



SPANNING THE INNOVATION SPACE THROUGH TECHNOLOGY AND DESIGN DRIVEN APPROACHES

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Abstract

Being technology and/or design driven is at the heart of today and tomorrow competition. The present work aims to contribute in enriching the research field on the types of innovation on one side by building an “innovation scale” and on the empirical research on the sources of innovation by finding cases where the design driven innovation to the more traditional technology driven innovation are linked. Several cases of sustaining/disruptive/discontinuous innovation and market/technology/design driven innovation have been found in the empirical literature and selected for comparison. In particular, to span the innovation space driven by technology and semantic and emotional dimensions as a continuum, as first, our work proposes a matrix of innovation in order to classify the richness of contributions and to read with a unique framework the technology, market or design driven innovations. Then, it describes and highlights the advantages of a “double” (technology and design) driven innovation.

Keywords

Innovation scale; sustaining innovation; disruptive innovation; discontinuous innovation; technology driven innovation; design driven innovation;

1 Introduction

With no doubts innovation is the new companies mantra, in a global and complex economy it is a key factor influencing change in many industries.

The literature bloomed with different characteristics and terms to identify the type, the grade, the depth, the source and so on of innovation, but is lacking in a clear classification of them. Moreover, recently the literature underlined also the semantic dimension carried out by the products and by the companies, and overcoming the traditional market-pull and technology-push dichotomy, Verganti (2003) proposed a model called “design driven innovation” (DDI). Indeed, the socio-cultural roots of innovation (eg. Pinch and Bijker, 1987) are fundamental: function and technology can together form a process of complex and pushed innovation.

In our opinion, in this context it is important to clarify the already existent cases of these types of innovations and to enrich the research field on the types and on the sources of innovation by finding some exemplar cases that evidence elements not clearly stated before.

This task will be accomplished by crossing the two classifications and addressing the following research questions:

- *What are the types and the sources of innovation?*
- *Are there any case of design driven disruptive innovation?*

Since the literature analysis highlighted the newness of the topic, the case-study is especially proper for new and explorative investigations (Eisenhardt, 1989). Therefore, to address the above questions the present research adopted the descriptive cross-case analysis research design, as defined by McCutcheon and Meredith (1993) and Yin (2003). Several cases of both disruptive and discontinuous technological and design innovation have been found in the empirical literature and selected for comparison. In particular, the most exemplar cases refers one to a leading company in the videogames business (it is a case of best practice that shows how the change of the meaning of the context linked with a change in the technology lead to a success strategy for the company) and the other one to a leading company in the furnishing industry (it is a case of disruptive business model design driven innovation).

The present work has a double task: to identify the main sources of creativity and innovation and to link the technology driven and design driven innovations in order to propose a framework to define and suggest how it is possible for a company to be a market leader through multiple sources of innovation.

Therefore it first explains the multiple facades of innovation, and comes to the theoretical foundations that permit to build a framework that we called the *innovation scale*, which explains the main differences among the three levels of innovation: sustaining innovation, disruptive innovation and discontinuous/radical innovation. Then, it focuses on technology driven innovation and design driven innovation and applies the innovation scale on them, taking examples from empirical literature to explain it. In particular, it focuses on the explanation of cases of both design and technology innovation, trying to underline how the link between design and technology can add value to the innovation strategy of the company. Moreover, we found some cases of The paper uses the descriptive cross-case analysis design (par. 2) to describe how companies innovate linking design and technology (par. 4), to finally suggest different possible DDI and TDI strategies by using a matrix and draw conclusions where the academic and managerial implications are highlighted (par. 5).

2 The research method and empirical base

The first part of the work is based on literature and aims to clarify and propose a new classification of the possible innovations, both by grade (sustaining, disruptive, discontinuous) or by type (market, technology, design driven).

Since the literature analysis highlighted the newness of the topic, the case-study is especially proper for new investigations (Eisenhardt, 1989). The present research adopts the descriptive case study research design, as defined by Yin (1989) and McCutcheon and Meredith (1993). The analysis of the case studies refers to periods from 2008 to 2009. In particular, the channels for the research were: companies’ official documents, websites and empirical literature in order to have multiple and different sources of information to compare and to build a complete and integrated description.

Therefore we used this methodology with two choice criteria: we highlighted cases of sustaining, disruptive and discontinuous/radical innovation from one side and of market, technology and design driven innovation from the other side. The criteria for the choice were companies that linked technology and design and that

present different types of innovation but that have different context in order to be compared: for example from different industries, with different sizes and different company history.

3 Literature review and theoretical development

3.1 The innovation scale

Innovation can be defined as “the process of successfully creating something new that has significant value to the relevant unit of adoption” (Assink, 2006:217). The literature is rich of contributions describing and classifying the innovation through its objects (product, service, processes, organization, transactions, management style and business model; see Johne, 1999), through its types (as for example the famous sustaining-disruptive dichotomy of Christensen, 2003) or through its application spaces (see Assink, 2006) and so on.

The ability to innovate and the ability of re-invention of the organization are more and more a need to realize a competitive advantage (e.g. Griffin and Page, 1993). A remarkable contribute to the growth is brought in particular way from the disruptive and radical innovations that break with traditions and reconfigure the rules of the industry which the firm belongs to (e.g. Christensen, 2003). While the sustaining innovation regards the “steady state”, “doing what we do better”, in other words to manage in an efficient end effective way the business, instead the concepts of disruptive innovation (Christensen, 2003) and discontinuous or radical innovation (eg. Phillip *et al.*, 2006) are equivalent to the concept of shifting the status quo. The disruptive innovation attacks slowly the status in an underestimated way, while the discontinuous innovation totally breaks the rules in an unpredictable way, collapsing and regenerating the status.

The literature on disruptive/discontinuous innovation prospered in the last decade and developed in different directions, as the analysis of the dimensions of discontinuity of an innovation (Veryzer, 1998) or their origins and causes (Chandy and Tellis, 2000) or the analysis of the new managerial approaches (Rice *et al.*, 2001), of the organization solutions and of the operative instruments supporting the disruptive/discontinuous innovation (eg. Veryzer, 1998).

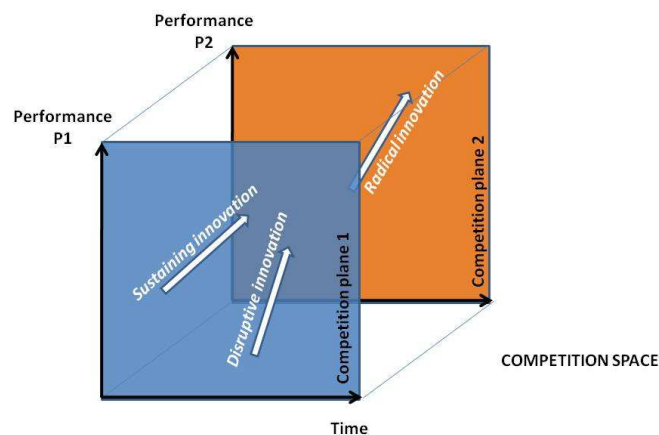


Figure 1. The innovation trajectories in the competition space

In our opinion, the main differences among sustaining innovation, disruptive innovation and discontinuous/radical innovation can be summarized into four main aspects:

- attack to the status quo;
- action during time;
- trajectory followed or technological solution offered;
- effect on the status quo.

While the sustaining innovation, in fact, poses itself always on the same competition plane across the same trajectory, and does a continuous action that is only a foreseeable improvement of the status quo; discontinuous/radical innovation is unforeseeable, and completely changes the status quo, the previous environment is completely destroyed and regenerated by this new innovation: the competition shift among a new different plane. The disruptive innovation finds itself in the middle, because it has the characteristic of beginning with a similar trajectory, that comes from the low end of the market and is so not suspected and undervalued, so the environment is only reconfigured and eroded, acting in the same competition plane. The trajectories are unchanged for the sustaining innovation, similar for the disruptive and completely new for the radical innovation, as shown in Figure 1.

Therefore we propose a matrix, that we called *innovation scale* (see Figure 2). It aims to classify the different types of innovations describing the premises and the final conditions of it and the trajectory of action during time. Moreover, the matrix of innovation that permits to read both the cases of technology driven innovation and design driven innovation. The application of this matrix has been also tested in two previous case studies of design driven business model innovation (Battistella, Biotto and De Toni, 2009).

THE INNOVATION SCALE							
		ACTION DURING TIME					
		CONTINUOUS		DISCONTINUOUS			
ATTACK TO STATUS QUO	UNFORESEEABLE			RADICAL INNOVATION	COLLAPSE & REGENERATION		
	NOT SUSPECTED AND UNDERVALUED		DISRUPTIVE INNOVATION		RECONFIGURATION & EROSION		
	FORESEEABLE	INCREMENTAL / SUSTAINING INNOVATION			CONTINUOUS IMPROVEMENT		
		UNCHANGED	SIMILAR	NEW			
		TECHNOLOGICAL SOLUTION					
						EFFECT ON STATUS QUO	

Figure 2. The innovation scale

3.2 The innovation scale applied to technology and to meanings

Technology and design can “enhance performance and unlocks innovation” (Design Council 2008:1). It is therefore important to understand how to operate and how to achieve breakthrough strategies for success, by technology and by design. For this reason, we tried to investigate the connections among sustaining/disruptive/discontinuous innovation and market/technology/design driven innovation.

From one side,

From the other side, the literature does not only investigate the concept of design and its links with innovation, but has also underlined how design is an important aspect in the corporate strategy. In fact design is an activity which overlaps with both R&D and with technological innovation, but can also make a contribution to the business of the firm outside either (Walsh, 1996).

Technology driven innovation

The *innovation scale* (see

Figure 2) tries to schematize all the concepts expressed above. It is mainly referred to technological innovation.

Design driven innovation

The literature is certainly focused on the analysis of the relationship between disruptive/discontinuous innovation and the technology change (e.g. Chandy and Tellis, 2000), but many scholars have underlined the importance of the meanings (e.g. Verganti, 2003) driven by the product, the service, the experiences or the entire business model of a firm.

The concept of meaning is strongly interconnected with the one of design. As a matter of fact, design can be defined as “making sense (of things)” (Krippendorff, 2005) and it is deeply connected with meanings that people give to products (as in Verganti, 2008), but also to the entire company and its business model (Fraser 2008; Battistella, Biotto and De Toni, 2009). This approach on design deals with socio-technical systems: “the

advantage of looking explicitly at socio-technical systems is that the co-evolution of technology and society, of form and function becomes the focus of attention” (Geels, 2004:902).

Out of doubts, design can be a lever for innovation (e.g. Walsh, 1996): it can be applied as “a strategic competence for the development of product and business innovation” (Bertola *et al.*, 2003) because it is “a core capability that shapes open innovation practice” (Design Council, 2008:4).

Surpassing the traditional dichotomy between technology-pushed innovation or market-pulled one, Verganti (2008) proposed a new model of innovation driven by design, the design driven innovation (DDI), that is “a strategy that aims at radically change the emotional and symbolic content of products, i.e. their meanings and languages, through a deep understanding of broader changes in society, culture and technology” (Verganti, 2008, p. 2). Design driven innovation is therefore a pushed innovation strategy. The introduction of design-driven innovations requires an approach of foresight and sensing the dynamics of socio-cultural models, and then firms and consumers interact to co-create needs and co-propose breakthrough meanings and product languages, looking forward to the future society to understand the possible new coming scenarios in the consumer environment.

Moreover Verganti (2008) highlights that an open innovation and network context is fundamental to favour the DDI: the connection of the firm with other actors (as designers, users, artists, suppliers, ...) and other external realities (as events, showrooms, design services, firms in other industries, ...) is important to understand the actual and future socio-cultural models, to unify the similar and different competences in order to imagine new meanings and innovate the old ones and to attain to find the weak signals coming from the periphery of the social and environment in order to foresee the tacit or distributed desires of the future consumers. A pivotal role in this process of sensing and foresight and of open innovation and networking is lead by the designers that have to act as “brokers of knowledge on languages and not only on technology” (Verganti, 2008:36).

The innovation scale can therefore be applied to meanings (Battistella, Biotto and De Toni, 2009): instead of considering a technological solution, it can be considered the innovation trajectory, therefore we can divide the design driven innovations in sustaining, disruptive and radical ones. Examples of meaning innovation in fact can be a disruptive innovation, as for example the mobile phones or a discontinuous/radical innovation, as for example the Wii, that we will better discuss in the next paragraph.

In our opinion, to study the different cases of innovation, it is necessary to classify them into the different three types of innovation and refer them to the different drivers of innovation, as in Table 1. Moreover, analyzing the case studies we found that not only technology and design can be linked for innovation but that an innovation can be for example disruptive as regards technology and radical/discontinuous as regards design and so on; we therefore classified them basing on crossing innovation drivers (see Table 2).

INNOVATION TYPE	RADICAL/ DISCONTINUOUS			
	DISRUPTIVE			
	SUSTAINING/ INCREMENTAL			
		MARKET	TECHNOLOGY	DESIGN
		INNOVATION DRIVER		

Table 1. Framework for classification of innovations based on crossing innovation types and innovation drivers

4 Empirical case studies

Table 2 shows the classification of some historical and most exemplar (for our purposes) cases of innovation, that we analyze in the following discussion.

TECHNOLOGY INNOVATION	RADICAL/ DISCONTINUOUS	<i>Terrestrial digital Plasm tv</i>	<i>Tv, Microwave oven</i>	<i>Internal combustion engine</i>
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	DISRUPTIVE	<i>Floppy-Disks</i>	<i>IKEA Cell phone</i>	<i>Nintendo Wii Sony radio</i>
	SUSTAINING/ INCREMENTAL	...	<i>Amazon / eBay Encarta SUV</i>	<i>iPod Swatch</i>
		SUSTAINING/ INCREMENTAL	DISRUPTIVE	RADICAL/ DISCONTINUOUS
DESIGN INNOVATION				

Table 2. Example of classification of innovations based on crossing innovation drivers

It has to be said that companies cross technology and design to innovate, but the innovation cannot be referred only to products, but also to business models. One of the first examples of business model innovation is surely *Apple*, that does not only have a breeding technology but also conveys its meanings (easy of use, beauty, lifestyle, simplicity and reliability) not only by the products, but also by its stores, by its brand and so on. That as regards meanings, but iPod by Apple can be seen as a radical innovation only for meanings and not for technology because mp3-player technology was already in the market, but iPod levered to iTunes to convey and sell music and to a lifestyle product.

Sustaining design driven innovation

1. Combined with Sustaining technology driven innovation
2. Combined with Disruptive technology driven innovation
 - *Floppy-Disks*: The floppy disk is one of the example described by Christensen for a disruptive innovation. In our opinion it is a case of disruptive innovation as regards technology, but didn't change any meaning of the disk.
3. Discontinuous technology driven innovation
 - *Terrestrial digital and Plasm tv* are both cases of discontinuous innovation in technology terms, but they did not change the meaning of the tv.

Disruptive design driven innovation

4. Combined with Sustaining technology driven innovation
 - *Amazon / eBay* were before not considered by the traditional book sellers, but by taking advantage of the so-called long tail and of the web-based selling, they conquered a big slice of the market.
 - *Encarta* was initially offering a meaning of low quality and not prestigious product in relation to the old dominant paradigm of a paper-made encyclopedia.
 - The *SUV* was not considered before as a change in the market of the automobiles, but the meaning is now different: a big car not only for the mountains but also for the city-center.
5. Combined with Disruptive technology driven innovation
 - *IKEA* disrupted the market proposing attractive but styled furniture and structuring the relation with its customers conveying meaning of 'saving money but not quality' (e.g. self picking from shelves, home-assembly phase, etc.).
 - The *cell phone* can be seen as a disruptive innovation in technology but also in meaning, because first it had the meaning to be a business-man device only for business communication offering medium-low performances related to existing technology. The mobile phones before had a business segment of customers, and nobody was suspecting their diffusion in all the people worldwide and of every age and social position.

6. Combined with Discontinuous technology driven innovation

- The *Television* was really a difference in terms of technology but disruptive in meaning, because it changed the way people look at information for example, but before it was considered something worse and its possibilities were underestimated.
- *Microwave oven* was initially judged not able to cook food offering a satisfactory quality level, but it was a real radical technological innovation.

Discontinuous/radical design driven innovation

7. Combined with Sustaining technology driven innovation

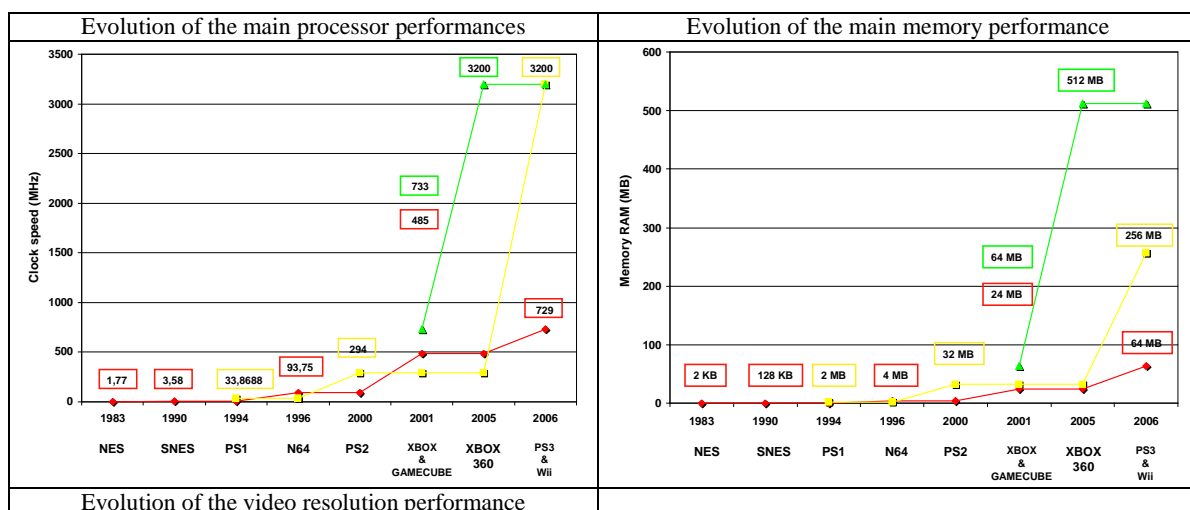
- *iPod* was sustaining in technology, because a similar technology was already in commerce before, but it won in the market by changing the meaning of the mp3-player, giving it a strong brand and a sense of membership.
- The *Swatch* adopted already existing quartz technology but as argued by Verganti (2008) radically introduced the meaning of a new fashion-young-personal device.

8. Combined with Disruptive technology driven innovation

- *Nintendo Wii*: Wii has radically changed the message conveyed by the videogame, by the meanings of player-videogame physical interaction and social networking between player and friends. As regards technological innovation, in fact, Wii does not represent a breeding innovation, but the wireless technology is anything technologically advanced, but it represents instead only a support for the new idea of playing with a high interaction player-console, by moving the body physically in the space and by socializing with other players. Wii won in the market with a low-level computing power performance and a low definition of the graphics. But Wii competed by changing the meaning of the console and by enlarging and enriching the competition space. In fact, while all the players were pushing the competition on technology, trying to improve the performance of the CPU, the computing power and the video resolution (see Figure 3), Nintendo changed the field of competition betting on human-machine interaction and on socialization. The name Wii in itself in fact recalls “we”, exalting the characteristics of simplicity and accessibility, interaction and socialization. It highlights not anymore the qualitative performances of the console, but the players’ imagine and behaviour, their relationships while playing and enjoying together, their centrality instead of the console’s one (for example in the advertisements, the people and their interaction with Wii are the center, not the Wii in itself).
- *Sony radio*: The first portable sony radio was initially offering lower sound performance than domestic radios but conveying a new radical meaning of parents-free control on music listening.

9. Combined with Discontinuous technology driven innovation

- *Internal combustion engine*: The combustion engine of the automobile has been an innovation that created a new market by allowing customers to solve a problem in a radically new way, and presents so peculiarities of both technology and new meanings.



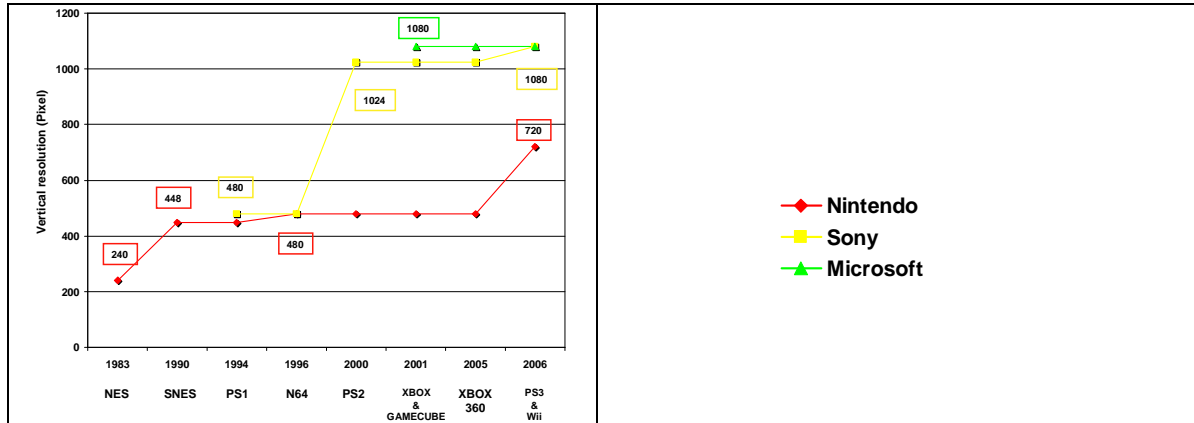


Figure 3. Comparison of technology evolution of Nintendo Wii, Sony Playstation and Microsoft Xbox

5 Conclusions

Technology matters. Design matters. Great design and great technology are the backbones of most successful products and innovative companies. Being technology and/or design driven is at the heart of today and tomorrow competition. Many scholars address in systematic way these key topics, but few of them (e.g. Verganti, 2008) span the innovation space driven by technology and semantic and emotional dimensions as a continuum. Customers read and make sense of both these dimensions, since what matter is the fact that “a great product embodies an idea that people can understand and learn about, one they emotionally engage with” (Brunner and Emery, 2009, p. 7).

To address this continuum, as first, our work proposes a matrix of innovation in order to classify the richness of contributions and to read with a unique framework the technology, market or design driven innovations. Then, it describes and highlights the advantages of a “double” (technology and design) driven innovation.

The work presents implications both for academics and practitioners. It identifies the main sources of creativity and innovation and links the technology driven and design driven innovations in order to propose a framework to define and suggest how it is possible for a company to be a market leader through multiple sources of innovation. On a practice level, the work gives some suggestions on how to link the sources of innovation and on which lever to act in order to create new meanings in the technologies.

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