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COMPETITIVE ADVANTAGES IN A NANOTECHNOLOGY VALUE CHAIN

Case study

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Abstract

The value chain analysis is one of the most important methods for understanding the industrial world. The main task of the value chain that links producers and buyers consists in understanding where or how exactly the value added is generated. In the case of products incorporating nanotechnology, most of them are still in the trial phase into laboratories, but there are some examples of good practices where nanoproducts discovered their way to the market. This paper tries to present two cases of value chains for nanotechnologies applied to textiles by identifying the competitive advantages and focusing on getting some answers for a better understanding of the entire process from production to the final user.

1. Introduction

The value chain analysis is one of the most important tools for understanding the industrial world. At the first glance, this world seems always in change and every player depends on it. Everybody involved in the industrial system is interested to reach the value that is generated during the process. The main task of the value chain that links together the producers and the buyers consists in understanding where exactly the value is generated.

The concept has to be updated and extended to cover the most difficult times of financial crises, technology development and product innovation that are the main characteristics of our days.

For a company, a good performance of the market means keeping competitive advantages in conditions of a strong competition.

The company has to keep a good contact with the customer while working hard to create value for him and taking care in the meanwhile of competing companies.

One of the most powerful weapons in competition is technology. In some cases as nanotechnologies, the competition depends on huge amount of investments to keep a high level of advantages, and the entry barriers are very high.

This paper tries to identify the competitive advantages that helped two companies coming from the world of nanotechnology applied to textiles and succeeded to make the value chain complete.

The paper is divided in three parts: the first one describes some theoretical aspects about the value chain; the second focuses on the case studies of Elmarco from Czech Republic and Holmenkol from Germany; the last part presents the conclusions of this paper.

2. Value chain from the theoretical point of view

There are many aspects of a value chain that allow a better perspective for guiding to an appropriate perception. In comparison with sector analysis, the value chain analysis is more dynamic, by catching inter - sector linkage.

Generally, the value chain comprises all the activities required to create a product from conception to physical transformation up to final use, the entire process being a number of value added links (Kaplinsky & Morris, 2000, p.2) which are repetitive and lead by various actors.

The literature refers to particular links as intra-firm or inter-firm, depending on the stage of the process or on the value system which means the value chain is a network of links created by the firm.

The value chain analysis plays an important role in understanding the way in which the competitive advantage can lead the process (Kaplinsky&Morris, 2000, p.11) through three perspectives: mapping the activities and income generated by each activity, the manner of the firm connection to the World and last, focusing on institutions that drive international specialization to identify the normative levers (Kaplinsky &Morris, 2000, p.41). In some cases, the analyses reflects information about the knowledge incorporated into the entire process of creating the value added since there are production sectors where skill content increased and this can be seen through decomposing the process (Kaplinsky &Morris, 2000, p. 94).

There are two main types of value chain depending on the key role played by the buyer or by producers, and in this way there are buyer-driven chains and producer-driven chains (Gereffi cited by Kaplinsky & Morris, 2000, p.32). The buyer-driven chains are specific to the labour intensive industries.

One of the main characteristic of the supply chain is the trend of the supply not always positive in conditions of a changing business environment and an acerb competition (Lu, 2011, p.16).

The essential element for modelling the supply chain is the demand volatility generally affected by the economic climate where some important factors as geo-political instability, the financial crises or technology development and product innovation push the actors involved to adapt to the new conditions (Lu, 2011, p.19).

As Lu shows (2011, p. 20) shows the customer loyalty has significantly decreased over the last decade. Thus technology could create competitive advantages so the lead-time from ideas to commercialization was shortened. Sometimes the new technology or product may not be appreciated by the consumers since they could not be convinced by the value created in terms of costs or some other gains.

As Lu (2011, p.20-21) says in conditions of globalization, every industry has own technological leaders evolved in development systems. The first mover captures its own advantages that make difficulties to other newcomers. Into the value chain the innovative ideas and new technologies come from suppliers or a contractor involved in the network. In the same time technology creates new directions to be developed, but it destroys some existing business and so, the existing networks.

As European Competitiveness Report (2012) shows, sophisticated products are not a subject of the outsourcing. Especially due to the crises, the companies tend to reduce the outsourcing and to keep the production activities inside the national territory.

On the other side, there are documents (ECSIP, 2013) showing that companies with headquarters in Europe operate globally and get best conditions from the places where there act. Asia seems very interesting to invest not only when it is about low cost labour or large scales of production, but also

when it is about great conditions for developing research and development investments.
Porter argues (cited by Hergert &Morris, 1989) that the profitability of a company depends on the industry attractiveness and its relative position within it that is determined by the competitive advantages in front of the competitors. The advantages created during market competition come from the capacity of the buyers to create value through exceeding the costs of generating it.
Value chain analysis allows understanding the role of some discreet activities and their impact on creating sustainable competitive advantages (Hergert &Morris, 1989).
The numerous publications regarding the value chain assumes that there is no a "definite" method to realize a value chain analysis, but there are some important steps that can be applied during the research (UNIDO, 200, p.9): first, it is important to map the value chain for understanding the relationship between the chain components; second, identifying the distribution into the chain that involves an analyze of the margins and profits; third, defining the upgrading needs within the chain that refers to the product, production, new activities or new functions, knowledge; last step, but not least emphasizing the governance role, which means the structure and the coordination of the value chain.
As UNIDO (UNIDO, 2009, p.16) shows the value chain means a quantitative and qualitative terms presenting the link through all activities and actors involved in industrial process and marketing.
The industrial production operations comprises (UNIDO, 2009, p. 21), utilization of inputs (raw materials, human resources), production system (systems used by competitors, utilization of raw materials, labour, flexibility to produce), products manufactured by the chain (products characteristics in terms of parameters compared with competitors).
The value added represents the value conducted by each industrial establishment and is deducted through "the difference between the value added to all goods and services produced and the value of those purchased non labour inputs which have been used in the production process" (UNIDO, 2009, p.27).
This means, each phase of the value chain is a value creator.

3. Nanotechnology value chain

As Ghemawat (2010, p.49) says competitive advantage cannot be perceived from looking at a firm as a whole. Sometimes the discrete activities are the key for facing the competitors. Porter (Ghemawat, 2010, p.50) discovered that the competitive advantage comes from costs, differentiation or focusing on both. In the case of products incorporating nanotechnology, most of them are still in the trial phase into laboratories. In their case, the value chain is not complete. At the first glance, the value chain for nanotechnologies has three main phases, as it can be seen in the Figure 1: nanomaterials, intermediary products and nano products (Stacey, 2011).
As it can be easily understood, the demand is a sine-qua non condition for a complete value chain but in some of the nanotechnology cases the demand for products incorporating nanotechnology is missing.
In the world of new technologies, as nanotechnologies, there are some examples for good practices where nanoproducts found their way to the market. In these cases the role of those successful companies is not yet well definite, because the information supplied by these players is not complete to help researchers in getting conclusions. For this reason, economic indicators as turnover, revenues, trade, are not yet ready to be disclosed and a value chain analysis from the cost point of view is difficult to be done.
For those who discovered the way to the market, their value chain has four main phases, as it is shown in the Figure 2: starting from raw materials (could be nano or not), then intermediary products, nanoproducts and final user (Stacey, 2011). Starting from this idea, it can be seen clearly that some companies are included in a model of three phases value chain while others built a complete value chain. For a better understanding of these differences, this paper tries to present two companies coming from the field of nanotechnologies applied to textiles that found the way to the final consumer, one named Elmarco from Czech Republic and the other Holmekhol from Germany. This paper tries to identify the competitive advantages that helped these companies to make the value chain complete through the perspective of some questions as: how did they find the way to the demand? What is their value-added? Is their success a result of endogenous or exogenous factors that created healthy environment for nanoproducts?

3.1. Case study 1: Elmarco S.R.O.

Elmarco S.R.O. is a private company from Czech Republic, an important manufacturer for nanofibers equipments and a provider of technological solutions applied to a wide range of activities. The headquarters is in Liberec and there are two commercial branches in USA and Japan. Today, Elmarco has about 80 employees, between them there are 35 researchers.
As Elmarco site (2013) says, the year 2004 was a historical moment for the company when an agreement was signed with the Technical University of Liberec. As a consequence of this agreement in 2005 a new revolutionary technology was born, called Nanospider, patented by Elmarco and it represents an electromagnetic spinning for organic and non organic nanofibers production.

Even if the Elmarco's activity is very complex and the technical terms seem very difficult to be understood, an overview of its value chain can make a simple and well understood reality as it can be seen in the Figure 3.
Following the model of the value chain from the Figure 3, the starting point is the purchase of the raw materials and in Elmarco's case this means in one hand buying components for equipments and in another hand buying polymers (Elmarco, 2010).
Then Elmarco manufactures equipments for nanofibers production and assemble services devices becoming a supplier for two main categories of customers and partners: universities and research institutes by supplying laboratory equipment and partners for the business of water cleanning, building, healthcare, energy, automotive and advanced textiles.
After the partnership with University from Liberec, Elmarco signed lots of agreements with worldwide research institutes for developing applications in every industrial field as filters for cleaning water, phonic insulation for walls, wounds and drug delivery, photonic cells. All these applications have high level of quality parameters in comparison with the traditional products.
As a market volume, Elmarco sold until 2013, 130 Nanospder equipments, this places it as one of the most important producers all over the world.
From the perspective of the industrial sector, the entry barrier is determined by the patent that confers exclusivity to the owner. To gain this patent, Elmarco received support from the Czech government and European Union. The relationship with the academic world assures notoriety and fast development for new applications of nanofibers or for using new raw materials. If a new competitor wants to enter into this sector, a new patent is required to get better performances at the lower costs and allowing a large scale production.
As Czechinvest (2014) shows, the main companies from the field of nanofibers are: Elmarco LTD, Contipro, Nafigate Corporation, Nanopharma, Nanovia LTD. The most important companies of the field are Elmarco, Contipro and Nafigate Corporation. An importantmoment was in 2010 when ex-manager Ladislau Mares, the founder of Elmarco left the company to open Nafigate, in this way becoming a real competitor for Elmarco. At that moment, when Nafigate was created, Elmarco had a downstream at least visible at the level of employees, the number decreasing from 250 to 80, while Nafigate had an amazing evolution signing a strategic partnership with China.
Even if the Elmarco's position is consolidated to the market, at every moment new discoveries could appear. An example in this way could be graphen (Kungl. Vetenskaps Akademien, 2010), named the material of the 21st century (European Comission, 2013).
In comparison with other nanocompanies, Elmarco discovered its way to the customers through Nanospider technology, which can be considered an endogenous factor for success, but the way to the final user was built with intensive investments sustained by the Czech state and European Union founds. This means the success of Elmarco was a result of endogenous, but in the same time endogenous factors.
Regarding the value added is not directly connected to the costs, but it comes from developing new applications, new finished products and new materials (Elmarco, 2009). The competitive advantage of Elmarco is built through knowledge coming from the research world, while the commercial success comes from strategic partnerships.

3.2 Case study 2: Holmenkol Gmbh

As the company site shows (Holmenkol, 2015), Holmenkol improved a traditional wax technology through a patent named CFC@technology, a hybrid technology with particular characteristics, bringing better properties for textiles, bicicles, bodycare and schi. Traditionally the slide effect was based on chemical reactions, but new patent improved through nanotechnology helped for some physical slide effects. The company was found in 1922 and 90 year latter, in 2012, Holmenkol become insolvable, but in a short time Sporto-med GmbH took Holmenkol under its protection, as its company and so the long existence of the company continued till nowadays.
In 2001 Holmenkol created the first wax based on nanotechnology dedicated to sportive races, being considered the nanotech product of that year.
Then, the company opened two branches, one in Norway, the other in Japan. The next five years, untill 2006, 18 patents were registered, making Holmenkol one of the most inovative cmpany from Germany. In 2006, The Winter Olimpic Games from Torino, 43 national teams used Holmenkol products. In 2008 an agreement is signed with Nanostart, who become an important share holder in Holmenkol and who assured an important financial investment in the research field.
Besides the technology mentioned before (nano-cfc@technology), another patent is used for textile products named Lotus-Hybrid Matrix, which stimulates the lotus effect on textiles and another patent named Hygiene Effect, which afford the washing in the low temperature conditions, allowing a perfect cleaning, killing bacteries and germs.
The value chain of Holmenkol seems simple, as it is represented in the Figure 4, but in reality it was built in 90 years and as the offer is premium quality, it arrives to the top clients from the sport world.
As it can be seen in the Figure 4, Holmenkol has suppliers of chemical substances and manufacurers

from Germany. This is a key for offering the top quality, as this is a good point for the company to be proud of it.
Even if the Holmenkol's offer is generous, taking into consideration only products dedicated to textiles, there are 16 products incorporating nanoparticles in a matrix which stops lung inhalation since the particles are cimented on the product surface where they are applied. Products are sold in spray package, through this way the substances are not used in their pure form, but they offer private characteristics as water resistence, makes the fabric breathable at extremely low temperatures, odor neutralisants and make a longer life of textiles and skin.
Finally, the demand for Holmenkol products dedicated to textiles is assures by top atheletes, famous ski federations and sport clubs from all over the world.
Having a look from the industrial sector, the entry barriers are very high, since a company that intends to compete has to invest a lot in research to get a patent with better properties, needs time to be trustful and well known as Holmenkol. The notoriety is the strongest point for the company under discution, and this helps Holmenkol to stay far away from competitors. 90 years of buildind top relationships could not be easily demolated by new competitors who target the same level of customers as Holmenkol.
Regardind the substitutes, these can be created as a result of a continuous research. On the market there are lots of similar products, especially cleaning products, but their effect and quality cannot outperform Holmenkol.
The bridge to the customer was built in almost one century, but the key for a very long existance like this was permanent innovation and upgrading to the times. A wide range of nano patents, a rich history, trust from investors and a top customers potfolio is a perfect combination between endogenus and exogenuous factors to build the right way to the demand.

4. Conclusions

The value chain analysis is dynamic and comprises all the activities performed by the company from conception up to the final product, understanding how the value was transformed during the process and how the competitive advantage leads the analysis. It is important to see how some discreet activites have a significat role in creating sustainable competitive advantages, margins and profits and how is the sructure and the coordonation of the value chain.
The competitive advantage cannot be perceived from looking at a company as a hole. In the case of products incorporating nanotechnologies, most of them are in the trial phase into laboratories and the value chain is not complete. In the world of nanotechnologies there are examples where nanoproducts found their way to the market. In these cases statistical data are not available making difficult the analysis of value added in terms of costs, but they provide certain characteristics that make them important on the market and persuade the customers to follow them.
In the world where technologies and research and development activity guide the way to the market through patent protection, behind this strengh force well understood there are other elements that push the companies near the customer. Sometimes there are reasons coming from inside the companies, but there are external opportunities that can help it.
This paper tries to identify the competitive advantages that helped two nano companies to make the value chain complete through the perspective of some questions: how did they find the way to the demand? What is their value added? Is their success a result of endogenous or exogenous factors?
On example is Elmarco SRO from the Czech Republic, an important manufacturer for nanofiber equipment and the provider of technological solutions applied to a wide range of activities.
Besides Nanospider technology, which can be considered an endogenuous factor for success, the way to the final user was built with intensive investments sustained by the guvernment and European Union. This means the real succes of Elmarco was a result of exogenuous combined with endogenuous factors.
In the case of Elmarco, the value added is not directly connected to the costs, but it comes from offering something that do not exist, being always with one step in front of the others. New applications, new products and new materials are the key of Elmarco's added value.
Another example is Holmenkol GmbH from Germany, providing wax technology for Alpine skiers and other special textile products incorporating nanotechnologies.
The way to the customer was build in a century of activity, by combining a traditional technology with new technologies, investing huge amount on research, a rich history, trust in front of investors; all these features created the portfolio for getting the top customers all over the world.

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Figure 1. Value chain for nanoproducts (Stacey, 2011)

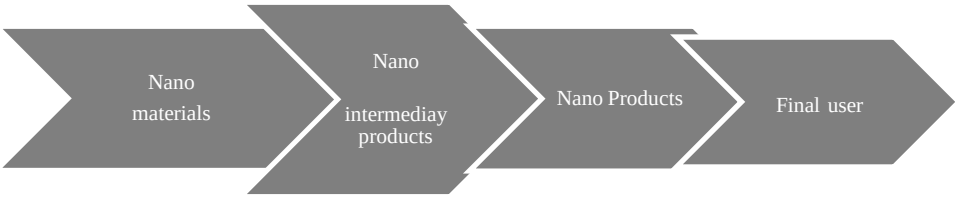

Figure 2. A complete nano value chain (Stacey, 2011).

Figure 3. Elmarco Value Chain.

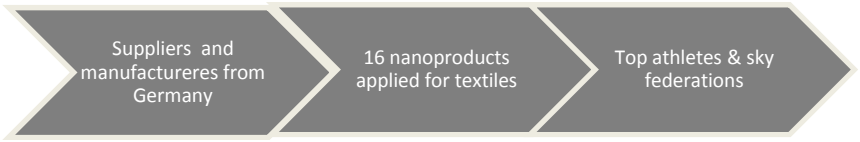

Figure 4. Holmenkol Value Chain