Achieving Strategic Flexibility Trough Manufacturing Innovation

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Abstract

Rapid technological changes, market fragmentations, the convergence of different industries, shorter product life-cycles, innovations , and so on, have made the environment more 'hypercompetitive' (D'aveni, 1994), truncate (Anderson and Tushman, 1990) and characterized by 'high velocity' (Bougeois and Eisenhardt, 1988) and chaos (DeMarie et al., 1994). As Chandler observed (1962, 1977) the impact of changing in technologies suggests new possibilities for strategies and for new organizational structures to carry out those strategies. In addition the operations have to act and react to the high level of complexity and uncertainty organizations developing new strategic approaches significantly different from the rudimental low cost, differentiation and focus archetypes (Lei and Goldhar, 1996). This paper aim to explore the impact of 3D printing technology on the strategic flexibility Proposition about strategic flexibility and a practice case are presented.

Introduction

Living with global instability and uncertainty is fast becoming a way of life for organizations to operate in different industries. While some corporations seem reactively responding and revert back to fixed strategies, resisting change, using high control fixedmethods strategy such as competitive and environmental analysis, others seem to be more open to accepting and embracing the change. These organizationsare looking for possibilities and opportunities that may somehow exist within this chaos and disorder, by seeking to contribute and collaborate towards co-creating strategies to proactively deal and work with the speed of change and globalization. In this framework new venture businessesare being establishedbasing their strategy on theculture of sharing new ideas and innovation and on the abilities to collect more and more collaborations in order to buildthe skills and resources neededto fulfill, grow and develop their quest of purpose.One example of thesenew ventures' category is based on internet platformsgathering, collecting and selling ideas and concepts 'posted' by external designers and consumers, use crowdsourcing resources to select the right concept, build up the idea and raise the funds to produce it . Finally the ideatakes shape toward a 3D printer manufacturing process. This new technology accelerates the dematerialization of the strategy approachingthe manufacturing production as a flexible service delivery. The 3D printer manufacture -incorporated in the strategic process as a technological capability -allows the organization to produce different, innovative and customized products, whilst increasing the firm's ability to respond to the dynamicity of the competitive environment and exploitnew market opportunities.While the 3 D printing enables the product flexibility, the internet platform model gives to the companies the opportunity to work selectively with external designers, suppliers, customers and other firms to rapidly compress the resource management and other important process onto the value chain such as the product development and the commercialization. This capability to create a different strategy according to the dynamicity of the environment bases its foundation not

only on the capability to identify and acquire flexible resources (Sanchez, 1995) but also on the capability to coordinatethe identified resources in flexible processes.The objective of this paper is analyzing the leverage of 3D printing technology on the flexibility and emergence of a new venture strategy thanks to a new venture practice case.

The emergent and flexiblestrategy: theoretical framework

Strategic flexibility (Sanchez, 1993) has been widely used by strategy researchers to denote firms abilities to respond to various demands from dynamic competitive environments. A strategic flexibility shows theability of the organization to adapt to substantial, uncertain, and fast-occurring environmental changes that have a meaningful impact on the organization's performance.As Sanchez underlined, in a dynamic environments a firm can achieve competitive advantage by managing the uncertainty toward acreation of strategic flexibility in a form of alternative courses of action or strategic options available to the firms for competingin product markets (Sanchez, 1993, pp. 254-255). The strategic flexibility depend jointly onthe inherent flexibilities of the resources and capabilitiesavailable to the firms and on the firms flexibilities in applying those resources and capability to alternative courses of action or, rather, to its organizational structure.As Sanchez noticed (1995) two are the main indicators of this kind of strategy: the first indicatoridentifying and acquiring the use of flexible resources in order to give to a firm strategic options to pursue alternative courses of actions and respond to the developments in its competitive environment. The second onedevelopingflexibility in order to coordinate the use of resources to maximize the flexibilities inherent in the resources available to the firm. Resource flexibilities can be characterized through a larger range of alternative uses to which a resource can be applied or can be used effectively develop, manufacture, distribute or market different products.In addition,the resource flexibility is greater when costs, time and the difficulty of switching from one use of a resource to an alternative use are lower(Sanchez, 1995).In the context of product competition, coordination involves processes thatdefine the firm's product strategies in terms of which products the firm intends to offer and which market segments it will target; the configure chains of resources the firm can use in developing, manufacturing, distributing, and marketing its planned products to targeted markets. and finally the arrange (i.e. 'resynthesize') resources through organizational structures that support the firm's product strategies. Analogously, in dynamic product markets that require frequent adjustments in product strategies, flexibility in coordinating the uses of product creation resources consists of flexibilities to redefine product strategies, reconfigure chains of resources, and redeploy resources effectively. As Sanchez (1995) defined, flexibility resources regard also the flexibility of production, distribution and marketing resources based on a range of product possibilities it can feasibly develop, including the cost and time to develop each new product. In this process, technologies and their evolution play a relevant role in affecting the “continuous morphing”of companies where the strategic orientation and the organizationmutually change (Rindova and Cotha, 2001) dynamically.

3-D Printing Technology

3-D printing is currently used in three different fields: rapid prototyping, specific niche and final products. Rapid prototyping was the earliest, and still the biggest application for 3-D printing. Whilst most 3-D printers are currently used for prototyping and in pre-production mould making processes, the use of 3-D printing to manufacture end-use parts is

also occurring now, changing many aspects of the manufacturing industry, and adding more flexibility to the management of the following aspects :

- Flexibility of the human resources relationships: through the link with the connection between designers and production players. The designer will have the chance to do not only the scratch but also the prototype of the product or, better, the final product. This change will allow the designer to acquire a part of the value chain belonging to the manufacturing organization.

- Flexibility of product personalization . A key attribute is that the technology makes it possible to produce 'one-off' or highly personalised parts more easily than other manufacturing methods;

- Flexibility of production through the shortening of cycle time between designing products and making them. This could help manufacturers in the developed world to compensate for their higher wage costs when compared with those in more emerging economies such as China. Joe Hogan, chief executive of ABB, the Swiss-Swedish engineering group, says:

  > '3-D printing means it's possible to go from concept to reality (in making one-off parts) in just a few hours. That's a big help when you are trying to be quicker and more reactive';

- flexibility in production bydecreasing production costs. Hans Langer, chief executive of Eos, a Munich-based company making 3-D printers, highlights the potentiality of 3-D printing

  > '...make items that are lighter, use materials more economically and behave differently to products made today. By reducing materials and waste when making single product units 3-D printing could lead to a completely new way to approach manufacturing'.

In the following paragraph we consider the Quirky case as an example of our consideration, using an explorative research based on the qualitative analysis.

Quirky practice case

The case study analysis was conducted over a period of 5 months, involving three main sources in an iterative way:

- a press analysis conducted on 16 journals and design-related magazines in the time range 2009-2013;

- five in-depth interviews, three of which were conducted with external consultant

- participation in four workshops and events based on 3D printing technology

These initial understandings derived by the press analysis supported the formulation of the main issues and questions that were explored in the subsequent interviews.
Interviews focused on the following aspects: flexibility of the production and flexibility of the resources.

Quirky is a consumer products company that turns crowdsourced invention into retail product via a manufacturing process based on a 3-D printing technology. Since launching in 2009, Quirky has rapidly changed the way the world thinks about product development.

The process that, from the idea, arrives at the final product involves a significant plethora of different types of actors . Each week, dozens of amateurs submit different ideas, from the kitchen staff to the technological device, up to the jewelry , etc..; then, hundreds of online community members (or "Quirks")- composed mainly of hobby inventors, students, retirees and product-design enthusiasts -weigh in on the products and vote for their favorite submissions. Quirky has an internal resource of 8 designers on staff out of a total of 40 people in the firm, and larger, but indeterminate, number of external designers and community (esteemed around 65,000) that bring their capability into the final products. The intrinsic characteristics of 3-D printing technology enable to produce different categories of products, in limited quantities and, above all, without a technological complementary relationship among them. There is an extremely high heterogeneity of produced and sold categories of goods: from fashion accessories, jewels, to toys, shoes, musical instruments, lamps, interior design products. Quirky produces 60 products every year belonging to different industries: Kitchen; Toys; Home Decor; Lawn & Garden; Electronics; Organization; Fitness; Accessories; Pets.

This product heterogeneity has to be based on a flexible strategy where creating new solutions and products is more than just sharing technological, esthetical, or category links of products (Sanderson, and Uzumeri, 1995), it shares a fixed knowledge and common processes and dynamic capabilities (Chesbrough, 2003). The way that the capabilities and resources of the new venture are used to generate different and new categories of goods has come to be recognized as an important contributor to strategy flexibility. The breaking of technological, esthetical and category links can also reduce the brand power on these productions. Some categories of the products dealt with – such as accessories, interior design products, jewels – typically linked to brand driven purchasing processes, in 3-D printing cases they lose the signalling value of the brand and acquire the signalling power of customization, which is in turn linked to creative processes and communities. Form this construction we can introduce the following proposition.

> *P1: The crowdsourcing of ideas and concepts leveraged by 3-D printing induces a product-portfolio policy where no product technology complementarities can be achieved and a flexible balance between volume and margins is pursued.*

Thanks to the community, Quirky collects the vast multi-disciplinary skills needed to turn an idea into something tangible: a design background, electrical engineering, marketing, fund raising and access to retailers and manufacturers are all required and found in the sourcing community in order to complete and sell the product . The ability to create a different range of products is sustained by the efforts to synthesize and subdivide functions and interests and reconfigure existing organizational routines to support the different product strategy (Sanchez, 1995) via a flexible organization. The product-portfolio heterogeneity has to be based on a flexible organization able to quickly redefine the resources and the value chain in relation to the product's needs . This kind of model is well represented by the Quirky network organization characterized by an increasingly shape a reciprocally interdependent relationship (Thompson 1967) between designing and manufacturing, as opposed to the traditionally linear sequential functional separations that usually delineate the two functions (Van de Ven, 1986; Hitt et al., 1993). In this model the relationship between designers and customers is changing too, requiring a greater and more flexible involvement of customers in

the creative and manufacturing process. The costumer and the designer create the product through a process of cooperation, feedback, trial and error to achieve high customization products based on the specificity of the clients .

As a flexible organization model also the distributive channels are flexible: Quirky, for example, extremely excited about the idea of a creative marketplace community, has developed on-line shops giving users the chance to buy products generated by various users-designers. Quirky, – mostly in line with the logic of pushing a distributive strategy – combines a retailing network of products conceived with their own platform. Actors specialized in organized distribution, such as Safeway, Target, Barnes & Noble, Amazon, Toys "R" Us, are only a few examples of partners where you can buy products powered by Quirky.These new relationships bring important innovative elements to the classic models of relationships between manufacturing organizations and distributive channels.. Given these considerations it is possible to draw the third proposition:

> *P2*: *The crowdsourcing of ideas and concepts leveraged by 3-D printing new ventures induces a heterogeneous distribution policy, where different channels and retailers categories are admitted, due to the continuous flexibility of the product-portfolio composition.*

3D printer involves the new venture inbeing strategically and structurally more flexible: for example sharing of the product's technical codes via the web, allowing the design to be reproduced in different places and with different printers push toward a network structure of laboratories and designers. The ability to use different kinds of materials on the same printer (e.g. aluminium, stainless steel, titanium, polymers, ceramics) demands the capability to manage and be connected with different suppliers. the capability to personalize products on the basis of customers' preferences and make amendments to the product simply with some adjustments to the CAD program, attest the relationship between designer and costumers .

This new manufacturing technology enables the organizations to achieve greater strategic flexibility in designing new products, producing high variety of products at low cost. The characteristics of this technology expand the range of the firm's potential growth paths reducing the potential barriers to enter related markets or similar market segments, thus increasing the firm's strategic flexibility (DeMeyer et al., 1989, Hayes and Pisano, 1994). Of course the exploitation of this new technology requires and pushes for a flexible organization design that allows quick responses in order to take advantage of the capabilities of this technology. From the perspective of strategic management, increasing economies of scope and greater flexibility mean that firms are not confined to pursuing a single generic strategy to achieve competitive advantage (Porter 1980) tailored the strategy to competitor and market profiles.

Emerging Issues and Conclusions

The exploit and development of 3-D printing in modern industrial and manufacturing economies is promoting new competitive mechanisms supported on an emergent strategy. The flexibility of resource management and value chain gives rise to a new form of network where the technological flexibility of 3-D printing technology finds a new way to deal with unpredictable, discontinuous changes in order to make them more manageable for the organizations. This strategy represents one type of dynamic capability that enables firms to address discontinuities in the environment (Eisenhardt and Martin, 2000; Teece et al., 1997).

In the current competitive arena, which features stable and consolidated relationships between large-scale production players, incumbent designers and design consulting firms (Capaldo, 2007; Dell'Era, Verganti, 2010), there is now a new scenario that features new players (including newcomer designers and small-scale producers) who base their competitive advantages on a flexible and emergent strategy . The proliferation of instruments and software open to design, the spread of cultures linked to 'making' and advanced self-production (Senneth, 2009; Micelli 2011), together with the potential of the 2.0 web and social networks, are the key factors and the background for the development of these new forms of creativity and manufacturing that produce flexible strategy

The objective of the strategy is then identified and adjusted if the environment or other circumstances change. Finally, it ends up with rational decisions and rational choices of the options and the most profitable strategy is implemented thanks to a specific list of activities.

The new technology (e.g., 3-D printing) does not have a central or leading role, but it is a trend accelerator to limber resources and organization centered on community and design/manufacturing crowdsourcing. An experiment of sorts that requires the culture of risk, opportunity and change, induces companies to define a profitable product portfolio based on a wide variety of customized and low-volume products with no technological complementarities, where the process and community management prevails over brand management. All the relationships that emerge in this new context often surpass the traditional vertical relationships between supplier, producers and distributors. Inside this expanding context, products do not have technological complementarities or branding relationships. With 3-D printers – given material limitations – companies produce lamps, shoes, accessories, or toys, without any type of category ties and complementarities.
In case of a positive and successful scenario, in the long term we expect the co-evolution with the existing manufacturing-based network, thus, a redesigning of a new competitive arena: some incumbent players will be thrown out or reshaped, other new comers will strengthen competitive advantages acquiring a central role in the new network. This dynamic process of co-evolution driving the ongoing transformation of competitive environment is a virtuous circle of change based on increasing flexibilities of new product creation technologies, product strategies and organization structures (Sanchez, 1995). This co-evolution seems not to be easy if not to the extent that the new technological capabilities are not sustained by a flexibility and openness of organization and strategy .Given its focus on empirical evidence from the diffusion of 3-D printing, our analysis cannot be employed to identify the specific features of a new emerging industry and its strategic features , but aims to present some first-hand trends in creativity industries.

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