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TITLE

DIFFUSION PROCESSES OF PRODUCT MEANINGS IN DESIGN-INTENSIVE
INDUSTRIES: DETERMINANTS AND DYNAMICS

(EIASM Murcia Special Issue)

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RUNNING TITLE

DIFFUSION PROCESSES OF PRODUCT MEANINGS

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DIFFUSION PROCESSES OF PRODUCT MEANINGS IN DESIGN-INTENSIVE INDUSTRIES: DETERMINANTS AND DYNAMICS

(EIASM Murcia Special Issue)

ABSTRACT

Literature on the diffusion of innovation (DoI) is particularly rich and articulated and has been a topic of practical and academic interest since the 1960s. Empirical research in this field has focused on new technologies and managerial practices. However, given the increasingly important role played by design in today's business and academic arenas, we must verify the validity of otherwise robust results obtained largely from tech-based industries with studies from design-intensive industries. This article aims to identify the factors (or determinants) that impact the diffusion dynamics of product meanings within the Italian furniture industry. In particular, we have identified three groups of determinants (Innovator Marketing Strategy, Innovator Characteristics and Competitive Environment), and we have conceptualized diffusion dynamics along two dimensions with their corresponding variables (*Speed*, *Contagion*). We analyzed more than 5,600 products proposed on the market between 1995 and 2006 by 215 furniture manufacturers operating within seven compartments (kitchen, upholstery, lighting, living, chairs, tables and night). The article discusses 82 diffusion processes of new product meanings.

Our results, which were obtained using linear regression analysis, enrich a broad literature on the diffusion of innovation, focusing on design-intensive industries. Diffusion processes that are activated by several companies are able to influence several manufacturers, and they spread very quickly (*Collaboration*). Companies concentrating their offerings on only a few product meanings are able to rapidly penetrate the market, proposing clear product identities (*Focalization*). *Reputation* does not impact *Speed* and *Contagion*, as new product meanings have the opportunity to significantly impact the market but only in cases where well-known companies have participated in the diffusion process since the beginning and have done so in collaboration with small proactive companies; otherwise, the new meanings remain confined to a market niche

phenomenon. Collaboration with several creative resources (*System Openness*) allows a company to seize dominant trends and improve its capacity to strongly influence the rest of the market. Our empirical results show that launching new product meanings in years when several proposals already exist negatively impacts the possibility of influencing other manufacturers (*Ferment*). From a managerial point of view, providing variables that characterize the early stages of diffusion processes (i.e., that determine their dynamics) allows our empirical results to be interpreted as forecasting suggestions. This article provides managers with new guidelines for forecasting the evolution of a product meaning in light of the characteristics of the innovators, the marketing strategies employed and the competitive environment associated with its launch.

Keywords: Diffusion of innovation, Product Meanings, Furniture industry

1. INTRODUCTION

Not surprisingly, the literature on the diffusion of innovation (DoI) is particularly rich, as it has been a topic of practical and academic interest since the 1960s, when the pioneering works of Fourt and Woodlock (1960), Mansfield (1961), Floyd (1962), Rogers (1962), Chow (1967) and Bass (1969) confronted the problems of modeling and forecasting. Empirical research on the diffusion of innovation focuses principally on new technologies and new managerial practices. The increasingly important role played by design in today's business and academic arenas is reflected in the explosion of academics and companies seeking to link design to competitive advantage (Gemser and Leenders, 2001; Platt et al., 2001; Borja de Mozota, 2003; Boland and Collopy, 2004; Creusen and Schoormans, 2005; Hertenstein et al., 2005). The aesthetic and symbolic values of products are becoming increasingly relevant to consumer choices (Dumaine, 1991; Schmitt and Simonson, 1997; Bloch et al., 2003). Postrel (2003) examines the significance of "look and feel" for people, places and things in many industries and claims that the aesthetic and symbolic dimensions of a product are increasingly pertinent to a company's success. Companies are investing more in new product designs to make their products more fashionable rather than more functional (Pesendorfer, 1995; Cappetta et al., 2006). The aesthetic and symbolic dimensions of a product are particularly relevant to the luxury and fashion industries; however, they are also becoming increasingly relevant in industries that are traditionally regulated by straightforward technological evolution (Trueman and Jobber, 1998; Ravasi and Lojacono, 2005; Rindova and Petkova, 2007). Indeed, despite the fact that companies such as Apple, Nokia, Nintendo or Bang & Olufsen operate in industries that are usually shaped by the emergence of new technologies, the success of their products has been strongly connected to the prominent role played by aesthetic and symbolic dimensions (Cillo and Verona, 2008). Although approaches to modeling the diffusion of a technology or new consumer durable are quite similar (Meade and Islam, 2006), the relationships between diffusion dynamics and models of aesthetic and symbolic innovation have not been sufficiently addressed.

According to Verganti (2009), product languages (e.g., materials, colors, shapes and symbols) can be used to deliver a message and convey specific meanings **such as emotional and symbolic values**. For example the Family Follows Fiction product line introduced by Alessi in 1993 adopted languages, such as plastic material, translucent

surfaces and daring colors, to stimulate new meanings, such as the need for tenderness, delicacy and intimacy (see Figure 1).



Figure 1: *Family Follows Fiction* product line launched by Alessi in 1993

Comparing the literature addressing radical innovation of meanings and technologies, Verganti (2008) studied the similarities and differences between the concepts of dominant design (Utterback, 1994) and dominant language. Explorations of large datasets show that industry dynamics are less affected by the emergence of dominant languages, and cultural dynamics have a strong effect on product longevity (Sanderson and Uzumeri, 1995; Marchesi et al., 2003; Verganti, 2009). Studies in cultural anthropology and cultural branding have demonstrated that the meanings associated with successful products often coalesce around archetypes and icons that are capable of surviving longer than their competitors (Holt, 2003). Intriguing research that was recently presented by Cappetta et al. (2006) constructs and tests a conceptual framework for the creation and evolution of stylistic innovation in the high fashion industry. In contrast to tech-based industries, it is difficult to identify a dominant design within fashion-based industries; instead, it seems more important to focus on a group of styles sharing several regularities. Moreover, they define convergent design as a style that most companies use as a reference point over a particular period of time. They explain the convergent design by idiosyncratic features of the context, such as the emergence of snob effects, consumers' need for differentiation and the signaling power of style for companies.

Previous research in the Italian furniture industry context (Dell'Era and Verganti, 2007) demonstrates that several product meanings coexist over a given period of time, and they are often new interpretations of existing product languages. In other words, innovations within this industry do not necessarily require use of new materials or new colors. Instead, innovations frequently entail proposing new combinations of existing product languages that ultimately convey new meanings. Consequently, innovations in

the meanings of a product can lead to articulated processes of diffusion and re-diffusion. In other words, new interpretations of old styles can certainly make a comeback if the meanings associated with them also become relevant again within the society. For example, between 1998 and 2002, Italian lighting companies reinterpreted a set of product languages that were already proposed in the market (e.g., translucent plastic and daring colors) to convey the meanings of playfulness and irony. In this period, there was indeed a real explosion of products that sought to convey the notions of youth and playfulness (i.e., “Young & Playful” product meaning) (see Figure 2).

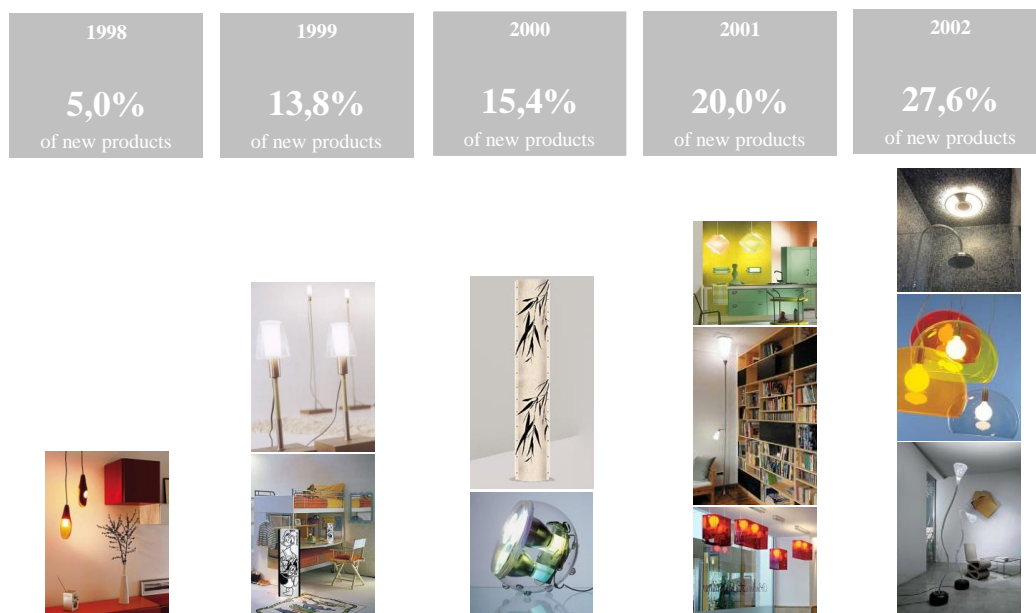


Figure 2: Diffusion of the "Young & Playful" product meaning in the Lighting compartment between 1998 and 2002

This article offers managers new tools for forecasting the evolution of product meanings. Specifically, it investigates the factors characterizing the launch of a new product meaning that influences its diffusion process among other companies, taking into account who are the innovators that initially proposed the new product meanings, the strategy they adopt and the role of the competitive context. Whereas traditional approaches to analyzing the diffusion of innovations have focused on innovations proposed by suppliers as well as the potential determinants of those innovations (e.g., supplier marketing efforts, adopter characteristics and competitive environment), this article adopts an alternative approach to provide a forecast-oriented model of the diffusion of new product meanings among competitors. Specifically, it investigates only

those potential determining factors associated with the launch phase. Thus, the article focuses on the marketing strategy employed, the characteristics of the innovators and the competitive environment for diffusion.

The remainder of the article is organized as follows: the next section introduces the conceptual framework, summarizes the literature on product meaning innovation and diffusion of innovation and formalizes the research hypotheses; the third section presents the method used for the empirical analysis, focusing on the characteristics of the industry and the dataset and in the fourth section, the empirical results are presented, and conclusions and managerial implications are discussed.

2. THEORETICAL BACKGROUND AND CONCEPTUAL FRAMEWORK

In our review of the rich literature on the adoption and diffusion of innovation, we isolated three types of potential determinants of diffusion dynamics. Specifically, an innovator's marketing strategy refers to a collaborative approach adopted by companies launching a new product meaning and to the relevance of that new meaning within their portfolio. With respect to innovator characteristics, we consider reputation as well as connections to creative resources (e.g., designers). Finally, we describe the competitive environment with respect to the notion of innovation ferment, which is itself a characteristic of the period during which a new product meaning is proposed. Diffusion dynamics are organized around two principal constructs: the rapidity of diffusion and the capacity to influence several competitors.

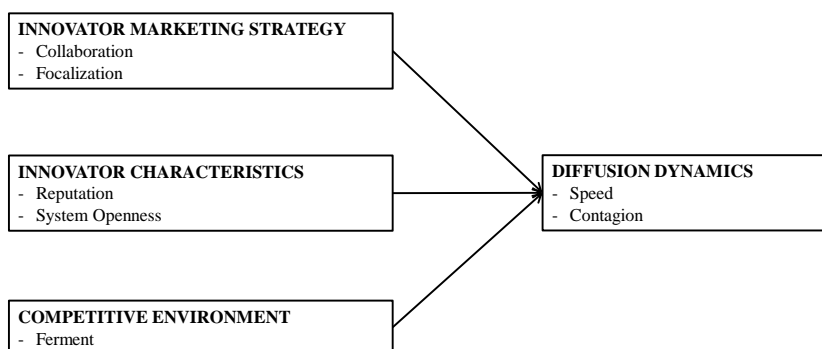


Figure 3: Conceptual framework

To introduce (and explain) our conceptual framework, we must first explore the principal contributions in the literature regarding innovation of product meanings. Then, we shall examine some of the principal references for the diffusion of innovation.

2.1. Innovation of product meanings

As mentioned earlier, several studies have demonstrated the influence of a product's aesthetic and symbolic values on consumer choices. Since the 1950s, several authors have analyzed the symbolic aspects of products (Gardner and Levy, 1955; Levy, 1959). According to Levy (1959), people buy products not only for what they can do but also for what they mean. Research over the last 30 years has stressed the importance of a product's semantic dimension as well as its capacity to achieve a competitive advantage (Csikszentmihalyi and Rochberg-Halton, 1981; Krippendorff, 1989; Cooper and Press, 1995; Margolin and Buchanan, 1995; Lloyd and Snelders, 2003). Hirschman (1982) stipulates that symbolic innovations "result from the reassignment of social meaning to an existing product, generating a secondary diffusion for it among those identifying with the relevant reference group" (1982, p. 537). Alternatively, technological innovations spring from the addition or alteration of a product's tangible features, distinguishing it from previous models. In cognitive terms, a symbolic innovation is one that possesses different intangible attributes that it did not possess in a previous stage. An intangible attribute is one that is associated with the object by consumers but does not arise from the physical nature of the object itself. A combination of semiotic categories, such as colors, materials and forms, generate an aesthetic value that can convey several symbolic meanings, such as elegance, ease of use, irony, youthfulness, and masculinity (Forty, 1986). Cappetta et al. (2006) define style as both an aesthetic and symbolic set of choices a company makes regarding its products or services, specifically the main features of those choices and how they are combined. According to Robinson (1961), styles are inevitably substituted, and thus they are phenomena characterized by a provisional life span. Stylistic innovations can describe articulated processes of diffusion and re-diffusion. In other words, old styles can come back if the meanings associated with them become relevant again in the society. According to Krippendorff (1989), design deals with the meanings that people give to products and the languages they use to convey them.

"The etymology of design goes back to the Latin de + signare and means making something, distinguishing it by a sign, giving it significance, designating its relation to other things, owners, users or gods. Based on this original meaning, one could say: design is making sense (of things)."
(Krippendorff, 1989)

2.2. Diffusion of innovation

As mentioned previously, there are several principal contributions to the literature regarding diffusion of technologies (Mansfield, 1963; Rogers, 1995; Mahajan et al., 1990; Ruttan, 2000). Diffusion of innovations, in particular, has been studied from numerous perspectives (e.g., economic, strategic, marketing, historical and sociological). However, recent literature is marked by a turn towards new interpretative and predictive models, such as bandwagons (Abrahamson and Rosenkopf, 1997) and models of social contagion (Burt, 1987). These in turn have enriched otherwise robust and well-known frameworks, such as epidemic (Mansfield, 1961) and probit models (Davies, 1979). The academic literature on innovation dynamics is very rich and complex. Schumpeter (1942) famously introduced the concept of innovation dynamics using the term “creative destruction.” In 1978, Abernathy and Utterback noticed regularity in the sequences of incremental and radical innovations within an industry and suggested that industries followed a natural and evolutionary path. Tushman and Anderson (1990) formalized a cyclical model of technological change made up of a succession of the following four phases: technological discontinuity, era of ferment, dominant design and era of incremental change. Dominant design has many definitions in the literature (Abernathy and Utterback, 1978; Tushman and Anderson, 1990; Utterback, 1994; Suárez and Utterback, 1995; Christensen et al., 1998). An analysis of the diffusion process usually implies studying the spread of a product or an idea within a given social system. Several variables have been identified in the literature as affecting the diffusion and adoption of innovations. Traditional approaches to analyzing the diffusion of innovation focus on innovations proposed by suppliers and the possible factors that influence them, such as supplier marketing efforts, adopter characteristics or competitive environments.

As previously mentioned, this article aims to provide a forecast-oriented model of the diffusion of new product meanings among competitors; in other words, it aims to provide a new interpretative lens that allows managers to forecast the evolution of new product meanings. For this reason, the article investigates factors characterizing the launch of a new product meaning that influence its diffusion process among other companies, taking into account who the innovators are that initially proposed the new product meanings and the role of the competitive context. Specifically, we investigate only potential determinants that are likely to be factors associated with the launch phase and can be observed when a new product meaning is launched on the market. In

addition to the competitive environment itself, we focus on marketing strategy and the characteristics of innovators.

In the following sub-paragraphs, we introduce research hypotheses describing the relationship between three types of potential determinants (Innovator Marketing Strategy, Innovator Characteristics and Competitive Environment) and two constructs related to diffusion dynamics:

- *Speed* is defined as the velocity through which an innovation spreads in the market;
- *Contagion* represents the capacity of an innovation to influence several companies to the point that they adopt the innovation.

Research hypotheses about Innovator Marketing Strategy

With respect to the marketing strategies adopted by innovators, several studies have demonstrated that the number of organizations that adopt an innovation influences the number of remaining organizations that will subsequently adopt the innovation (Mansfield, 1961). From a marketing perspective, one of the critical decisions that a company must make at product launch is whether to be a "market pioneer" or a "follower." This choice should be evaluated by first analyzing the trade-offs between the risks of premature entry, on the one hand, and the problems of missed opportunities, on the other (Lilien and Yoon, 1990). The most important alternative to consider is the option of working with other companies to help educate potential users. In reviewing the academic literature and the business press and by interviewing several marketing managers, Easingwood and Beard (1989) identified two important forms of *Collaboration*. The first foresees the need to educate other producers of similar technologies or rather, the need to educate a target market about the workings of the new technology. Frambach (1993) states that cooperation with other suppliers through shared technology or educating a target audience (including other producers) can increase the speed of innovation adoption. Therefore we posit the following:

H1: The Collaboration between companies launching new product meanings will be positively associated with the Speed of the diffusion process

A second form of collaboration suggests that sharing the technology (i.e., the innovation) with other companies increases total demand and sets new standards (Frambach, 1993). The early adoption of emerging technologies can be exploited to

introduce “lock-in” actions: companies that act fast and first can propose new solutions, which, if successful, can become “standards” for competitors and partners alike. The volume of companies proposing similar innovations can increase an early adopter’s capacity to influence the entire market and thus to set new standards. As demonstrated by Dell’Era and Verganti (2007) innovative Italian furniture companies establish informal collaborations with other manufacturers (even if some are competitors) to be part of the same design discourse: these companies develop a continuous dialogue about socio-cultural models and patterns of consumption impacting the adoption of specific product meanings by the rest of the market. Put it differently, the more companies that contemporaneously propose the same product meaning, the higher the capability to influence competitors in the adoption of the same product meaning. This leads us to argue that:

H2: The Collaboration between companies launching new product meanings will be positively associated with the degree of Contagion of the diffusion process

Moreover, each company can collaborate at different intensities, with each one deciding to focalize their strategy on a few innovations or to distribute their efforts across different proposals. According to Karjalainen and Warell (2005), the recognition of similar connotations across multiple products allows for the development of consistent messages and the enhancement of identity. In design-intensive industries where several styles co-exist (Cappetta et al., 2006; Dell’Era and Verganti, 2007), only those product meanings that have been contemporaneously proposed by several companies with precise identities represent signals that can be quickly perceived and followed by the rest of the market. Therefore we posit the following:

H3: The Focalization on the launch of a limited number of new product meanings will be positively associated with the Speed of the diffusion process

Research hypotheses about Innovator Characteristics

A sociological perspective of diffusion model underscores the importance of innovator *Reputation*, specifically, their capacity to influence the decisions of subsequent adopters (Wasson et al., 1970). Wind and Mahajan (1987) remark on the role of early adopters in the diffusion processes, noting how the dissatisfaction of a few opinion leaders and experts can ultimately have a devastating effect on the market’s acceptance of an

innovation. Similarly, several authors have noted the potentially negative effects on innovation diffusion of word-of-mouth communication (Richins, 1984; Leonard-Barton, 1985). Acting as opinion leaders, companies with high reputations accelerate the diffusion of innovations (Valente and Davis, 1999). As previously mentioned, design-intensive industries are characterized by several co-existing styles (Cappetta et al.; 2006; Dell’Era and Verganti, 2007); for this reason, the reputations of companies proposing new product meanings produce signaling effects and legitimize the innovation, allowing competitors to quickly perceive and adopt the innovation. In different words, the participation to the launch of innovations by companies with high reputation accelerates the diffusion process. This leads us to argue that:

H4: The participation to the launch of new product meanings by companies with high Reputation will be positively associated with the Speed of the diffusion process

Bandwagon theories assume that firms that have initially adopted an innovation put pressure on potential adopters to adopt that innovation (Abrahamson and Rosenkopf, 1997). This pressure can be based on several different factors. Towards this end, the literature identifies two bandwagon theories: information contagion and fad theory. The former assumes that potential adopters have only partial information about an innovation; thus, later adoptions of innovations by other companies stand to provide new information. According to this theoretical approach, early adopters play a critical role in the diffusion process, as their opinions about an innovation (disseminated through a word-of-mouth communication process) can have a significant impact on subsequent adoptions (Webster, 1970; Martilla, 1971; Czepiel, 1974; Arthur and Lane, 1993). Fad theories posit that simply an awareness of the number of previous adopters itself is sufficient to generate a bandwagon effect (even in cases where information about the innovation does not circulate within the social system) (DiMaggio and Powell, 1983; Tolbert and Zucker, 1983; Abraham and Rosenkopf, 1990). In other words, in the eyes of potential adopters, early adopters, especially those with a significant reputation, legitimize the innovation, stimulating both the imitative and competitive reactions of later adopters (DiMaggio and Powell, 1991; Abrahamson and Rosenkopf, 1993). Therefore we posit the following:

H5: The participation to the launch of new product meanings by companies with high Reputation will be positively associated with the degree of Contagion of the diffusion process

A company's capacity for innovation is significantly affected by the diversity of its direct contacts. In addition, the number of such contacts is relevant, to the degree that it increases the probability of network diversity. Several studies of networks suggest that the portfolios of partners that a firm maintains can be just as influential as the dyadic characteristics of those alliances (Gulati, 1998). Different approaches and organizational backgrounds among partners can increase the number of information sources, making an organization more likely to become aware of an innovation (Zaltman et al., 1973). Rogers (1995) argues that system openness and interconnectedness are positively related to innovation adoption (system openness is a measure of how members of an organization are linked to others who are external to the organization). In design-intensive industries, collaboration among several partners suggests the possibility of interpreting otherwise weak signals that have the potential to become future trends; leveraging rich networks that provide knowledge diversity, innovators are able to influence large segments of the market, pushing their competitors to adopt their product meanings (Dell'Era and Verganti, 2010b). This leads us to argue that:

H6: The collaboration with several creative resources (System Openness) by companies launching new product meanings will be positively associated with the degree of Contagion of the diffusion process

Research hypotheses about Competitive Environment

Several empirical research studies highlight the relationship between market competitiveness and the rate of innovation diffusion in that market (Baldwin and Scott, 1987; Kamien and Schwartz, 1982); high levels of competition can increase the pressure to adopt a certain technological innovation, as a single company can be forced to adopt an innovation simply to avoid competitiveness in the market. Design-intensive industries are characterized by peculiar phenomena; as shown by Dell'Era and Verganti (2007), imitators are often unable to interpret new product meanings that are initially proposed by the first mover companies. As a consequence, they tend to propose to the market products with incongruous meanings. Several researchers associate the inability to interpret the selective dynamics of product meanings with the inefficient and

ineffective development of internal research processes (Cappetta et al., 2006; Cillo and Verona, 2008; Dell’Era and Verganti, 2007). This inability especially emerges when innovators contemporaneously propose several new product meanings before the affirmation of a convergent design (Cappetta et al., 2006), thereby reducing the capability to influence other potential adopters and consequently favoring the diffusion of few new product meanings. This is why we posit that:

H7: The Ferment of the launch period of new product meanings will be negatively associated with the degree of Contagion of the diffusion process

3. EMPIRICAL DESIGN

In terms of empirical analysis, this article focuses on the Italian furniture industry for several reasons. First, furniture companies develop numerous semiotic innovations. The furniture sector is a basic industry in most industrialized countries. According to a report from the European Association of Furniture Manufacturers, the furniture industry represents between 2% and 4% of the production value of the manufacturing sector, approximately 2% of the GDP and 2.2% of the total workforce in European countries. This article relies on Webmobili (an Internet spin-off of Federmobili, the Italian Association of Furniture Manufacturers). The Internet database (www.webmobili.it) developed by Webmobili is particularly well-suited for our research questions. It contains more than 20,000 products, divided into 16 sub-sectors. Because it features data about every company and employs an industrial structure, it is considered to be a good representation of the Italian furniture industry’s offerings. All products in the Webmobili database are actually on the market, and each listing includes the name of the product, its producer, its designer, the production year, the materials used, its price range and any awards it has received. Our dataset is composed of more than 5,600 products from seven compartments (kitchen, upholstery, lighting, living, chairs, tables and night) that were placed on the market between 1995 and 2006 by 215 furniture manufacturers. In an effort to analyze the diffusion of new product meanings, we have adopted the following process:

- *Step 1.* Using information provided by the Webmobili database, we identified 12 categories of materials: wood, varnished, laminated, fabric, leather, polymer, metal, glass, alcantara, paper, straw and stone. Certainly, a product can be composed of several materials; thus, we have identified more than 200 different

combinations of these materials. Next, with respect to new products proposed on the market, we mapped the changes over time in the percentage of specific combinations of materials.

- *Step 2.* To isolate processes potentially related to new product meaning growth and diffusion, we defined materials combination minimums for the beginning and end of diffusion processes. We also excluded processes that only lasted a year, processes that began before the first year in the time frame and processes that finished after the last year of the time frame.
- *Step 3.* Finally, a panel of experts, composed of three professors from the Industrial Design Faculty at the Politecnico di Milano, evaluated the remaining 118 “potential” processes and ultimately selecting 82 processes that were associated with diffusion of new product meanings. As mentioned above, in many design-intensive industries (and especially in the case of the furniture industry) the adoption of product languages changes significantly over time, as companies are able to discover new meanings and interpretations within the same materials. Considering that this article aims to investigate the diffusion processes of new product meanings, experts selected the 82 material combinations that propose new values and interpretations in the market. For example, Alessi’s well-known product line, distinguished by the slogan “Family Follows Fiction” and composed of a set of colored plastic kitchenware products, is a good example of a reinterpretation of an existing material combination in order to communicate new meanings. In 1993, they adopted plastic materials, historically used in the kitchenware industry, to convey particular product meanings, such as irony and a sense of childhood.

3.1. Operationalization of the diffusion dynamics

Operationalizing the diffusion dynamics described by each process is performed with respect to two variables: *Speed* and *Contagion* (see Table 1). Both variables refer to the 82 diffusion processes of new product meanings (m) identified through three steps, as previously described. As previously mentioned, this article investigates the factors characterizing the launch of a new product meaning that influence its diffusion process between other companies. For this reason, both *Speed* and *Contagion* derive from variables that characterize the period following the launch year ($[t_1(m), \dots, t_T(m)]$, $t_0(m)$ represents the launch year of the product meaning m , $t_1(m)$ the following year and $t_T(m)$ the last year of the diffusion process related to the product meaning m).

Variable	Definition	Formula
Speed (m)	Rate established by the difference between maximum and initial percentage <i>Adoption</i> of product meaning <i>m</i> during its diffusion process and the time necessary to reach maximum <i>Adoption</i>	$\frac{[\text{MaxAdoption}(m) - \text{Adoption}(m, t_0(m))]}{[\text{YearMaxAdoption}(m) - t_0(m)]}$ <p>where</p> <p><i>Adoption</i> (<i>m</i>, <i>t</i>) is the percentage of products launched during year <i>t</i> that adopt the product meaning <i>m</i></p> <p><i>MaxAdoption</i> (<i>m</i>) is the maximum adoption of product meaning <i>m</i> during the period [<i>t</i>₁(<i>m</i>), .. ,<i>t</i>_T(<i>m</i>)]</p> <p><i>YearMaxAdoption</i> (<i>m</i>) is the year during the period [<i>t</i>₁(<i>m</i>), .. ,<i>t</i>_T(<i>m</i>)] with the maximum <i>Adoption</i> of the product meaning <i>m</i></p>
Contagion (m)	Mean <i>Adoption</i> of the product meaning <i>m</i> during its diffusion process excluding the companies participating in the launch	$\sum \text{Contagion}(m, t) / [t_T(m) - t_0(m)],$ $t = t_1(m), \dots, t_T(m)$ <p>where</p> <p><i>Contagion</i> (<i>m</i>, <i>t</i>) is the percentage of products launched during year <i>t</i> that adopt the product meaning <i>m</i>, including only those companies that did not adopt product meaning <i>m</i> during the first year of the diffusion process (<i>t</i>₀(<i>m</i>))</p>

Table 1: Operationalization of the *Diffusion Dynamics*

To provide a concrete example of the operationalization of the diffusion dynamics, Figure 4 shows the application of previous formulas related to the diffusion process of the “Young & Playful” meaning within the lighting compartment, between 1998 and 2002. The process lasted five years. The percentage of products launched in 1998 that had adopted a “Young & Playful” meaning was 5.0%. In four years, the percentage increased to 27.6% (*Speed* = 5.7%). In 1999, only 13.8% of new lamps conveyed the “Young & Playful” meaning and were launched by companies that had not proposed this product meaning in 1998 (first year of the diffusion process of the “Young & Playful” meaning). The value of *Contagion* moved from 13.8% in 1999 to 20.7% in 2002; the mean *Contagion* was 14.8%.

3.2. Operationalization of the diffusion determinants

As noted in the theoretical background above, the literature recognizes several variables that affect the diffusion and adoption of innovations. In examining the factors that characterize the launch of a new product meaning and influence the process by which it diffuses among other companies, we emphasize the innovators that originally proposed these new product meanings and the role that competitive context plays. We also introduced the *Size* of companies as a control variable to take into account the influence of large companies in the diffusion of new product meanings. Table 2 describes the operationalization of a set of variables examined as potential determinants of diffusion processes.

Variable	Definition	Formula
INNOVATOR MARKETING STRATEGY		
Collaboration (m)	Percentage of companies launching products in the first year of the diffusion process that propose the product meaning m	% of companies launching products in the first year $t_0(m)$ that propose product meaning m in the same year
Focalization (m)	Mean percentage of products adopting meaning m within the portfolios of companies launching the diffusion process of the product meaning m	Mean % of products with meaning m (in relation to all products proposed in the same year) proposed only by those companies that proposed meaning m during the first year $t_0(m)$
INNOVATOR CHARACTERISTICS		
Reputation (m)	Number of companies launching the diffusion process of product meaning m that have also received (or have been selected for) the “Compasso d’Oro” award in the last two years	# of companies proposing product meaning m during the first year $t_0(m)$ that have received or have been selected for the “Compasso d’Oro” award in the last two years ($t_0(m)$ and the previous year) We have used the “Compasso d’Oro” award as a measure of reputation in the innovation field. We have considered two years because the award has been assigned on average every two years
System Openness (m)	Mean number of designers that have collaborated with companies launching the diffusion process of product meaning m in the last two years	Mean normalized # of designers that have collaborated in the last two years ($t_0(m)$ and the previous year) with companies proposing product meaning m during the first year $t_0(m)$ Because the number of designers progressively increases over time, we normalized it using the mean number of designers that have collaborated with all companies in the last two years. We use two years because new product development in the furniture industry, on average, lasts two years

(Table continues in the next page)

COMPETITIVE ENVIRONMENT		
Ferment (m)	Number of diffusion processes launched in the same year in which product meaning m was launched	Normalized # of diffusion processes related to new product meanings launched in year $t_0(m)$ We have normalized the number of diffusion processes to make the seven compartments comparable
CONTROL VARIABLE		
Size (m)	Mean number of employees of companies launching the diffusion process of product meaning m	Mean # of employees of companies proposing product meaning m during the first year $t_0(m)$

Table 2: Operationalization of the Diffusion Determinants

Again, considering as an example the diffusion process of the “Young & Playful” meaning within the lighting compartment between 1998 and 2002 (see Figure 4), we observe only three of 15 companies that had adopted this product meaning in 1998 launching new products (*Collaboration* = 20.0%). In other words, Cappellini, Flos and Luceplan introduced products that adopt the same language to the market, increasing their capability to influence the market. On average, companies that launched Young & Playful lamps in 1998 dedicated 11.0% of their overall portfolio to this product meaning (*Focalization*). Specifically, Cappellini launched 17 new products in 1998ⁱ, but only one of them proposed the "Young & Playful" meaning ($1/17 = 5.9\%$); a similar rate was shown by Flos ($1/14 = 7.1\%$), while Luceplan launched ten new products in 1998, and two of them adopted the "Young & Playful" meaning ($2/10 = 20.0\%$). All three companies have received (or were selected for) the Compasso d’Oro award within the last two years (*Reputation* = 3). As previously mentioned, this construct intercepts the signaling effects produced by the participation of companies with high reputations to the proposal of new product meanings. If the volume of companies that contemporaneously propose a new product meaning can provide an indication of the robustness of the innovation in the furniture industry, the number of companies with high reputations represents a significant signal about the value of the new product meaning. On average, companies that launched Young & Playful lamps in 1998 have collaborated with 3.9 designers over the last two years (*System Openness*)ⁱⁱ. Specifically, all three companies showed rich networks of industrial designers that allow them to intercept weak signals that have the potential to become future trends. Cappellini especially was characterized by a high value of openness: it collaborated with 5.4 designers in 1997 and 1998. Two diffusion processes were launched within the lighting compartment in 1998 related to the "Young & Playful" and "Essential & Sleek"

meanings, offering a value equal to the mean of the entire time frame (*Ferment* = 1.0). Finally, in 1998, Cappellini employed 190 people, Flos employed 203 and Luceplan employed 107 (*Size* = 167). Table 3 reports descriptive statistics of the variables described above.

Variable	N	Minimum	Maximum	Mean	Std. Dev.
Speed	82	0.2 %	23.2 %	6.2 %	5.0 %
Contagion	82	2.0 %	39.3 %	11.7 %	8.0 %
Collaboration	82	2.6 %	76.9 %	16.3 %	17.3 %
Focalization	82	5.3 %	83.3 %	31.6 %	18.0 %
Reputation	82	0.0	8.0	1.4	1.6
System openness	82	0.0	5.5	1.8	1.2
Ferment	82	0.3	2.0	1.1	0.5
Size	82	25.0	202.5	132.6	47.5

Table 3: Descriptive statistics

4. ANALYSIS AND DISCUSSION

We explored the relationships between marketing strategies, the characteristics of innovators, competitive environment and variables representing diffusion dynamics (e.g., *Speed* and *Contagion*), using a linear regression analysis (see Table 4).

According to H1 and H3, the *Speed* of the diffusion processes is positively influenced by *Collaboration* and *Focalization*. Marketing strategies based on collaboration with other manufacturers (*Collaboration*) and focused on specific product meanings (*Focalization*) allow semantic innovations to diffuse throughout manufacturers over short periods of time. Consistent with the literature (Easingwood and Beard, 1989; Frambach, 1993), collaboration with other manufacturers through the adoption of the same product meaning increases the speed of innovation adoption. Diffusion processes activated by several companies are able to spread the product meaning very quickly (*Collaboration*). As noted by Karjalainen and Warell (2005), companies that concentrate their offerings on a few product meanings, proposing a clear product identity, are able to rapidly penetrate the market. The Italian furniture industry, in particular, is characterized by several co-existing styles (Cappetta et al., 2006). However, only product meanings contemporaneously proposed by several companies with precise identities represent signals that can be quickly perceived and followed by the rest of the market (*Focalization*).

	Speed	Contagion
<i>INNOVATOR MARKETING STRATEGY</i>		
Collaboration	+ 0.351* (0.166)	+0.363** (0.118)
Focalization	+ 0.216* (0.100)	+ 0.116 (0.071)
<i>INNOVATOR CHARACTERISTICS</i>		
Reputation	- 0.243 (0.160)	+ 0.156 (0.114)
System Openness	+ 0.130 (0.122)	+ 0.195* (0.087)
<i>COMPETITIVE ENVIRONMENT</i>		
Ferment	- 0.035 (0.117)	- 0.166* (0.083)
<i>CONTROL VARIABLES</i>		
Size	- 0.041 (0.118)	- 0.203 (0.084)
Adjusted R ²	0.149	0.569
F	3.360**	18.825**
N	82	82

* p ≤ 0.05; ** p ≤ 0.01; (Standard Error in parentheses)

Table 4: Linear regressions of Diffusion Dynamics (Speed and Contagion)

Contrary to H4, *Reputation* does not impact *Speed*. Even if several literature contributions underline the role of reputation as an accelerator of the diffusion process (Dell'Era and Verganti, 2007; Valente and Davis, 1999), empirical results do not confirm Hypothesis 4. One possible explanation is related to the fact that companies with high reputations are particularly proactive in the launch of new product meanings, to the point that 71% of the diffusion processes were activated by at least one company that has received (or has been selected for) the “Compasso d’Oro” award. Furthermore, splitting up the diffusion processes into two groups, according to the mean value of *Reputation* (1.4), the *t* test does not show significant differences in terms of *Speed* (see Table 5), even if diffusion processes activated by more than one company with a high reputation show a greater average value of *Speed* (7.1 %).

	Diffusion processes activated by 0 or 1 company with high reputation	Diffusion processes activated by more than 1 companies with high reputation
Speed	5.8 %	7.1 %
N	55	27
T	- 1.041	
df	39.545	

* p ≤ 0.05; ** p ≤ 0.01

Table 5: Speed - t test about Reputation

According to H2 and H6, *Collaboration* and *System Openness* positively influenced the degree of *Contagion* in the diffusion process, whereas *Ferment* negatively impacts the capability of new product meanings to influence several adopters, supporting H7. As argued by Dell'Era and Verganti (2007), the proposal of new product meanings by a group of manufacturers increases the possibility of influencing the rest of the market. The contemporaneous proposal by many companies of the same product meaning increases the capacity of influencing competitors as well as the possibility of facilitating the contagion phenomena over time. As demonstrated by previous research (Dell'Era and Verganti, 2007; Verganti, 2008 and 2009), Italian furniture companies use to establish informal collaborations with other manufacturers in order to be part of the same design discourse. Supporting a continuous dialogue about socio-cultural models and patterns of consumption, these companies develop collective and networked research processes on new product meanings, identifying those solutions that can significantly influence the market (*Collaboration*). The following quote by Alberto Alessi, chief executive officer of Alessi, resounds very meaningfully:

In the '80s and in the '90s myself, Gandini of Flos, Castelli of Kartell, Zanotta of Zanotta, Longhi of Elam, Astori of Driade, Cappellini of Cappellini, and some other guys used to meet periodically to share possible evolutions of the design world, to organize joint exhibitions, to develop specialized magazines ... We were "the group of nine ..."

According to the literature about *System Openness* (Rogers, 1995), collaboration with several creative resources affords the capacity to seize upon dominant trends and improve the capacity for a strong influence upon the rest of the market (especially those companies sharing the same designers). Diffusion processes activated by companies that collaborate with several creative resources are able to influence many other competitors, pushing them to adopt the same product meaning. Similarly to the results obtained by Gulati (1988) and Zaltman et al. (1973), network connections with several external designers allow for the appropriate interpretation of new product meanings. Collaborations with several designers increases the capability of companies to recognize those weak signals that have the potential to become future trends; in other words, companies immersed in dense and rich networks of designers are able to activate and anticipate diffusion processes about new product meanings adopted by the majority of

the market. In their analysis of more than 650 different collaborations between Italian furniture manufacturers and designers that are responsible for approximately 1,800 products, Dell’Era and Verganti (2010b) demonstrate that innovators collaborate with a broad range of external designers compared to imitators. Innovative companies, those companies able to significantly influence other manufacturers, develop rich networks of creative resources. This suggests that innovativeness does not depend solely on the capacity of an individual designer but also on the diversity of designers that constitute an entire portfolio. Alternatively, the value of a single collaboration lies in the externalities generated by other collaborations (*System Openness*). Consistent with the literature (Cappetta et al., 2006; Cillo and Verona, 2008), our empirical results show that if new product meanings are launched during years when several proposals already exist, the possibility of influencing other manufacturers is negatively impacted. New product meanings proposed in periods characterized by elevated entropy values cannot significantly influence several manufacturers. The contemporaneously appearance of several new product meanings produces noise on the market, dispersing manufacturers' choices. In other words, new product meanings proposed in quiet times (when there is less competition) are more likely to spread throughout the market (*Ferment*).

Similarly to *Speed*, empirical results do not confirm H5: *Reputation* does not impact *Contagion*. Applying the same approach and splitting up the diffusion processes into two groups, according to the mean value of *Reputation* (1.4), the *t* test shows significant differences in terms of *Contagion* (see Table 6). The participation of one company with a high reputation in the launch of a new product meaning does not represent a signal that is sufficient to convince the rest of the market to rapidly react. Only when a group of companies with remarkable reputations activates the diffusion process of a new product meaning do competitors adopt the same style.

	Diffusion processes activated by 0 or 1 company with high reputation	Diffusion processes activated by more than 1 companies with high reputation
Contagion	9.5 %	16.3 %
N	55	27
T	- 3.123**	
Df	31.179	

* $p \leq 0.05$; ** $p \leq 0.01$

Table 6: *Contagion* - *t* test about *Reputation*

Similarly to *Reputation*, our empirical results demonstrate that the control variable *Size* does not impact *Speed* and *Contagion*. The entry barriers in the furniture industry are very low; thus, dynamic and small companies have the opportunity to propose new

product meanings. In contrast to technological innovations, often, new product meanings can be introduced without significant investment, and consequently, they also represent an intriguing strategy for small companies. Considering the results obtained with respect to *Collaboration* (positive impacts on *Speed* and *Contagion*), *Reputation* and *Size* (absence of significant impacts), we can argue that new product meanings have the opportunity to rapidly and significantly influence the market only if they are proposed by groups of companies with different profiles: where large and well-known companies have participated in the diffusion process since the very beginning and in collaboration with small and proactive companies, new product meanings can quickly and pervasively spread through the market. Otherwise, they remain confined to a market niche phenomenon.

5. IMPLICATIONS AND CONCLUSIONS

As previously mentioned, given the increasingly important role played by design in today's business and academic arenas, this article aims to identify the factors (or determinants) that impact the diffusion dynamics in design-intensive industries. Leveraging robust frameworks and results obtained largely from tech-based industries, our study explores diffusion processes of new product meanings in the Italian furniture industry. Our empirical results enrich an otherwise broad literature on the diffusion of innovation, focusing on design-intensive industries. Table 7 provides an overview of the principal results obtained from the linear regressions of diffusion dynamics (*Speed* and *Contagion*); our empirical results support five hypotheses (H1; H2; H3; H6; H7), but H4 and H5 are not supported by the data analysis.

	Speed	Contagion
<i>INNOVATOR MARKETING STRATEGY</i>		
Collaboration	+ (H1)	+ (H2)
Focalization	+ (H3)	
<i>INNOVATOR CHARACTERISTICS</i>		
Reputation	(H4)	(H5)
System openness		+ (H6)
<i>COMPETITIVE ENVIRONMENT</i>		
Ferment		- (H7)

Gray cells are about not verified hypotheses

Table 7: Results overview

While *Collaboration* positively impacts both dimensions of diffusion dynamics (i.e., *Speed* and *Contagion*), other determinants also have an influence, yet they do so in different ways. The activation of diffusion processes by numerous groups of companies that share the same product meanings influences the stylistic proposals of many other manufacturers and helps spread the product meaning very quickly. The contemporaneous proposals by many companies of the same product meaning increase the capacity to influence the rest of the market as well as the possibility to facilitate the contagion phenomena over time (*Collaboration*). Companies that concentrate their offerings on few product meanings propose a clear product identity and, consequently, are able to rapidly penetrate the market. The Italian furniture industry, in particular, is characterized by several co-existing styles; only product meanings contemporaneously proposed by several companies with precise identities represent signals that can be quickly perceived and followed by the rest of the market (*Focalization*). Moreover, new product meanings have an opportunity to influence the market, but only in those cases where a group of well-known companies participate in the diffusion process (*Reputation*). Collaboration with several creative resources affords the capacity to seize upon dominant trends and improve the capacity for a strong influence upon the rest of the market, especially those companies sharing the same designers (*System Openness*). Finally, new product meanings launched during years when several proposals already exist do not have the possibility to influence other manufacturers. In other words, new product meanings proposed in quiet times (when there is less competition) are more likely to spread throughout the market (*Ferment*).

From a managerial point of view, this article offers managers new tools for forecasting the evolution of product meanings. That said, these forecasts are determined by the characteristics of innovators, the marketing strategy employed and the competitive nature of the environment during the launch. This article has introduced several research questions that should receive further attention. It will be important to verify the external validity of our conclusions, as our data only reflect the Italian furniture industry. For example, although Italian furniture companies develop several products in collaboration with external designers, firms located in other countries may tend to develop their products using only in-house designers. Use of other potential determinants might also enrich the model and improve its robustness. For example, we did not explore the roles played by an innovation's characteristics.

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ⁱ In the calculation of *Focalization* we consider the entire product portfolio of companies, taking into account products that belong to different compartments. Furniture companies build their product identity and define the innovation program at the portfolio level rather than at the product category level.

ⁱⁱ In the calculation of *System Openness* we consider the entire product portfolio of companies, taking into account products that belong to different compartments. Knowledge about product meanings, shared with a designer during the development of a lamp, can be exploited by the same company during the development of a chair. For this reason, we consider the contribution of the designer network that collaborates with each company independently from the compartments.