with technical and scientific services such as contract R&D, laboratory testing services, technology consulting, industrial design, engineering.

The paper is based upon an empirical study which is composed by: (i) an extensive analysis, in which information has been collected (for about two hundred of companies) about size, location and type of services offered; (ii) an intensive analysis, in which one case is studied in depth of a company providing product development services. Some conclusions have been drawn about the characteristics of the market of product development and the management and organisation of companies offering services for new product development.

## 1. Introduction

Several authors in recent years have discussed the observed trend towards the externalisation of (part of) the firm's R&D activities (Arora et al., 1999; Howells, 1999; Bessant and Rush, 1995; Chatterji, 1996; Quinn, 2000). As a consequence of this trend, several companies have been created that provide the innovators with technical and scientific services such as contract R&D, laboratory testing services, technology consulting, industrial design, engineering. In general terms, it can be said that a "market for technology" is growing (and is becoming more and more relevant) (Arora et al., 1999), in which companies offer (a set of) services supporting the R&D process of companies.. Within this market, the activities specifically related to product development are increasingly relevant (Bruce et al., 1995). In this paper we specifically focus on

companies offering services for the new product development process, from initial concept definition, through design, engineering, prototyping and laboratory testing, to final commercialisation and marketing.

The aim of this paper is twofold:

- to shed light on the market of product development;
- to study the management and organisation of companies operating in such a market.

To this aim, section 2 of the paper describes the conceptual context of this research, giving the basic theoretical background, concepts and definitions. Then, section 3 defines, as precisely as possible, the research objectives and the methodology followed in order to achieve them. The empirical study, which represents a critical step in the research and which has been designed coherently with the research objectives, is described in section 4. Finally, section 5 discusses some conclusions, according to the main results of the theoretical and empirical study.

## 2. Services supporting Product Development: the conceptual context

The literature has deeply examined the contribution of the external organizations to the innovation process of the firms, the ways to realize that profitably and the reasons of this steady evolution. It is not part of the paper to provide a wide and comprehensive overview on the literature, but these following are starting points for our analysis.

Several authors have studied and demonstrated that, also in the innovation development field, the interaction with external actors is growing (Quinn, 1999, 2000), even in activities considered strategic (Quinn & Hilmer, 1994), with a considerable level of benefits for the companies that have properly adopted (Chatterji & Manuel).

This phenomenon is observed not just in the small firms (MacPherson, 1997) but, for different reasons, also into greater enterprises. This trend toward the externalization of firms' R&D – increasing of their R&D outsourcing, downsizing at the same time, of their internal department – has been widely discussed in literature, as seen in the introduction. Among others, the following issues concerning outsourcing has been studied: i) external sources of innovation outputs (MacPherson, 1997); ii) relationships between participants (Chiesa & Manzini, 1998; Millson et al., 1996; Kotabe & Swan, 1995; Zagnoli & Cardini, 1994), iii) reasons for collaborating (Howells, 1999; Quinn, 2000) iv) effects on costs and advantages (Kessler et al., 2000) v) product development outsourcing (Smith, 1998; Bruce *et al.*, 1995).

On the other side the data about small product development firms show a solid growth (Ho, 1997).

The innovation outsourcing process can be divided into several phases (Quinn, 2000). We focalise our attention on the “outsourcing of new product development and introduction” that allows to obtain several common advantages. These can be summarized into some key words (Quinn, 1999):

- resource limit: in this way a company can overtake its internal limits;
- specialist talents: in the same way cannot have a depth knowledge or motivation in all technical sectors;
- multiple risks: the company the outsource innovation process (part of) can afford risks and outsourcers can split it into many customers;
- attracting talent: talented people tend to go to the best specialists in a sector, like these outsourcers are.
- speed: companies can get to market faster through small, often more flexible, firms.

So, this tendency creates a new category of services (and suppliers, of course) called KIS – knowledge intensive services (Windrum & Tomlison, 1999) – or KIBS – knowledge intensive business services (Miles, 2000) – characterized by an high innovative level and scientific intensity of the outputs.

The definition of a KIS firm is “private sector organizations that rely on professional knowledge or expertise relating to a specific technical or function domain. KIS firms may be primary sources of

information and knowledge or else their services form key intermediate inputs in the products or production process of other business.” (Windrum & Tomlison, 1999). This kind of services can be applied on several sectors: from banking to real estate, from market research to insurance services.

Later a more specific subset, called TSS – technical and scientific services – consider KIS, or KIBS as a wide sector in which TSS are a part of them. TSS are services which lie upon technical and scientific knowledge and give an output that is, again, technical and scientific knowledge. A framework about the classification of TSS is proposed (Chiesa & Manzini, 2000), especially the role played in the innovation process of a product.

Other forms of data aggregation are available on literature (OECD, 1999), but what can be observed is that, anyway, services supporting the whole product development process, or part of, are not well known yet, as are the actors of the context. There are some specific analysis on territorial context (MacPherson, 1997) but a view on the whole sector is very difficult to find.

Some interesting data can be found in the AMA research report, (Outsourcing: the AMA survey, 1997), that shows that the 12% of overall outsourcing is on product design and 16% on components design. To compare note that production has a percentage of 31% and assembly 20%.

In the same source we note that in 88,7% of the outsourcing activities in product design are involved more partners (87,3% in components design). The 93,8% is a partial outsourcing of product design (93,3 in components design), while the difference is a complete outsourcing.

What can be argued is that most of the existing research contributions analyse the services for product development from the point of view of the innovator, who needs to access to external sources of support in order to develop new products. In other words, the general perspective is that of the client of the service. In this paper, we adopt a different perspective, i.e. we study the market from the viewpoint of the supplier of services for product development.

Coherently with what we said above in this preliminary theoretical background, what we expected in our research is to discover a fragmented market and a wide choice of specialized companies, activities, competencies.

## 3. Research objectives and methodology

As pointed out in the Introduction, in this paper the focus is on companies that support the process of product development, from concept definition to market commercialisation. The study is articulated into two distinct logical parts: the first one concerns the analysis of the market of companies offering services supporting the product development process and the second one to the managerial and organisational difficulties found by companies operating in such a market.

As far as the first part is concerned, the research objective is not to give a complete and exhaustive picture of the market of product development, but to shed some light on it. In particular, the topics on which the study concentrates are:

- the relevance of the market of product development, i.e. the level of diffusion of companies offering

services for product development. Some economic observation is also considered, in order to capture, even very approximately, the potential value of the market;

- the type of different services offered by companies operating in such a market, i.e. the various activities that can be found available. The aim here is to understand which kind of support is offered to innovators for product development, even from a single firm (able to support the whole development process) or from a set of companies (each one performing a sub-set of activities).

In our view, this first part of the study should support the second one, which is aimed to deepen some of the most relevant managerial and organisational problems faced by companies offering services for product development. As a matter of fact, it gives some relevant insights on the competitive context. More in detail, the research objective of the second part is to analyse and discuss:

- the interaction between the service company and their clients, from the initial phases of the relationship (how the service provider offering meets the potential client), to the end of it (how the service is actually released, how the relationship is concluded);
- the problem of acquiring, maintaining and developing the competencies needed to offer a leading edge service in product development;
- the organisation and management of the single projects.

According to the research objectives above, and starting from the conceptual context described in section 2, an empirical study has been designed.

The first research objective undoubtedly requires an extensive study, i.e. data and information from a wide sample of companies operating in the market of product development. The second one, on the contrary, needs to be supported by a detailed case study, in which managerial and organisational issues can be discussed and analysed in depth. Hence, the empirical research, that is described in section 4, is composed by two distinct parts: the extensive study and the case study.

Finally, the empirical study allows to discuss some conclusion on the market of product development and, in particular, on the problem of organising and managing companies operating in such a market.

## 4. The empirical study

The empirical study has been articulated into two distinct parts:

- the extensive analysis;
- the case study.

### 4.1. The extensive analysis

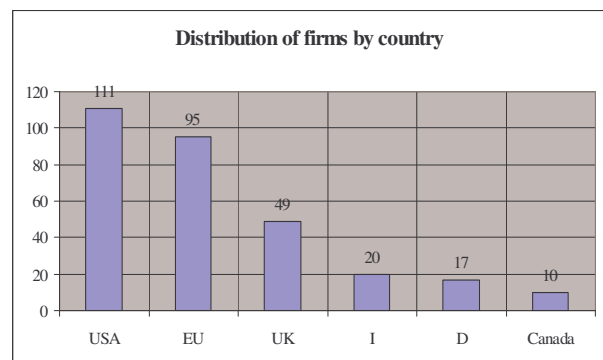
The extensive analysis was aimed to capture some

general characteristics of the market of product development. The problem in organising such an analysis was that, as enlightened in section 2, the market itself is quite new, databases are not available, the competitive arena is not clearly defined, there is a lack of common definitions and concepts. After consideration of these difficulties, we decided to base our extensive research upon the web, searching for the web sites of companies offering services for new product development. The underlying idea was that the (supposed) competencies and culture of companies offering high tech services for product development should undoubtedly force them to introduce the web as a mean of communication. In terms of localisation, we decided to consider two geographical areas: North America and Europe. Extending the analysis beyond these borders would require consideration of countries in which the economic, social, political and cultural features are totally different and, hence, in which the market is not comparable with European and American ones.

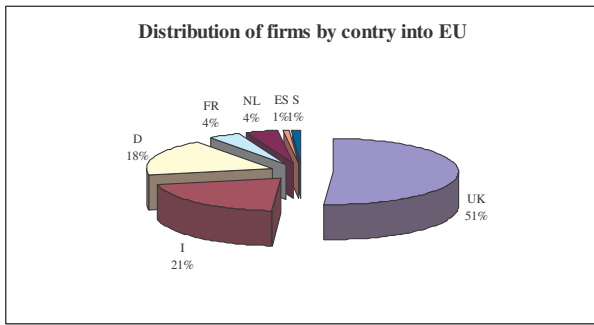
Beyond the identification of companies, i.e. the definition of the actors operating in the market of product development, the aim was to analyse the web sites in order to find out information about:

- the type of service offered, i.e. the type of activities that companies are able to perform;
- the birth year;
- the size, in terms of number of employees.

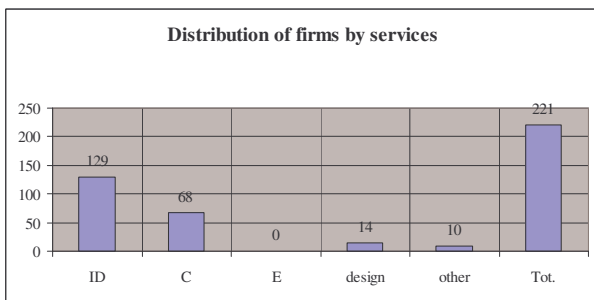
The results of the research are here briefly described. About two hundred of companies offering services for product development have been found. For each company, data have been collected about the localisation and the type of activity, whilst information about the size and the birth year has been found only partially. Figures 2, 3 and 4 present a synthesis of the data referred to the localisation and the type of activities.



Picture 2: distribution of firms by country



Picture 3: distribution of firms by country into EU



Picture 4: distribution of firms by services

ID: industrial desing  
 C: complete product development (all services)  
 E: engineering  
 Other: other services

The results of the extensive analysis confirm that many different typologies of companies operate in this market, offering various (set of) activities. This suggests us to concentrate our case study on companies that are able to support the whole process of product development, from concept generation to commercialisation. This would allow to investigate a greater set of managerial and organisational issues, with a higher level of complexity. This, in turn, would greatly enrich the scope of conclusions.

#### 4.2. The case of the MR&D-Institute

The case study concerns an Italian company able to support the whole new product development process: the MR&D-Institute (Marketing, Research & Development).

It was founded in 1991 and now operates with its own highly specialized structure, organized in five divisions and, through a series of collaboration agreements with outside organizations, draws on the resources of Universities, Research Centers and Companies specialized in particular technologies.

The main objective of MR&D is the new product; in order to achieve it, three are the most important activities developed:

- research the market's needs;

- design innovative products;
- construct productive processes able to guarantee the cost and quality objectives.

Specifically, a large number of technological tools are available in MR&D for i) design (CAD, CAE, structural calculation....) and ii) prototyping (rapid tooling...)

A typical relationship with the customer passes, in the scenario of a complete product development, through five macro - areas:

- marketing: it is essential to gain all the necessary information about the market that is to be tackled and the technologies required to be competitive in order to fully understand the background of the new product. The Product / Market / Process framework relating to the new project, therefore, must be well defined. To carry out this activity, the MR&D Institute development team is composed of Marketing, Industrial Design, Product Design and Engineering specialists coordinated by the Project Leader.

- research: precisely due to its innovation-oriented mission, MR&D Institute develops goal-oriented research programs for its clients in which new technologies or new functionality/performance are the main objectives. The programs are often conducted with the collaboration of Universities and Research Centers, above all for theoretical/practical testing and extremely complex subjects. The outcome of this research activity is a feasibility study that enables an initial assessment of the project's objectives, of the technical interest and of the economic relevance.

- industrial design: in a new product - even an industrial product - design has taken on such an important role that at times it can make the difference between market success or failure. Industrial Design is not simply the ability to make a product attractive, but it involves analyzing the "Human Factors", Ergonomics, Material Research, Ecological Design, Disassembling Design and so on.

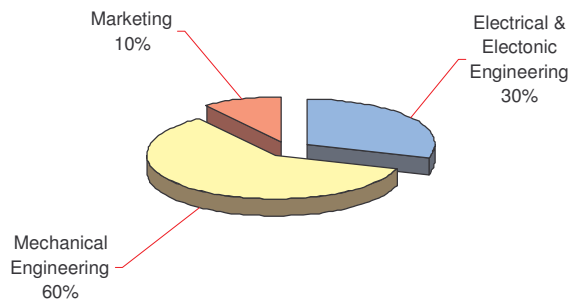
- product design: MR&D develops new products with a wide range of market categories: this results in the need of numerous specialized design structures: like mechanical design, electrical design, electronic design, lighting design.

- engineering: the last phase involves the technical expertise and technological and production know-how, to implement the process design and the engineering of the product.

MR&D operates in two categories: consumer and industrial. More specifically the clients belong to the following sectors:

- healthcare and medical products
- telecom systems and products
- home & building automation
- small – medium size household appliances
- white and brown goods
- fitness, sport & utility goods
- automotive (components)
- lighting technologies
- professional equipment
- military instruments

and they are indifferently start-ups, small and medium enterprises and multinational groups. Actually, the areas in which MR&D operates, give this percentage on the sales, as shown in the following picture:



Picture 5: Percentages on sales of the different activities

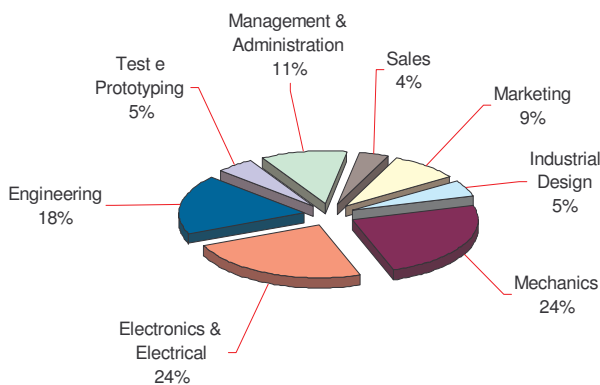
To conclude the picture over MR&D market note that it operates on several countries from Italy to South America, from China to Europe.

MR&D has a relevant commercial structure, which has the aim to contact new potential client; there are several ways to obtain this result:

- visiting professional fairs: paying attention to the sector they belong to, and following a precise segmentation of the market of the potential clients, fairs allow a direct, customized presentation of the firm;
- Web site: it is used like a virtual window over the firm and over its projects;
- direct marketing approach: MR&D operates on firms' databases, sending them informative documents about the MR&D and the services proposed. These documents include i) a customized presentation of MR&D ii) "credentials", that are previous new product developed.

The results of this continuous marketing campaign show that, beginning from an initial group of firms contacted in these ways, a 40 - 50 % is really interested in the services offered, but just a 7 - 8 %, will draw a real contract.

MR&D is characterized by competencies in many different technical sectors and scientific discipline, that allow to support the whole product development process. The graph, in the picture 6, shows the relevance of the different internal competencies, in terms of employees dedicated.



Picture 6: Relevance of internal competencies

The MR&D involves internal and external specialists and that varies in the number and specialization of its members, depending on the

project's advancement stages. The development frameworks are the most important part of MR&D Institute and involve approximately 70% of its 60 in-house collaborators. Added to them there is a wide outside network of associated and specialized firms (part of the support facilities), particularly in the areas of rapid prototyping, manufacturing and sector consulting.

The internal development frameworks are set up by projects, so the Project Manager is strongly predominant in a heavy matrix structure. He is entrusted with responsibility for the project's operations in working with the customer.

The way of customer relationship is defined by three parameters: (i) quality (defines the required performance level, the innovation and thus market placement) (ii) cost (determines the margin of contribution and it is thus an objective that must be achieved in order to give the product the profitability required by the project's business plan) and (iii) time (justifies the economic effort sustained by the company and creates leadership in the market).

In the initial phase of this collaboration, the first step is a research on the market to:

- explore the market; on this research will be based the industrial design and the concepts of the product,
- collect quantity data about the sector, to create a complete framework, until a complete "business plan", including, potentially, also a strategic analysis, fund raising and certification.

From the initial proposal, MR&D and the customer will define together the aim and scope of the collaboration. This one is the first step, in a process that will involve a great activity of (effective) communication, but it has an enormous importance, since after that the partners can operate in a independent way.

The Client is informed on a weekly basis with structured reports on how the work is proceeding, the current difficulties and the obtained results. More in detail, the scheme of contacts with the partner is based on three levels:

- 1.meetings between the top management of both parts;
- 2.meetings between project manager and project leader, that are key – role of the entire collaboration;
- 3.interactions between the operative employees.

During the all new product development process there are some "check points", in which the customer receives a complete "state of the art".

In terms of operative tools, MR&D usually applies all the typical Project Management tools.

## 5. Conclusions

The empirical study suggests some relevant final remarks. According to the research design and to the structure of the empirical research conducted by the authors, only few observations can be drawn about the characteristics of the market of services for product development, that, in our opinion, requires a more focused investigation and could represent an interesting research area for the future. On the other hand, many observations can be referred to the managerial and organisational implications. Finally, some conclusions can be drawn about the role of governments and

institutions in supporting the market of product development services.

### *5.1. About the market of services for product development*

The synthesis of the extensive analysis, that is described in figures 2, 3 and 4, shows that:

- industrial design represents the most common type of service offered; in particular, in Germany it represents the 73% of the market of product development;
- a great number of companies operates mainly in the USA, with the 47% of the total number of companies, but Europe as a whole account for the 40%;
- with respect to the USA, in Europe companies offering ID services are more diffused;
- USA seem to be more specialised in companies offering the complete set of activities for product development; in Europe, on the contrary, ID is prevalent;
- In Europe, UK seems to have a dominant role, with the 51% of the European companies; even if only a few data are available, this could be related to the fact that the former companies offering services for product development was born in the UK.

### *5.2. About the management and organisation of services for product development*

The case of the MR&D-Institute shows that a service company can (potentially) support the development of new products, from concept to commercialisation, including the phases of fund raising and certification. In other words, a service company can become a unique interlocutor, a critical information source, able to support the company for the many different difficulties that may arise during the development process. Furthermore, in many cases it may become a real source of innovation, suggesting new concepts, features, functionality for potential new products. However, despite these potential advantages, the market of product development still face several problems, that strongly limits its business opportunities and economic returns. The case studied points into evidence some managerial and organisational problems, and, in some case, suggests interesting solutions.

A first critical problem refers to marketing communication. A field study conducted in MR&D demonstrates that only 40% of the potential clients contacted are really interested in the services offered and, furthermore, that only 7-8% of that potential clients eventually become real clients, drawing a collaboration contract. This means that the market is not well known yet, and that the offering itself is not completely clear for the potential clients. In order to improve the communication effectiveness, it is

important to: (i) use adequately the web, describing in detail the activities performed, the 'modus operandi', and emphasising examples of successful collaboration, with important companies with good reputation; (ii) stimulate the clients already served and satisfied to promote the service company, including in their web site news and information about the collaboration; (iii) participate to meetings, conferences and fairs in which the services can be directly described and offered to a wide set of potential clients.

A second critical point relates to the competencies needed to offer services for product development. As showed for the MR&D-Institute, the set of competencies required is really wide and it is impossible to reach excellent levels with the internal resources. Furthermore, innovation is frequently the result of the integration of knowledge and technology from different disciplines (technology fusion). Hence, it is necessary to possess (or to have access to) many different competencies, in order to adequately support the development of a new product. This, on the one hand, creates business opportunities for service companies, since innovators cannot afford the new product development process with their internal resources. On the other hand, it forces service companies to greatly enlarge the scope of their activity and the set of competencies possessed/accessed. As a consequence, building and maintaining an external network of competencies is fundamental to keep the pace with leading edge technologies and knowledge and to exploit business opportunities. To this aim it is critical to: (i) activate collaborations with universities and research centres, that represent excellent sources of knowledge; (ii) identify other companies that offer excellent services for product development and establish relationship with them for pre-competitive collaborations; (iii) keeping contacts with leading innovative clients, that frequently represent an important source of information and knowledge. Building an external network of competencies is difficult, but maintaining and sustaining such a network is even more difficult and it is critically related to the firm's ability to maintain the promised performance and, ultimately, to the company's reputation.

Another issue related to competencies concerns the management and organisation of such competencies. The MR&D organisational choice (the matrix organisation described above) allows a continuous improvement of the firm's competencies: people involved in projects are forced to improve their knowledge in order to face the new problems and, in turn, the evolution of the projects usually provide people with new information, data and, ultimately, scientific and technical knowledge. But this is not enough: for continuously building and developing competencies it is necessary to stimulate people to participate to conferences and meetings, to propose training activities (for example in excellent technology schools), to fully exploit the external network, in particular universities and research centres.

The above problems are in part related to that of the localisation of PD service companies. In many cases, in fact, it has been observed that there is the need of physical interaction with the client for a successful collaboration. This means that the market is in some case limited by the localisation of service companies, that need to be physically close to the client. This problem could be faced through the development of tools for distant team working, but, at the

moment, the culture and competencies of the potential clients don't seem to be as such as they should to allow this way of interaction. Face to face contacts are still essential both in the initial phase of the relationship and during the collaboration. Hence, a network of external competencies, with a different location, could greatly enlarge the set of potential clients that a company can reach and serve.

A third set of observations relates to the interaction with the clients, that poses several difficulties. As already pointed into evidence, the first problem is to establish an effective communication, making clear the type of support that the service company may provide. Then, once the message has been clearly received by the potential clients, the service company has to deal with their resistance and opposition. This is due to several factors: (i) organisational resistance, related to the diffuse opposition of internal employees towards external people; (ii) NIH syndrome, due to the fact that, in many cases, the service company becomes the real source of innovation; (iii) cost factors, related to the fact that companies frequently underestimate the cost for providing a service for product development, because they cannot completely appreciate the effort needed to acquire and maintain the underlying competencies; (iv) the complexity of contracts that deal with intangible assets (competencies, technological knowledge, scientific know-how), both as inputs and outputs and that should adequately regulate the exploitation of an innovative product; (v) the problem of the intellectual property rights over the new knowledge/technology produced: who can exploit such innovation? How can/should be divided the relative benefits?; (vi) the need to link the development process with manufacturing (manufacturing liaison): in some case this link can be difficult to achieve, when the development process is assigned to an external company; (vii) localisation problems, as mentioned above. Some of these problems (particularly point (i) and (ii)) have already been discussed in literature and the case of MR&D does not provide for new solutions. In general terms, it can be argued that:

- the management of such a sophisticated projects requires the use of project management techniques, that (partially) facilitate the interaction with the clients during the realisation of the activities and (should) ensure the respect of certain requisites in terms of quality, timing, costs;
- improving the effectiveness of communication can also improve the interaction with the clients.

Some issues in our view represent interesting areas for further research. Among them in particular, the problem of the intellectual property rights and of the evaluation of intangible assets in contracts.

## 6. Notes and references

This paper is the results of the joint work of the authors. However Vittorio Chiesa wrote section 1, Raffaella Manzini wrote section 3 Emanuele Pizzurno

the sections 2, 4. The section 5 has been written jointly

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