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The evolutionary dynamics underlying the emergence and development of design as a business

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Abstract
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The opinions expressed in this paper are those of the authors. The usual caveat applies. Preliminary draft: please do not quote without authors’ permission.
1. Introduction

Despite broad consensus that ‘design’ escapes easy categorisations few studies tackle the question of how design practices become embedded within the portfolio of firms’ activities and how they bear upon decision-making. This is relevant because the domain of influence of design activities potentially cuts across the whole organisational spectrum thereby suggesting significant organisational and strategic consequences. To be sure the formerly ‘hidden role’ of design has been observed to play a central role for innovative performance in multiple spheres including the strategic, financial (Roy and Wield, 1986, Walsh et al., 1988, Potter et al., 1991), economic, sociological and managerial (Rothwell and Gardiner, 1983, Walsh and Roy, 1983, Walsh, 1996). Yet the literature traditionally emphasises aesthetic aspects of products thus downplaying important organisational processes. It is argued here that this is partly due to the difficulty of agreeing on ‘what design is’. A recent attempt by Beltagui et al. (2008) to summarise different definitions in the literature reinforces this notion by disclosing a wide variety of meanings. Design involves decisions about both form and function of products, about the mode of production and even delivery (Walsh, 1996). Therefore besides agreement on the fact that design does not sit comfortably neither inside nor outside firms’ boundaries (Walsh, 1996; von Stamm, 1997, 2008) no study has made headway in analysing critically the ascent of design activities from being relatively peripheral to becoming a key asset for competitive strategy.

From a conceptual viewpoint the goal of understanding how design expertise is embodied into a firm’s product range and appreciating the associated organisational consequences falls comfortably within the literature that stresses the mutual interdependencies between the dynamics of technological knowledge and the division of labour. Thereby following Rosenberg’s lead we connect industry emergence (Rosenberg, 1963) with processes of knowledge creation, systematisation and diffusion (Rosenberg, 1998). Throughout the paper we also refer to the case of the furniture sector in Italy to illustrate the extent to which the technological developments of the 20th century contributed to the establishment of design as an independent and leading business function for both innovation and strategy. The furniture sector in Italy, widely known for its long standing tradition and success, provides a fitting empirical backdrop for this analysis (Kristensen and Lojacono, 2002, Ravasi and Lojacono, 2005, Utterback et al., 2007, Verganti, 2009).

Summing up the paper will tackle the following research questions:
(1) What are the factors that contribute to the emergence of industry?
(2) And, how does the interplay between division of knowledge and division of labour drive the emergence of standalone business functions like design?

The remainder of the paper is structured as follows: Section 2 reviews the existing literature on design and connects with crucial aspects of the theory of the firm. Section 3 illustrates a series of findings concerning the emergence of design as an industry as well as the organisational consequences at firm level. Section 4 will discuss the extent to which design represents a good case in point to appreciate emergent processes of business evolution. Section 5 concludes and summarises.

2. Literature review

2.1 Drawing the boundaries of the study

Over the last few decades design has acquired a variety of meanings in the scholarly discourse. Originated literally from ‘making of a drawing’ this word is now a concept encompassing a wide spectrum of domains including strategy, creativity, organisation of production and engineering. The lack of agreement as to where the boundaries lie is perhaps
best signified in the paucity of statistical data about design as both activity and sector. Nevertheless scholars have debated over its influence on firm competitiveness on several occasions. The first major initiative launched by the British Government in the 1980s, the Funded Consultancy Scheme/Support for Design (FCS/SFD) programme, led to the production of numerous reports and scientific articles (Walsh and Roy, 1983, Roy et al., 1986, Potter et al., 1991, Walsh et al., 1992). By and large these concur that design impacts both prices and other factors such as product performance, ease of use, durability, product delivery et cetera (Walsh et al., 1992). More recent studies emphasise that the approach towards design management is crucial for firm performance but still miss to spell out how design activities practically integrate with innovative practices and strategy-building (Gemser and Leenders, 2001, Hertenstein et al., 2005, Perks et al., 2005). Indeed we coincide with Chiva and Alegre (2009) in arguing that research in this direction is still at infancy.

Back in the mid-1980s Kotler and Rath singled out the importance of design as strategic tool. In their definition design is a process that seeks to optimise consumer satisfaction and company profitability by creating performance, form, durability, and value in connection with products, environments, information, and identities. Furthermore, they suggested, satisfactory results can be achieved by training general managers, marketers and engineers to understand design, and designers to be aware of and learn about the role of these people (Kotler and Rath, 1984). Although sympathetic with this view Dumas and Whitfield (1989) illustrate how, unlike technology developments, design developments are not clear-cut and companies are left with serious dilemmas. Yet another in-depth investigation of the strategic dimension followed as competitive strategies adjust to the global challenges of the new century. Looking at the success achieved by Italian manufacturing firms Verganti (2003) appraises the central role of designers within those organisations that grind their strategy upon radical design-driven innovations. Taking the practical example of the Metamorfosi lamp by Artemide, Verganti concludes that the roots of competitive advantage in the new era are in new languages (e.g. brainstorming ideas through workshop attended by the firm’s CEO and managing director for brand strategy, five well-known designers and a design professor), new technologies (e.g. by exploiting new applications of lighting technology), and new product developments (i.e. combining the new meanings with the new technologies). In more general terms Verganti singles out three key ingredients: a personal network of stable relationships with brokers of languages; a range of alternative channels to access this knowledge; and apt internal coordination to support the integration of these inputs (Verganti, 2003:42).

This brief foray in the scholarly literature suggests that the relevant aspects associated to design need not be conflated to the proverbial “eureka!” moments in which a new idea takes shape (Tether, 2006) but should rather be articulated within a wider strategic view that appreciates the multitude of processes involved. Elements such as aesthetics, envisioning a new meaning, improving functionality, are basic to the definition of design. Within a given organisational setting, boundaries with other business functions are blurring and additional understanding is urged at this regard.

### 2.2 The organisational challenges underpinning the design function

To make matters operational, let us refer the European Union’s definition of design:

- Design is a process, an activity, and not only the results of that activity;

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1. For instance, the NACE code has not included design underneath a unique category yet and design-related activities are considered as sub-categories of other sectors.
2. The Programme aimed at promoting the use of professional design expertise in small and medium-sized firms across the country.
3. This definition is adopted for practical purposes and is not necessarily antagonistic to that proffered by scholarly research (see Beltagui et al. (2008) for a systematic summary).
• Design entails an holistic approach that goes beyond aesthetics and includes functionality, ergonomics, product safety;
• The design activity can be undertaken in any type of organisation since it can relate to products, processes, services, communication (Commission Staff, 2009:11).

Practically speaking this definition implies that design decisions are not limited to aesthetic aspects but encompasses also ease of manufacture, efficient use of materials, the incorporation of innovative technologies, components or materials, etc. (Walsh, 1996).

The difficulty of locating design within organisational charts is due to various reasons: first, design is a knowledge-intensive business service whose skill mix differs substantially from other sectors (Miles et al., 1995; Consoli and Elche-Hortelano, 2010). Second, and consistent with the former, the career development of designers does not follow standard paths as other professions, such as lawyers or architects, do: in some firms designers are consultants within a bigger structure (Ulrich and Eppinger, 1995) whereas in others they take strategic lead of the innovation strategy in art director capacity. Third, competition consumers’ tastes bring to bear significantly on competitive behaviours thus urging firms to sourcing efficiently inputs from functions as different as R&D, marketing, design and production. Important empirical studies dating back to the 1970-80s show that the integration of specialised activities like marketing and R&D is essential to innovation success (Souder and Chakrabarti, 1978, Cooper and Kleinschmidt, 1986, Moenaert and Souder, 1990), design and manufacturing (Gardiner and Rothwell, 1985, Johne and Snelson, 1988). Conversely other studies on the management of design expertise (Bruce and Morris, 1994, Ravasi and Lojacono, 2005, Ravasi et al., 2008) did not produce clear insights on the interaction manufacturers-designers can be best managed especially in terms of skills and know-how.

For what concerns design, firms have three basic options: (i) developing the expertise in-house, (ii) employing external designers, or (iii) using a combination of both in-house and external design (von Stamm, 1997:2). The same study analyses attitudes to buy-in design skills and finds that half of the firms that did not use external designers declared to have an internal design team, whereas one-third declared that they ‘do not need design service’. In fact, a major barrier to use external designers was the cost (i.e. design is seen as a luxury), followed by the difficulty to find a talented designer who could understand the specific requirements of the firm (von Stamm, 2008). More recently, Filippetti (2010) emphasised that keeping designers in the periphery generates an ‘essential tension’ with the firm. To the extent that successful design solutions are observed to be a central ingredient for long-term sustainable advantage the advantages of integration seem clear.

2.3 A matter of division of labour and division of knowledge

Higher awareness of the importance of design has led firms to re-think their innovation strategies and the associated organisational structures and managerial practices. Interestingly the studies reviewed in the previous sections tend to concentrate on either division of labour (Verganti, 2003, Perks et al., 2005, von Stamm, 2008) or division of knowledge (Ravasi and Lojacono, 2005, Filippetti, 2010). But arguably the fate of innovation depends on the division of labour as new knowledge is generated, new practices and skills are needed, and new types of firms emerge. It is argued here that the dynamics of design service firms are best understood when framed in a perspective that integrates the matrix of knowledge-creating activities with the division of labour. Innovation scholars, in particular economists, have largely neglected the interplay between division of labour and division of knowledge, hence

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4 It is worthy emphasising that we do not simply refer to the codification of knowledge that is needed to setting up standard procedures, but to the non-tangible knowledge whose highest expression is the design embedded into the final product itself.
5 This latter observation draws upon primary interview data.
the urgency to explore further how design capabilities combine with firms’ existing resources and internal procedures (see Figure 1 below).

**Figure 1:**  Interplay between division of knowledge and division of labour

In what follows we propose to connect explicitly the organisation of design activities (with a focus on the underlying skill bases) with the generation of future knowledge and product developments. Alfred Marshall had portrayed that firms can benefit from external economies, which do not come for free (Marshall, 1910) and need to be organised. To this remit, organisational capabilities are essential and Edith Penrose (1959) has provided the foundation: she conceived the firms as a pool of resources, and any firm’s attempt to acquire new skills and competencies is aimed at managing efficiently these resources. The development of firms’ internal knowledge base (i.e. their innovative growth) will then depend on which skills are selected and how their embodiment within organisational routines and linkages takes place (Loasby, 1994). Clearly design knowledge needs to be integrated within the broader portfolio of firm’s routines to play a key role in innovation strategies. The key is to understand how such ‘translation’ occurs given the difficulty posed by the intrinsically tacit nature of design: on the one hand design is effective as long as it manages to bind together aesthetics with ergonomics, functionality, product safety, etc.; on the other hand the blurring of traditional ‘design’ boundaries hinders the possibility to assess how firms perceive design (e.g. to improve visibility, to reach innovation leadership, etc.) and what type of efforts they put into it.

A hint in this direction is provided by Rosenberg’s (1998) account of how the chemical engineering discipline (i.e. a certain way of organising labour practices) emerged in response to growing demand of specialised knowledge. Different from the new growth theory, where only investment in R&D and tangible capital are considered, Rosenberg emphasises the progress of technology and the inter-temporal externality between existing knowledge and new knowledge (‘A new blueprint today spills over to lower the cost of future blueprints’, Rosenberg (1998:168)). By focusing on the progress of chemical engineering as a discipline, the author points to the existence of two distinct types of knowledge: scientific knowledge, which practitioners get through professional and/or graduate qualifications, and practical knowledge, i.e. know-how that is developed ‘learning-by-doing’ and that is important to organise production and remain innovative.

These elements appear to resemble the case of design, which can be conceived as a venue whereby relevant knowledge is generated, organised and utilised for shaping future innovation. Hence, the following questions become of great relevance in this context: ‘How is this knowledge generated?’, ‘Who generates it and who uses it?’, ‘How is it organised from the blueprint stage through the whole industrialisation stage?’.

Further relevant insights are provided by Vincenti’s (1990) study of the aeronautical industry in the early 1920s arguing that the creative, constructive knowledge of the engineer bridges the gap between scientific research and the final product. The appealing concept here is that of an autonomous engineering epistemology, that is, of a body of technical knowledge not subservient or derivative of science but organised according to its own dynamics, principally that of problem-solving. Especially relevant to this paper is the systematisation of operative standards for airplane control which resulted in control-volume analysis, a specific
discipline to allow engineers applying “the physical laws governing mass, momentum, energy and (when needed) entropy” (Vincenti, 1990:113). Such cases, Vincenti insists, are paradigmatic for a broader set of phenomena in which recursive learning in practice contributes to the definition of operative criteria.

In a broadly similar fashion, we argue, the task of industrial designers is to ‘dress’ the product looking for a balance across different dimensions such as aesthetic, technology and new concepts; while this knowledge penetrates the business, boundaries conform to a new contour which firms will (implicitly) adjust to. Unsurprisingly, this knowledge is biased in some way by the skills of the subjects undertaking the specific activity; for this reason it is important to investigate to what extent changes in design practices depend on the growth of the knowledge within the field as opposed to the growth of individual skills, and if there is an interplay (as this is supposed to be the loci of innovation), and how this can be best described. Moreover, we should not neglect that additional input to furniture manufacturers had been provided by the emergence and establishment of prototyping as a method for testing ideas in fields where design is also essential crucial to innovation back in the 1960s (e.g. aeronautics (Dreyfuss, 1974), software technical systems (Wilson and Wilson, 1965)). How did these dynamics influence firms’ choices with regard to production processes and, in turn, on the building of internal competencies?

In line with these arguments, this study adopts an evolutionary approach to analysing the emergence of design as a business function. By observing the technological trajectory of the furniture industry, already regarded by other scholars for its relevance within the national economy (Heskett, 1980, Sparke, 1983, Olins 1986, Politi, 2000), we claim that different forces have been (and partly still are) in play and influenced the path of growth to different extent. As mentioned already, the study focuses on the case of furniture firms in Italy, where by ‘furniture’ we mean the set of sectors undergoing the domain of ‘home furnishing’, therefore including not just the sector of wooden furniture itself, but also other sectors such as lighting, interior design, kitchen furniture, office furniture, and contract design. The choice of this ‘half-way’ definition satisfies a twofold need: on the one hand, it avoids industry-biased findings and allows a minimum of cross-industry analysis; on the other hand, there is a need for homogeneity in terms of knowledge bases in order to investigate coherently how design processes work and how knowledge is articulated. Based on primary- and secondary-source qualitative data, the following section presents the findings. With regard to the former, interviews have been conducted with different senior managers within furniture firms (i.e. R&D director, engineering unit director, marketing director, art director, head of the firm). Also, we build on books and design catalogues consulted in the library of the Faculty of Architecture and Design of Milan Polytechnique.

3. The co-evolution of knowledge base and labour specialisation

3.1 Technological advancement in furniture throughout the 20th century

The structural change of a given industry raises interesting questions about its industrial dynamics and technological advancement. In the furniture industry there had been limited technical advance, at least at the beginning: while countless new machine-tools were being developed, advances in materials were mostly limited to the field of metals in the early 20th century.

6 From a theoretical as well as a methodological point of view, it would be incoherent to treat the innovation through materials in a furniture firm similarly to the innovation through new fabrics taking place in a fashion design studio: the knowledge base is clearly different, thus difficult to test existing theories or develop new general principles.
century. Iron, in its cast state, and later in the form of steel, was the material of the day. As a result, craft-manufactured products such as furniture started being influenced by the advent of new materials: existing materials were being substituted by new ones in order to decrease costs and increase efficiency and it was only with the advent of tubular steel, bent plywood and plastics that furniture designers began to respond aesthetically to the potential of new materials, inventing new forms that could be appropriate to the modern age. For instance, with the introduction of the ‘plastic procedure’ (as defined by a designer), it was possible to produce one piece instead of three or four as before, and curves were even more pleasant. Therefore, the challenge had become to produce objects from everyday life in a simple and efficient way.

However, the course of action of these dynamics was not straightforward mainly because of the difficulty to identify the motivating factor. To start with, materials in the Italy of 1950s showed a contradiction in the availability of resources and the actual products that were being produced. There was an endemic shortage of natural resources and a widespread use of aluminium. Artificial fibres were being produced and experimented for alternate sources of materials. At the end of the 1960s, the State concentrated on the economy and culture in order to offer better living standards to citizens, with a stronger focus on urban problems. In the early 1970s, Italian consumers showed increasing interest in trendy furniture, although there was a fall in the market. These dynamics show manifestly how knowledge was flowing across fields: from iron to aluminium, to plastics, manufacturers learnt how to treat them all for design purposes.

The availability of such materials and craftsmanship (i.e. availability of both knowledge and labour skills) favoured the development of an industrial context (new?) for which no knowledge base existed before, yet a spread enthusiasm was encouraging new entrepreneurial initiatives. In fact, due to demand from people living in cities, prefabricated construction elements were introduced for the first time in an attempt to promote an economy of construction and shrinking living spaces. Along with the trend of making household products modular, in the 1970s design continued the fashion begun in the late 1960s of exploring seating possibilities, this leading to a 60 percent increase in furniture production (Wulfing, 2003:44). In this scenario, many of the activities that were undertaken mainly to promote Italian design were gaining international consensus. Some of them deserve specific mention. The Triennial is an international exhibition dedicated to the decorative arts taking place on a three-year basis. Having been initiated in the 1920s, Triennials were playing mainly an informative role, by encouraging ideas and experience exchange and providing incentives to production and critical assessment and with a focus on town planning, social architecture and high-quality industrial production. Such approach has been resumed in 1947, when different curators proposed to tackle the post-war recovery more systematically; under the direction of Bottoni, effort was put in building a quarter in the Milan suburban area, which resulted as an experiment for the new architecture. The project revealed successful as it initiated the interest on themes that have been tackled by future Triennial exhibitions.

Worthy of being mentioned is also the Compasso d’Oro, that is an award for designers and manufacturers in the field of large-consumption products who demonstrate achieving a synthesis of form and function. It was the idea of a few influential individuals of that time (the architect Gio Ponti, the deputy of ‘La Rinascente’ Cesare Brustio, the critic Augusto

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7 The French Art Deco was taking advantage of those new materials for decorative reasons (e.g. balconies, metro stations), the US had a more operative approach by developing the all-steel car body, an innovation which was made possible by using the new steel-stamping machinery.
8 In 1971, the Italian population was counting 54,600,000 inhabitants and almost 50 percent of them were living in cities where there was a clear shortage of urban housing (Ambasz, 1972).
9 Source: www.triennale.org.
Morello) following a successful exhibit in 1953 that highlighted the talent of many artists. From 1959 to 1965 the competition was co-organised by ADI, which then assumed full charge of spreading the prestigious affair in 1965 (Wulfing, 2003). A further event contributed to spreading the Italian design, that is the Salone del Mobile. This first took place in Milan in September 1961 and included 328 exhibitors covering 11,860 square meters of floor space (Sparke, 1986:202). Its initial aim was to promote the different production traditions of Italian furniture manufacturer; it then revealed a precious meeting point for collaborations and innovative growth amongst the different exhibitors and the same clients.

The co-existence of these elements encouraged firms towards a more systematic approach to the management of design-related skills. In fact, the positive influence product design was wielding on firm competitiveness and performance pushed many small workshops to shape their internal processes around the principles of efficiency and innovativeness. In other words, firms started to research for new materials and/or technologies (i.e. new production techniques), which could foster the systematisation of design-related knowledge and the exploitation of its benefits over time. Despite this increasing interest in innovative methods of production, designers and manufacturers had still to acknowledge the economic and ecological requirements of certain materials.

The major changes in the 1980s were related to the technological advances of the computer industry, which were entailing a shift from the industrial sector towards the service sector, and a growth in middle management in the workplace. In the 1990s, there was a search for new standards beyond modernity as well as a trend in collecting modern furniture from the past. The simple lines of fifties’ and sixties’ designs made of wood, glass and metal by the masters of their day were again being appreciated as the poor aging process of plastics had become apparent (Wulfing, 2003). Nevertheless, research in artificial materials and new treatment of plastics continued and the increase of globalisation led to a common interest: the sharing of knowledge and design concepts with other sectors. Thus, just as in the case of the machine tool industry (Rosenberg, 1963), whose application waved on many industries and led to product innovations through new production techniques, the increased use of IT within design increased exponentially its applicability by fostering knowledge sharing across disciplines. For instance, the artisanal production of wooden cabinetmaking was transferred to numerical-controlled machines, and the artisans were dealing mainly with the finishing touches; even further, the discovery of new ways to treat materials allowed to use plastics in more traditional pieces of furniture, such as cabinets, tables, but also in more particular objects such as chairs.

With events and exhibitions becoming more regular, and the wide spread of new materials and production processes, firms could rely on the (newly) emerging knowledge base and routines which to source their innovations from. Even education institutions started to organise both professional and graduate courses aimed at training practitioners who could balance the engineering vs. aesthetic component underlying the design activity. Initially, firms used to refer to graduates from architecture faculties or post-graduates from design schools, amongst many the Domus Academy. By mid-1990s, the Polytechnic of Milan had founded the first university-based School for Industrial Design, which was deemed to uncover the various aspects of the design disciplines.

3.2 Organisational dynamics underpinning the growth of the sector

From the section above, we can notice that, more remarkably since mid-1980s, industry-level dynamics were influencing the path of growth of the industry as well as the

\[10\] From interview with Amadori Carlo (source: rai.it).
specialisation of labour. On the one hand, the discovery of new materials pushed firms to undertake R&D activities and modify internal processes to accommodate the new production methods; on the other hand, firms’ increased interest inspired institutions towards a proactive approach to communicate design and grow through it.

The development of new knowledge had led firms to look for new skills to employ in their innovation processes. As we already argued, design is not a one-off product, rather it is a process drawing upon different elements, from functionality, to ergonomics, to aesthetics. Based on this consciousness, firms started to collaborate with designers whose activity would facilitate the embeddedness of technological innovations into the final output in order to meet consumer preferences and enter a high-volume production; in other words, when new projects were receiving high consensus by the market, firms seized the opportunity and started up to scale their production.\textsuperscript{11} To this remit, we must emphasise that firms were no longer seeking for design with a mere furnishing function, but to innovate systematically through it; the use of technologies proved of significant support to routinise and reproduce their projects for further exploitation.\textsuperscript{12}

Throughout this transitional phase, firms started to ‘consult’ external professionals in order to improve their innovation processes, machinery or to develop profitable collaborations with the suppliers of specific material or technology. Generally, professionals could be of a diverse background, from architecture to engineering, to the more recently established industrial design, however a common thread was featuring their relationship to the firm, that is: a strong drive to learn as much as possible about the firm production and innovation capability, and securing a certain (trust-based) authority on their decision-making. The interface would most likely be with the technical office (or R&D) internal to the firm (so-called ‘Ufficio Tecnico’, i.e. office of technicians) for two reasons: first, designers had to become familiar with the firm assets (e.g. skills, technologies, production techniques) and assess the types of production capabilities present in-house; second, designers were playing an intermediary role to the extent that they were coordinating the purely engineering-oriented approach of engineers or technicians with the aesthetic component of design. Alberto Alessi provides us with a nice example of how firms needed to adjust to new technologies and materials. His firm was adopting only the cold presswork technology for steel treatment while innovative and more efficient ways to obtain new products were being discovered (e.g. traditional technology required nearly 100 operations to produce a stainless steel coffee maker, whereas the immersion technology was quicker and even, more suitable for more complex shapes). Given that their traditional specialisation was locking the firm into existing technologies, the surrounding dynamics ‘spontaneously forced’ his firm to open up the route to new materials, machinery, and technologies.

In other words, the domain was being formalised and change taking place also at the organisational level. Designers entered organisations ‘from the back door’ as stated by one expert, meaning that there was not a space prescribed for the design function as such, yet their role became increasingly relevant in the context of innovation processes. As a result, while collaborations with external professionals were still active, design expertise has started to be attached to the internal R&D function. This could in fact encompass many diverse skills and capabilities, ‘from the painter to the varnisher, from the expert of polyurethane to that of plastics’, as stated by the founder and chairman of B&B.

\textsuperscript{11} From interview with Baroni Daniele (source: rai.it).
\textsuperscript{12} From interview with Baleri Enrico (source: rai.it).
3.3 Dynamics of labour specialisation

From the historical trajectory described above, it emerges that it was easier for architects to discover new materials and technologies in the mid-1950s rather than later in the century, when globalisation led to increased competition (e.g. Carlo Mollino conducted the first major experiments on wooden furniture, and this was facilitated by the emerging and flourishing industry in the nearby Brianza region). Once reconstruction was over, the approach to design changed: furniture firms were using design expertise (and knowledge) to coalesce the benefits of technologies with product ergonomics, functionality, aesthetics, and image. For instance, the production of the plastic chair was the outcome of research conducted throughout many years and aiming not specifically at a ‘new’ shape, but aiming to produce a shape that could best exploit the properties of plastics. Another example is constituted by the employment of paper into lamps: paper did not fall into the Western tradition for lighting production, however the discovery that the passage of light through the discontinuous filters of paper were generating warmth all around the lamp led to the successful establishment of a line of products following this insight.

A source of inspiration to delve further into this argument is provided by Vincenti’s (1990) and Rosenberg’s (1998) contributions as reviewed in the literature section. Their work suggests how focus on the learning process can shed light on the developments leading a certain field to reach a reasonable mature stage. In this context, a key point of departure is the observation of the turning points featuring the growth of the design knowledge base; changes have taken place as a result of action by both education institutions and firms in response to emerging needs and willingness to satisfy them. Theoretical tools and quantitative data are certainly necessary for designers to carry out their activity. However they are not enough. Designers also need practical experience, which may not lead to clear-cut rules or techniques, still this can support substantially the theorisation or programming of technology-based machines or tools. This knowledge is often not formalised, but expressed through rules of thumb or embedded into learning-by-doing processes.

Below we present three examples where we illustrate how the interplay between division of knowledge and division of labour have contributed to shaping organisational roles (and boundaries?), as a result of changes in the surrounding industrial context.

Technology developments and changing role of craftsmanship

It is widely accepted amongst designers and manufacturers within the furniture sector in Italy that a significant contribution to the development of designers’ knowledge base has been provided by craftsmen, a valuable source of specialised expertise. We can observe a change in the role of Italian craftsmanship throughout the century due to discoveries of new materials or technologies, which have nurtured the development of production processes. In the 1950-60s, craftsmanship was the alternative to industrial-scale production, this latter being accessible only to large manufacturing firms. With the increasing specialisation and the building of various capabilities in-house, the role of craftsmen changed: the small workshops were no longer the alternative option, but the loci where engineers or designers could carry out their experiments; in fact, despite the large scale production now in place, trial-and-error activities are still essential for the completion of design projects given that not all the knowledge can be routinised.

13 From interview with Colombari Rossella (source: rai.it).
14 From interview with Branzi Andrea (source: rai.it). A further example is provided by Busnelli Piero Ambrogio (source: rai.it) with regard to the fabrics.
Prototyping and new roles

Technological development and regular collaboration between designers and craftsmen favoured the emergence and establishment of prototyping as a crucial step for efficient production processes. Prototyping was in fact the means whereby trial-and-error could take place before manufacturing plants were set for high-volume production. This approach found in the chairman of **Olivetti** one of the first advocators who acknowledged the relevance of prototyping for innovation.\(^{15}\) This division of labour has pulled universities and post-graduate schools to providing more structured training courses centred on the meaning and role of prototyping in design. If we look upon the programmes organised by some of the major schools of industrial design (e.g. Polytechnic of Milan, European Institute of Design), it is possible to see how, beyond the preliminary sketching skills to apply in computer-generated 3D models and rapid prototypes, courses vital to design include ergonomic principles, design for manufacturing production, and design for sustainability (environmental practices). These latter are also defined as the ‘hands-on’ component of design.

New technologies (e.g. CAD) and change in the skills required

The advent of new technologies had also affected the design process itself. Previous studies have confirmed the importance of prototyping for design processes, a stage whose role has changed because of technological advancement. Before processes were automated, prototypes were subsequent directly to the sketch the designer (or architect) had finalised. With the establishment of rapid prototyping, the meaning of ‘test’ has changed: in fact, a significant portion of the trial-and-error activities are undertaken through the software with evident saving of time and resources in general. Moreover, rapid prototyping had allowed to try on a wider range of possibilities that the realisation of a physical prototype would constraint. This is only one side of the coin: while the software was playing this intermediary role, designers were not as in (direct) touch with the materials and functioning of a specific technology as before. This has reflected also on the specialisation of professionals: while education programmes list ‘rapid prototyping and use of CAD’ amongst their mandatory modules, on the other hand manufacturers ‘complain’ about the designers lacking of a practical perspective to the solution they are proposing. Thus, we believe this is another instance in which external dynamics have shaped the design process (e.g. prototyping being split into digital and physical processes), and these in turn shaped the specialisation of professionals (e.g. designers involved with the definition of the brief first, then later moving to the physical prototype).

4. Discussion

The interplay between division of knowledge and division of labour is not enough for investigating the dynamics of organisational development. The current research illustrates how the development of a knowledge base at the industry-level led to changes at the firm-level, and how this further reflected at the institutional level, where training institutions have provided specific education programmes.

To start with, our study has been informed by the work from Verganti (2003) and Filippetti (2010), whose contributions hint to the fact that design fits into firm strategies and that its impact goes beyond the mere aesthetics. In observing these phenomena, our findings have attempted to illustrate how the embodiment of design into product development takes place, and thence, how this business ‘function-activity’ is in turn embodied into the organisational structure. There is a bundle of skills that the firm does not necessarily coordinate in a certain way, yet the specific needs originating from a design project may push

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\(^{15}\) From interview with Giulio Castelli (source: rai.it).
towards a new professionally type of managing, and new ways of coordinating. We found that design is embodied into the firm products, hence into the organisational context; the overall argument does not relate only to how design shapes innovation strategy, it highlights that this has generated consequences in terms of new organisational settings, a new business ‘function’ indeed. Furthermore, the current study sheds light on the ‘lateral knowledge’ firms must develop with regard to new materials, technologies, specialised training, etc. Filippetti refers to an ‘essential tension’ between firms and design consultants, and the need to develop a long-term trust; however, the current research indicates that beside trust, it is crucial that external designers comprehend the firm vision, embed it into their creative activity and portray a common language via the new products.

Despite the attempt to picture the technological and non-developments featuring the design industry in Italy according to a linear logic (Figure 2), some reflections are to be made. As the dotted lines in the centre of the graph indicate, interactions take place between the different domains in a non-sequential way and at different points in time.

**Figure 2  The emergence of an independent (business) function**

This is a first, clear add-on to the existing literature on industry dynamics and growth of the firm: existing economics literature has been involved with either division of knowledge or division of labour (Rosenberg, 1963); industrial evolution studies have been concerned mainly with technological progress and division of labour (Rosenberg, 1998). Under this light, we suggest that Figure 3 provides a fairer representation of the dynamics underpinning the establishment of a standalone discipline.
It seems we are now in a better position to observe how the development of design as a discipline has supported organisations’ choices accordingly. Unlike the tradition of organisational studies to focus mainly on routines and practices in the context of a given business function (e.g. R&D, marketing), the case of design witnesses that industrial dynamics are also important for two reasons: first, technological progress is inherently embedded into the growth of an industry, and if we are to unveil the role of design as booster to innovation, advances within the concerned industry shall not be neglected; second, firms’ decision-making is influenced by the internal strategic approach as well as the routines and practices that develop and become established at the industrial level (e.g. events have influenced firms’ approach to design, and gained an increasingly wider audience). These remarks resonate with Nelson’s (1994) view of industry evolution shaped and directed by the interplay across institutional, technological and organisational dimensions.

The processes of emergence and establishment of design as a discipline provide insights for exploring how the role of designers as professionals has changed throughout the evolution of the industry. In fact, we could notice that from delivering a service mainly attached to product appearance (i.e. during the wartime, furniture design was aiming mainly to re-furnish the damaged houses), designers are now significantly involved with the R&D unit and other experts of production. In fact, the high demand pulled entrepreneurial initiatives that have shifted the focus of design activities to a technological dimension, in which differentiation through materials or technology were gaining ground (point “a” in Figure 4). Furthermore, such a context favoured the regular organisation of events (e.g. exhibitions, prizes) whereby the meaning of design was reaching an increasingly wider audience. The Association for Industrial Design was founded in 1956 in order to support manufacturing and practitioners in the field and favour knowledge sharing amongst them (point “b” in Figure 4).

Change has also affected the role of craftsmen: due to the above described developments, their expertise was no longer a mere alternative to high-volume production, but of great support to designers who were in need of a loci where to experiment and select the best prototype (points “c” and “d” in Figure 4). The way teamwork was organised within workshops had in fact fostered a constant interaction between manufacturing firms and
production experts on the one hand, and designers on the other. Eventually, even education institutions had to adapt to the emerging discipline: schools at both professional and graduate level started providing different courses (e.g. UG degree in industrial design, training courses on rapid prototyping, ergonomics, etc.) that could shape the design professional, besides the engineer or architect (point “e” in Figure 4).

While the increased attention of education institutions towards design UG and PG programmes signals a process of professionalisation of the field, on the other hand we question whether this would hinder originality and heterodox thinking of design professionals. As Baumol (2005) highlights, there is at trade off between education that focuses on technical competence and mastery of currently available analytic tools on one side, and the education which aims to foster creativity and imagination for stimulating an original approach on the other: more emphasis on either one of them may hinder rather than facilitate innovation. We claim that practice-based knowledge is essential for designers to act as innovators within firm product development processes; we are not downplaying the role of education institutions, rather stressing that practical knowledge must constitute a significant share of their design programmes.

Figure 4 The changes affecting the development of design

A key element in the development of a strong knowledge base had derived from the fact that designers were invading production floors: only through a hands-on approach, they could understand the language of specialised workers, translate it into product characteristics and functionality, and interface with the managerial levels for strategic purposes. In particular, the careful selection of materials and craft plants that should carry out the production have helped bridging the gap between tradition and innovation and allowed for a transformation in design that enabled the two to come together (Sparke, 1998). Parallel to this, prototype has emerged with a different ‘aura’ compared to other fields: while in aeronautics it was conceived as a methodology (Wilson and Wilson, 1965, Dreyfuss, 1974), in furniture it developed as a stage
of the production process essential to assess the feasibility and reaction of certain materials to certain conditions (e.g. pressures, temperatures, etc.).

In general, we can detect an attempt of firms to internalise the so-called dynamic transaction costs, that is ‘the costs of not having the capabilities you need when you need them’ (Langlois, 1992:113). In line with Langlois’ argument, in investigating the boundaries of a firm, one cannot neglect the process of learning taking place within the firm itself as well as in the market, and this is what we believe is lacking in Rosenberg’s (1998) study of an emerging discipline. In fact, the emergence of chemical engineering was the result of a joint effort by chemists and engineers who were working separately within the same firm; the major, maybe the only, external influence was coming from institutions such as MIT, which were fostering the intellectual debate around a new field of science. Design is an example of how industry-level dynamics, mainly of technological and institutional nature, have shaped firm organisational boundaries; similarly, changes internal to the firm, mainly regarding the knowledge base, have pulled out a response by educational and professional institutions. We believe this is partly intertwined with service dimension of the design activity, which by definition is nurtured through a wide array of inputs and its output constitutes most of the times an intermediate input to the innovation processes of other actors.

5. Conclusion

Organisational studies have often explored the types of routines and practices underpinning a certain business function, but they have rarely been concerned with observing the force underlying the emergence of the function itself, more specifically how labour specialisation at different levels, i.e. industry-, firm-, institutional-level, interplay and lead to the establishment of a standalone knowledge domain. It was the aim of this paper to focus on these issues and unveil the process whereby labour specialisation can lead to the emergence of a standalone business activity or ‘function’. In particular, we observed a cyclical process based on which certain routines have shaped organisational choices and these, in turn, spread across the industry and influenced institutions’ decision-making.

The study indicates also that designers are located between the engineers on the one hand (these with a strong background on technical requirements) and the firm’s top management or art direction on the other (these latter obviously in hold of the strategic lead). Therefore, there appears to be a blurred line within which professional designers’ technical skills are fundamental, and beyond which their talent for aesthetics and strategic thinking becomes essential. To some extent, it is this type of specialisation that makes some firms more successful than others.

Different dynamics have supported the emergence of a knowledge base, such as: the contribution by craftsmen with regard to specific prototyping capabilities; trial-and-error activities aimed at proposing different alternatives, then choosing the most efficient one; the advent of new technologies has modified the types of skills needed throughout the product development process by leading to the emergence of new organisational roles (e.g. designers, prototypers, art directors). Unsurprisingly, allowed many firms to step up to a high-volume production scale, especially from the 1980s onwards, and as a result, affected the trajectory of technological development (e.g. search for new materials or reinventing the existing ones).

A final remark concerns design as a creative rather than a more technological or professional knowledge-intensive business service, which draws the attention to the professionalisation of a given field. Unlike more traditional fields (e.g. pharmacy, law) in

16 Needless to highlight that these dynamics have reflected back on the types of specialisations that were emerging across the country: education institution were establishing courses on specific subjects such as innovation through materials, technologies and structures, etc.
which the professionalisation has undergone the establishment of a professional body or specific education requirements, the design ‘industry’ has been featured by events and technological advancements that have impacted professionals’ visibility only indirectly, yet pushed towards the systematic repetition of certain activities. Therefore, design as a KIBS can be seen as an example that binds together creativity and professionalisation while shaping industry-level dynamics.

Although the foremost aim of this study has been to investigate how the interplay between division of knowledge and division of labour can explain the development of the design function, further effort should be addressed to understand how changes in individuals’ skills have impacted organisational practices and routines; we expect this to be the focus of the next step within the research project.
References


