THE OTHER SIDE OF EXTERNALIZATION: A STUDY OF THE PRODUCT DEVELOPMENT FIRMS

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ABSTRACT

In the last few years, it has been observed that a large number of 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 and so forth. This is a consequence of an observed trend towards the externalisation of (part of) the firm's R&D activities. This is a subject that several authors have widely discussed and the reasons why. The outsourcing of these activities has been largely explored, but the state of the art of the literature is less complete by the side of the firms that can be considered as addressees of this outsourcing process.

The paper has the aim to provide, first, an " exploratory map" of these firms, analysing their location and distribution worldwide and the level of competencies these firms are able to provide to their clients. To reach this objective, an empirical study, consisting in an extensive analysis, has been conducted; many information have been collected (for about two hundred of companies) about size, location and type of services offered.

Second, an intensive analysis, consisting in a deep case study concerning a company providing the complete range of product development services, from conceptualisation to industrialization has been developed.

Finally, 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 and some new research guidelines have been traced out.

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, Chiesa et al. 2002), 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 draw a descriptive map of the market of product development. The word *map* doesn't mean just a geographical distribution of these firms but also in terms of competences, services offered, etc;
- to study, more precisely, 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 is divided into two parts:

(i) the extensive analysis designed coherently with the research objectives, is described in section 4. Section 5 discuss the results of the empirical analysis;

(ii) the case study, that explores the main organizational and managerial problems this kind of firms are currently dealing with., are discussed in section 6. Finally, section 7 draws 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 the following issues can be considered a starting point.

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, 1993).

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 have 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).

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 – considers 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

Accordingly with the diffusion of suppliers of product development firms, 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 (Quinn, 1999). The data about these small product development firms show a solid growth (Ho, 1997). Also a previous research of the same authors (Chiesa et al., 2002) show that the dimension, in number, of this kind of firm is relevant.

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.

3. RESEARCH OBJECTIVES AND METHODOLOGY

As pointed out in the introduction, this paper focuses 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 former concerns the analysis of the market of companies offering services supporting the product development process and the latter identifies some managerial and organisational difficulties companies operating in such a market are currently dealing with.

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, which the study concentrates on, are:

- the relevance of the market of product development, i.e. the level of diffusion of companies offering services for product development. Some economic observations are 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, two distinct parts compose the empirical research :

- the extensive analysis (section 4) and the relative observations (section 5);
- the case study (section 6) and relative comments (section 7).

4. THE EXTENSIVE ANALYSIS

The extensive analysis was aimed to capture some general characteristics of the market of product development. The main problems concerning the analysis organization, as enlightened in section 2, are that:

- 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.

In particular, this last point was critical: in fact, during the research it was found that, not only a directory of the PD firms was not available, but there is not a common definition of what a “PD firm” is.

In the light of the above issues, 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 suggest them to introduce the Web as a mean of communication. In terms of localisation, we decided to consider mainly 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. However some considerations over enterprises will be presented.

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. More than 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 1 and 2 present a synthesis of the data referred to the localisation.

The synthesis of the extensive analysis, among the other, shows that:

⇒ 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 41%;

⇒ UE and USA together cover the 86% of the market of these kind of services.

The results of the extensive analysis confirm that many different typologies of companies operate in this market, offering various (set of) activities.

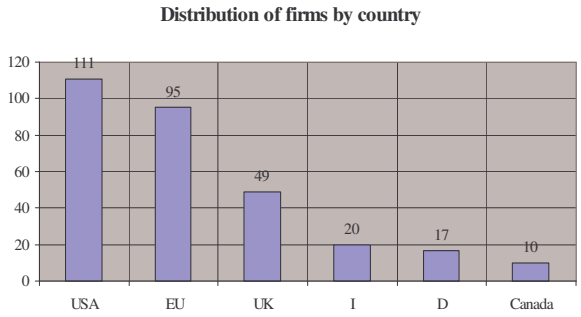


Figure 1: distribution of firms by county

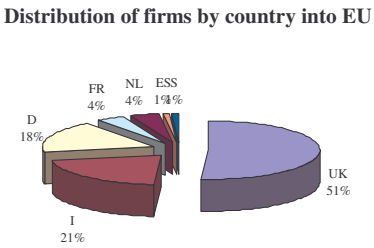


Figure 2: distribution of firms by country into EU

5. A DESCRIPTION OF THE PD FIRMS

In detail, the results of the empirical analysis showed that the considered market is rather fragmented and it's characterised by a large number of new firms' typology. In fact, we found firms belonging to the following categories:

(a) Complete product development firm *declared*;

(b) Complete product development firm *demonstrated*;

(c) Complete product development service just in a specific industry;

(d) Electronic plus extension of the services to complete product development on request;

(e) Industrial design plus mechanical engineering and marketing;

(f) Industrial design;

(g) Industrial design in a specific industry;

(h) Industrial design with a limited value added;

(i) Project Management services plus the management of a network of external competencies;

(j) Mechanic and electronic engineering;

(k) Low value added design;

(l) Technical services

(m) Low quality level of services.

Coherently with the aim of the paper and the research, these typologies of companies have been a grouped into five categories. These were created basing over a careful observation, thanks to an analysis framework, of what appear to a potential client on the website of these companies:

1. industrial design firms;
2. technical development firms;
3. integrated industrial design firms;
4. integrated project management firms;
5. complete product development firms.

premising that:

1. Firms belonging to the categories from (a) to (d) can be grouped into the category called *Complete product development process*; in fact, in any case, firms in that category can be considered as suppliers of an integrated product development service;
2. Firms in position (e) are exactly which will be defined into *Integrated industrial design* category*;*
3. In our opinion the firms in (f), (g) and (h) can be aggregated into the same category called *Industrial design;*
4. Project Management services plus the management of a network of external competencies (i) are exactly the firms that we considered in the *Integrated project management;*

5. In the *Technical services* we comprehend the firms that provide just a phase of the PD process: design, MEE, prototype, etc. (j), (k), (l) (m).

Looking at the results of the extensive analysis, in the light of this aggregation, we note that:

⇒ with respect to the USA, in Europe companies offering ID services are more diffused, in fact in Europe, this service is prevalent (Table 1);

⇒ On the other hand USA seem to be more specialised in companies offering the complete set of activities for product development (Figure 4); 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;

⇒ there are firms over 18 countries, but just the 5 countries represented in figure 4 show more than 10 companies;

⇒ the most diffused category all over the world seems to be *Integrated industrial design* (Figure 3);

⇒ industrial design (integrated or not), among the countries with the largest number of companies, represents the 65% of the German market of product development, the 61% in the UK one;

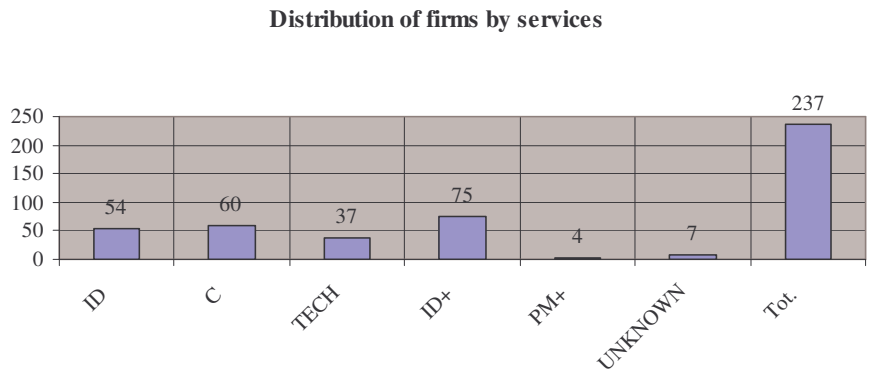


Figure 3: distribution of firms by services

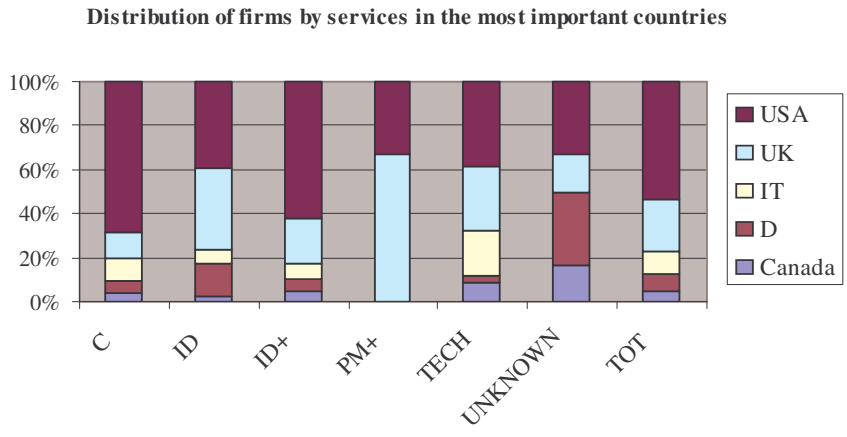


Figure 4: distribution of firms by country and service

ID: industrial design

C: Complete product development services

TECH: technical services

ID+: integrated industrial design

PM+: integrated Project Management

UNKNOW: service not exactly defined

⇒ just the most advanced countries (respect to product development) have firms classified as *Project Management companies*, specialised in the management of a network of external competencies. That's because to develop this kind of firms it's basic to have a wide market of PD services;

	D	*ES*	*FR*	*IT*	*NL*	*UK*	*Svezia*	*Tot UE.*	*% UE*
C	*3*		*1*	*5*		*6*	*1*	*16*	*17%*
ID	*7*		*2*	*3*	*2*	*16*		*30*	*31%*
ID+	*4*	*1*	*1*	*5*	*1*	*14*		*26*	*27%*
PM+						*2*		*2*	*2%*
TECH	*1*			*7*		*10*		*18*	*19%*
UN	*2*				*1*	*1*		*4*	*4%*
								96	*100%*
Tot.	*17*	*1*	*4*	*20*	*4*	*49*	*1*	*96*	

Table 1: distribution of firms in EU countries

	UK+USA	*Rest of the world*	*USA + UE*
C	68%	32%	83%
ID	65%	35%	91%
ID+	76%	24%	91%
PM+	75%	25%	75%
TECH	62%	38%	84%
Tot.	43%	57%	86%

Table 2: Distribution of the firms worldwide

Accordingly, the PD firms have been grouped in macro categories, listed hereafter:

1. Industrial Design firms;
2. Technical Development firms;
3. Integrated Industrial Design firms;
4. Integrated Project Management firms;
5. Complete Product Development firms.

In the followings, the main features of each category have been provided.

1. Industrial design firms

Firms that, primarily, provide activities concerning industrial design, such as materials choice, interface study, ergonomic, usability, graphic and communication language, compose this category. The typology of competencies owned by this category and their levels are showed in Figure 5.

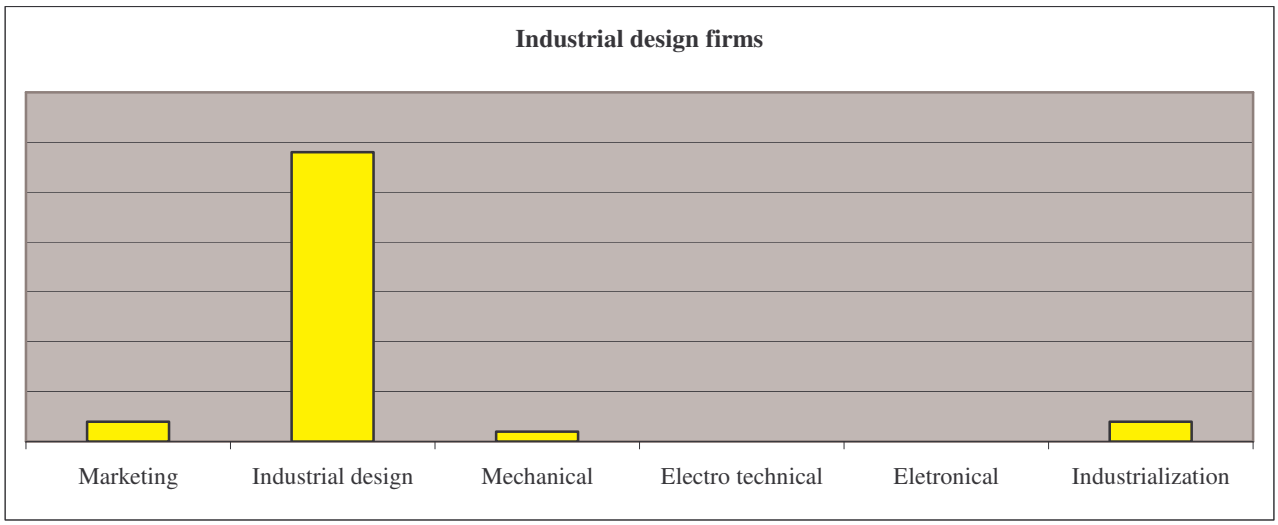


Figure 5: The typology of competencies of Industrial design firms

The level of innovation provided by these firms is low, concerning mainly the surface of the product, without touching its technological heart. In fact, in most cases the client has already defined the main specifications, leaving to the PD firm just a limit space for action, concerning the marginal characteristics of the product, such as its aesthetic and imagine. Moreover, most of the products developed by these firms show problems in the production phase, mainly due to the firm's lack of productive competencies.

According to the above issues, the industrial design firms can provide only marginal contributions to their clients' PD process; the process still keeps on being led by the client itself. Usually a co-development relationship between the two parts takes place, being the client totally involved in the PD process.

This category of firms, in order to provide a more complete service, could try to acquire from the outside the competencies they lack, creating a network of specialised actors able to deal with technical issues; nevertheless, these firms seem unable to manage external specialised contributions, leaving to the client the duty to co-ordinate all the different actors.

2. Technical development firms

This category groups all the "technical" firms, meaning those companies that have developed specialized competencies especially in design, mechanic, electronics and electro technical fields. They possess the competencies necessary to develop new product features, providing innovative and relevant contributes concerning the use, application and integration of the newest available technologies.

Technical development firms usually focus on a particular field, i.e. mechanic, and, at the same time, maintain the level of competencies needed to manage the innovation in the others areas - i.e. electronics and electro technical - internally

or through partnerships with other players. Due to their high level of specialization, these firms usually provide services for high technology markets such as telephony, computer science, robotics and industrial automation.

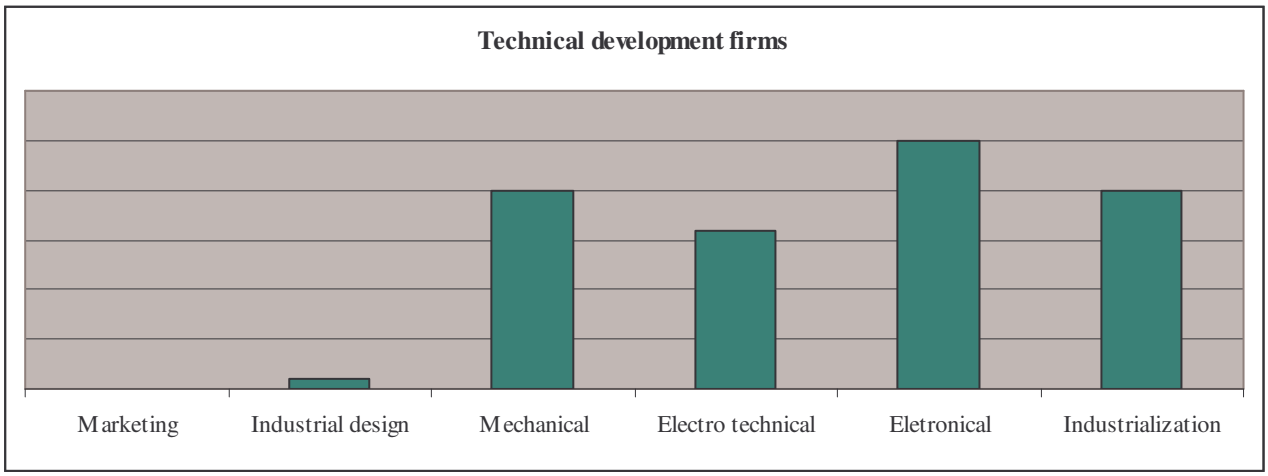


Figure 6: The typology of competencies of Technical development firms

As shown in figure 6, their competencies usually do not include marketing and only partially the industrial design. In this perspective, the technical development firms can manage internally only the central phase of the PD process, because their contributes, even though innovative and relevant, need clear inputs from the client; accordingly, the client has to (i) deal with the product design - the low level of design competence owned by these firms allow just to "dress" the product - and (ii) manage the final activities before the launch of the product, such as communication and packaging. Technical development firms can provide a helpful support to the production phase; in fact, thanks to their technical knowledge, they can consider the existing production ties in the planning phase of the PD process and, if required, they can provide new productive equipment or adapt the existing to the new specifications.

3. Integrated industrial design firms

These firms try to overtake the lack of competencies enlightened for the industrial design firms: as shown in figure 7, this group of companies possess competencies in marketing, mechanic and engineering fields.

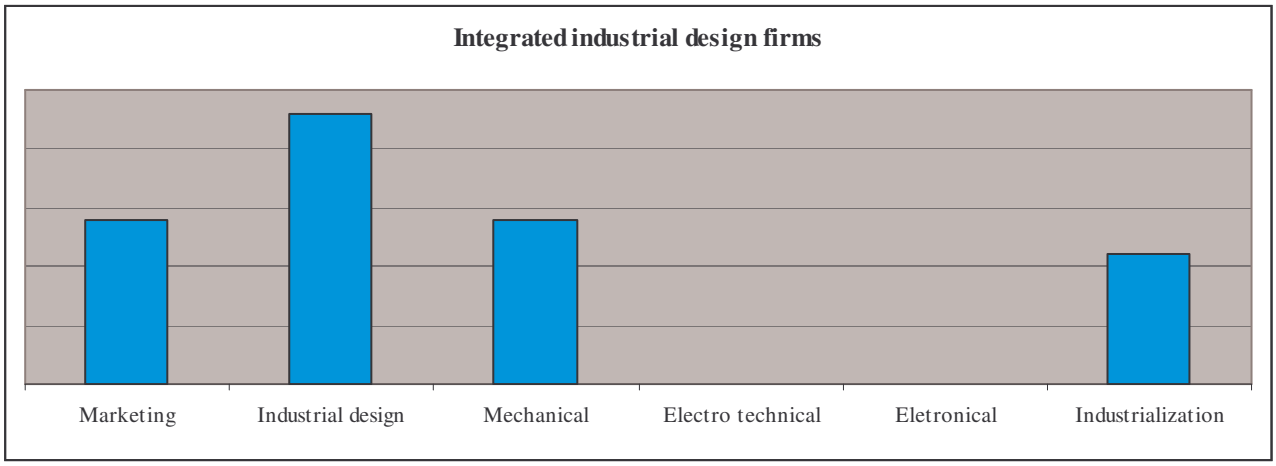


Figure 7: The typology of competencies of Integrated industrial design firms

This category is able to devise and develop in a completely independent way mechanical products of high imagine: on the contrary, they do not own the competencies needed to develop products embedding electronic or electro technical functions.

These companies, being responsible of all the PD process, have structured their organisations according to project management theories and considering the necessity to built a tight relationship with the client. Moreover, the empirical analysis has showed the tendency of the clients to delegate to them the development of complex products, limited to their own competencies: they are mainly responsible of the layout of the product and collaborate with the client itself or with an external partner for the development of the technological heart of the product.

For firms belonging to this category, the service of "manufacturing liaison" is a key success factor: the term addresses to the creation, by the integrated industrial design firms, of a network of selected productive units which the client can eventually refers to for the production of its new product. It's a value added service for the client: in fact, due to the novelty of the product, the client in many cases doesn't posses the level of knowledge required to search and select the best productive system and location.

4. Integrated Project Management Firms

This category is relative new for the market: specifically, with the term "Integrated Project Management Firms" we address to those companies that propose themselves primarily as PD process consultants in the manufacturing industry.

These firms usually provide a complete service to their clients, resulted from the union of the different contributes provided by their partners: in fact, Integrated Project Management firms entrust themselves to a network of partners, each specialised in a different areas of the PD. In this view, their contribute to the final result consists in co-ordinating and managing the relationships among the partners of the network (see figure 8).

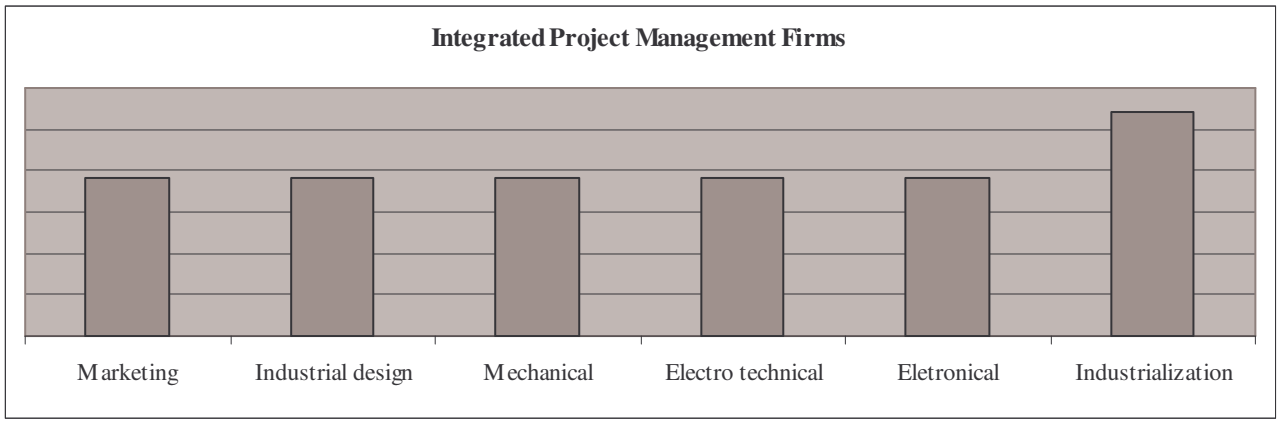


Figure 8: The typology of competencies of Integrated Project Management Firms

In the light of the above issues, the advantages are double: (i) the client interacts only with the integrated project management firm and not with a network of players, (ii) the integrated project management firm has a high level of flexibility (flexible structure), being able to collect the different contributes by the best performing companies as they would be a part of its own structure and leaving them if not more necessary.

The main problem these firms have to deal with concerns the co-ordination: in many cases, their lack of technical competencies together with their small dimensions, do not allow the firm to develop the huge coordination structure such an organisational model required. In our opinion, this can be considered a transitional organisation model: in fact, the company adopts such a structure for the time necessary to develop some competencies to keep inside, however continuously supporting by the external network.

5. Complete Product Development Firms

These firms can be considered "complete" both for the PD process phases they can preside and the competencies they possess (see figure 9): generally they are able to plan and develop a complex product, providing a high level of novelty and supporting the client in all the phases of the PD process.

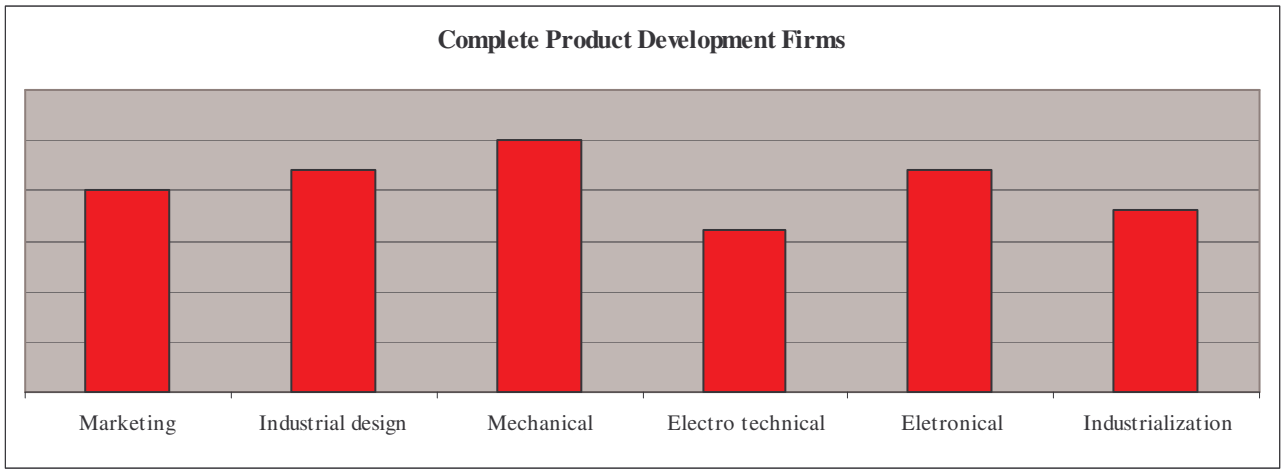


Figure 9: The typology of competencies of Complete Product Development Firms

They develop a strategic collaboration with their client aimed at improving its market performance: they can reach this goal through different typology of innovations, going from the development of products that embed new technologies to process redesign in order to gain more efficiency.

These firms sometimes adopt a matricial organisational structure: project managers create multidisciplinary teams composed of members belonging to internal functional units and, sometimes, external specialists.

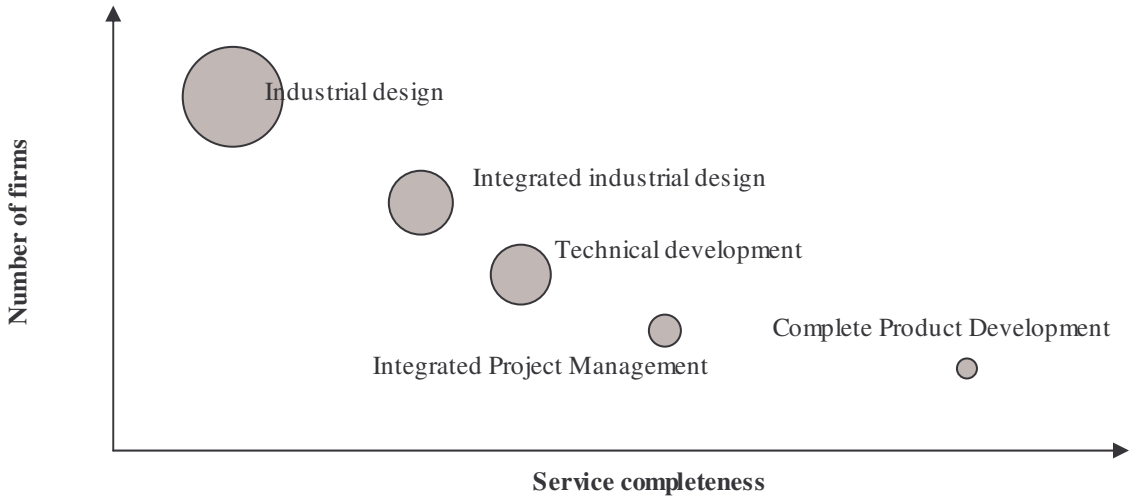
Focalisation of their organisational structure and operating activities on the PD process are the main strengths of this kind of actors: in fact, the daily experience matured in dealing with different projects and actors, respecting costs and time limits, undoubtedly influences company culture and its internal way to work. Consequently, complete product development firms continuously sharpen their management modalities, improve their human resources' competencies and skills and possess a dynamic structure, characterised by a strong feel of belonging and cohesion that in a company's internal division are difficult to develop.

These firms usually develop many projects in parallel in order to saturate their human resources: operating in different industries, they have information - concerning the industry lifecycle phase, its evolution trends, etc.-, that allow to (i) reduce the client commercial risks and (ii) see the eventual opportunity of a cross-fertilisation.

Final considerations concern the dimension of each category examined above; as we expected, the more competencies increas e in typology and level, the more the number of actors decreases. (see figure 10)

All these consideration suggest 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.

Figure 10: The Competencies related to the number of the firms



BOX 1: The Italian landscape

In this box it is opened a short presentation about Italian situation, in partcular the following table shows the Italian landscape, in terms of:

- the name of PD firms involved in this research;
- the typology of the services offered.

	Firm	Country	Services
1	MR&D Institute	IT	C
2	Studio AEMMEV	IT	TECH
3	Giugiaro - Italdesign	IT	C
4	Pininfarina	IT	C
5	Prototipo	IT	C
6	Sciro	IT	C
7	King & Miranda	IT	ID
8	Leverplan	IT	ID
9	Studio PrimaLinea	IT	ID
10	Design Group Italia	IT	ID+
11	Giugiaro Design	IT	ID+
12	Pininfarina Extra	IT	ID+
13	Spring Design	IT	ID+
14	Ugolini Design	IT	ID+
15	Why group	IT	TECH
16	Partec	IT	TECH
17	Sintec	IT	TECH
18	VIP Technology	IT	TECH
19	Albacad	IT	TECH
20	Technimold	IT	TECH

Table 3: the Italian landscape

6. 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:

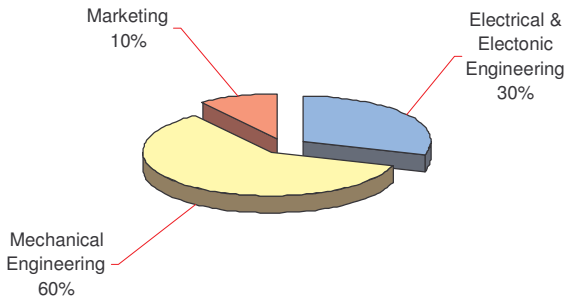


Figure 11: Percentages on sales of the different activities

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 figure 12, shows the relevance of the different internal competencies, in terms of employees dedicated.

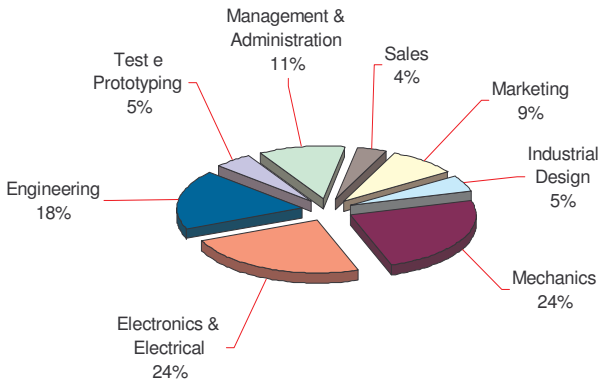


Figure *12: Relevance of internal competencies*

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.

7. OBSERVATIONS ABOUT THE CASE STUDY

The case of the MR&D-Institute shows the potential contributing that a firm can provide to the development of new products: in particular, the case study enlightens the possibility to support internally all the product development process, 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 faces several problems, that strongly limit its business opportunities and economic returns.

The case studied points into evidence some managerial and organisational problems, and, in some cases, suggests interesting solutions.

A first critical problem refers to marketing communication. The 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.

In this perspective, the study has pointed out the main features a client takes into consideration in the outsourcer's selection: (i) brand reputation and track record, (ii) costs and time, (iii) work methodology, (iv) level of experience in the client's market, (v) singleness of the interlocutor (capability to provide a complete service). In the light of the above issues, service companies have to focus all their efforts in performing these variables at their best.

Moreover the study has enlightened that MR&D and direct rival firms have similar companies (often the same) in their clients portfolio. Such a result, first underlines that the target market is still in an embryonic phase, second, shows that the same client may have different product development partners, due to the fact that it can outsource a variable part of the its PD process, depending on the type of innovation it's dealing with.

Another important result has to be introduced to the reader: even though the client's level of satisfaction for services provided by MR&D and direct rival firms is about 80% (in the sense that about 80% of their clients prosecute in the business relations), pushing the client to keep on its partnership (s), the profitability (or level of innovation provided) of such a collaboration decreases to the projects number growing. Specifically, a service PD firm seems to be able to provide its maximum level of innovation once it has reached a deep knowledge of its customer and its market (this usually takes some projects); subsequently, it starts to conform to the client's way of thinking and, consequently, it becomes more and more unable to provide a valuable external contribute. In that moment, the client has to change its partner in order to receive a new contribute free from conditionings.

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 PD companies, since innovators cannot afford the new product development process with their internal resources. On the other hand, it forces PD 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.

The main advantages concerning the building of an external network of competencies are (a) the increase of the

available resources not tied to the structure (it means more flexibility), (b) the increase of the available specialised competencies and (c) the potential reduction of the operating costs. On the other side, building an external network of competencies is difficult due to the long time ad high costs required by the partners process of selection, 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 cases limited by the localisation of service companies that need to be physically close to the client. On the other side, PD firms need to be present in the most innovative and technological areas (i.e. Silicon Valley in the U.SA. and Cambridge in G.B.). In fact, their presence in such areas increases their possibilities to develop valuable partnerships and find high qualified human resources and new customers, due to the fact that the most important industrial groups have a location there.

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, many PD firms have created beside to their headquarters, where all the different competencies are simultaneously present and continuously developed, a network of external competencies, each with a different location, in order to enlarge the set of potential clients and preside their different technologies.

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 factor: (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 under estimate 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 cases 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.

8. FINAL REMARKS

Considering the empirical analysis as a starting point, the paper has provided a first *classification* of the PD firms: companies have been grouped into five categories and for each one, the main features and the possible future trends of development have been identified.

In this perspective, the empirical study suggests some relevant final remarks. Coherently to the research design and to the structure of the empirical analysis conducted by the authors, only few observations (see paragraph 4.1), can be drawn about the characteristics of the market of services for product development, that, in our opinion, requires a *more focused investigation,* representing an interesting future research area.

At this level, considering as basic a deeply exploration of such a market in order to verify the classification proposed in a wider number of firms and contexts, two are the possible further steps:

- to access to data about the Japanese context and firms, not considered in the empirical analysis;
- to try to comprise the correlation (if existing) between the specialisation of the offered services and the countries, in particular related to the developed competencies. In other words, in our opinion, it will be interesting the comprehension of the factors that influence the specialisation of the countries and the distribution of specific typology of PD firms. A more deep analysis on the Italian landscape is functional to this objective.

In particular about the Japanese context, collection of data and information of PD firms that, not available at the moment, is essential to draw a picture of the world, representing the actual limit of the research.

The case study, instead, has provided a first sight:

- inside a complete NPD firm – a company able to support the whole product development process of its client-: in particular, the paper has shed light on (i) its internal organisation, (ii) its external network, (iii) the bundle of competencies it possesses, related to the five macro – areas which a typical relationship with the customer pass through, (iv) its target market and (v) the steps followed in order to develop a collaboration with its customer.
- of the main managerial and organisational problems the PD service firms are currently dealing with, providing, in some cases, interesting solutions. Specifically, the problems the paper draws to the reader attention concern (i) marketing communication, (ii) competencies development/acquisition, and (i) competencies organisation and (iv) interactions with the clients.

Accordingly, the paper has identified open areas for further researches, concerning:

1. the analysis of the main features – i.e. dimension, target market, internal and external organisation, etc.- for each typology of firm provided in the classification (see section 5).
2. the identification of effective solutions to the main managerial and organisational problems enlightened above: in this perspective, Internet and the ICT technologies can play a key role. Currently, companies are analysing how web-based solutions can support their processes in order to gain competitiveness. According to the increasing market turbulence and competition, company processes are now provided by a network of different actors: in this perspective, web-based solutions, enabling integration and collaboration among the players of the network, can improve company performance. Accordingly, future studies may concern the analysis of the available web-based solutions supporting PD process – i.e. collaborative design, collaborative engineering, collaborative product development management, etc.- and their effect on company organisation.

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This paper is the results of the joint work of the authors. However Vittorio Chiesa wrote section 1, Raffaella Manzini wrote section 3, Stefano Ferrari wrote sections 6 and 7, Emanuele Pizzurno the sections 2, 4 and 5. The section 8 has been written jointly.

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