Technological Innovation and Business Strategy: A Cognitive Mapping Approach

Lilia Hedfi Khayati, Manel Belghuith Koubaa, Mahmoud Zouaoui

Abstract

Technological innovation has become important prerequisite for firms’ survival and growth. This leads to wonder about the position of technological innovation in the firms’ managers’ strategies of the industrial sector. For this, a qualitative approach based on cognitive mapping was adopted. Research results show that technological innovation is much more integrated into cost leadership and differentiation generic strategies than into intent strategies. Thus, moving from strategic logic based on “product–market” ratio; to strategic intent logic based on mobilizing resources and competencies, is remaining elusive for managers’ in Tunisian industrial firms.

Keywords

Technological innovation, Generic strategies, Strategic intent, Cognitive mapping

I. Introduction

Firm survival and growth condition its competitiveness degree in globalized economy context. At the same time, several theoretical and empirical researches have shown that innovation is increasingly essential for becoming competitive. Particularly, technological innovation must be given prominence in business strategy. Technological innovation has been addressed differently by diverse strategy thought schools. Indeed, we report that there are two strategy conceptions: adaptation conception oriented towards firm positioning and strategic intent conception oriented rather towards firms inside. Innovation is then used differently to explain competitive advantage. However, neither adaptation nor strategic intent conceptions have treated technological innovation-business strategies link. In addition, several studies (Laroche and Nioche, 2006) showed that business strategy is influenced by firm manager’s values and cognitive structures. Moreover, strategy is a set of abstractions in managers’ mind; it emerges from ideas and constructs, allowing information processing and strategic decisions making.

Given these advances and the preponderant position of technological innovation in strategic field, we propose in this article to answer to the following research question: How is technological innovation integrated into strategies of Tunisian industrial firms? In other words, is technological innovation falling within adaptation strategy or within adaptation strategic intent? Empirical research review on corporate strategy reveals the existence of two approaches types: “objective” and "subjective" strategic approaches. Given that our purpose is to explore, in a cognitive perspective, business strategy and technological innovation link, we will adopt subjective approach essentially based on a query of manager’s perceptions of their business strategy various dimensions.

To answer to our research problematic, we structured this article as following: we begin delineating technological innovation and corporate strategy concepts and then the relationship between them. Identified relationships allowed making two research propositions. To analyze business strategies and technological innovation manager’s perceptions, we adopted a qualitative approach based on cognitive mapping. Cognitive mapping technique enables us to develop cognitive maps from semi -structured interviews conducted with six industrial firm managers. Analysis of cognitive maps has allowed in a first time to identify our principal research concepts as influence and causality relationships between them, which led us in a second time to define technological innovation space in business strategy.

II. Literature Review

1. Technological innovation: Definitions and typologies

Tremblay (2003) defines innovation as transformation of an idea into new or improved product, business process and new method or service. So, we can first distinguish between invention as a process of producing new ideas and innovation as transforming these ideas into marketable products or processes. In fact, innovation has certainly technical background, but it is the economic value that incites firms transforming ideas into new products and processes. Technological innovation is based on technology. It transforms this technology into response to internal or external user needs. Technological innovation is to be distinguished from other innovation types requiring neither scientific nor technical progress such as commercial innovation and organizational innovation. Most authors (Song, Xie, 2000; Herrmann et al, 2007; Corbel, 2009) assign innovation a newness connotation, nevertheless, debate persists about the question “Innovation as newness, ……new to whom?” (Johannessen and al., 2001:p1) Some researchers evaluate technological innovation regarding firms and believe that it involves adoption of an idea that is new to organization. Consequently, novelty refers to creating and acquiring product or service that is new to the unit adopting this one (Damanpour, 1991; Johannessen and al., 2001). Other researchers (Muller, 2005; Herrmann et al, 2007) advocate that novelty assessment is relatively to market and consider that technological innovation is market introducing of new products. Others like Souitaris (2002) council the two points of view and suggest that technological innovation occurs when a firm has to
market new or changed product or when it adopts new or changed processes. Consequently, we believe that both firm’s or market’s evaluation of technological innovation enables to distinguish between two types of technological innovation: radical innovation and incremental innovation.

Based on technological innovation scope, we can differentiate product innovation and process innovation. Product innovation provides market of product or service, with at least a novelty compared to existing products or services, so that novelty is perceived by customers (Loilier and Tellier, 1999). According to “Oslo Manual” (1992: 37), a technologically new product “is a product whose technological characteristics or intended uses show significant differences compared to previous products. Such innovations can involve radically new technologies, or technologies based on combining existing technologies in new applications, or resulting from leveraging new knowledge”. Process innovation means transforming industrial processes to design, produce and distribute products and services (Tarondeau 1994). This requires the use of new techniques for manufacturing new products or improving existing ones (Dubuisson and Kablo, 1999).

Boynton and Victor (2000) argue that product/process innovation distinction is not systematic and propose four combinations crossing product and process innovation on one hand, and corresponding progressive and revolutionary change on the other hand. Firm is then, either in a mass production system, or in “invention”, “development”, “dynamic stability” situation.

2. Business strategy: From adaptation to intention

According to Chandler (1986), business strategy is “determination of the basic long-term goals and objectives of an enterprise and the adoption of courses of action and the allocation of resources necessary for carrying out these goals”. Early in 1990s, a new strategic paradigm was stood out in strategic management field. Indeed, strategic analysis which was mainly based on firm-environment adequacy or strategic fit, was transformed into strategic intent based on manager’s deliberate will (Prahalad and Hamel, 1990)

Porter’s generic strategies as coping strategies

Strategy involves adaptation to environment to gain market dominant position and defend it. “SWOT” model analysis has been the basis to define and develop coping strategies. Then, other strategic analysis models was appeared and ended with Porter’s model. This model included, coherently and in detail, all strategic researches’ advances and contributions developed since sixties (Métais and Saias, 2001). In fact, according to Porter (1980), for a given strategic business unit (SBU), three major and exclusive strategy families are conceivable: differentiation, cost leadership and focus strategies which are presented in the following table:

<table>
<thead>
<tr>
<th>Strategic target</th>
<th>Strategic advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>The whole sector</td>
<td>Product uniqueness is perceived by customers</td>
</tr>
<tr>
<td>A particular segment</td>
<td>Firm position tcharacterized by low costs</td>
</tr>
<tr>
<td></td>
<td>Differentiation strategy</td>
</tr>
<tr>
<td></td>
<td>Cost leadership strategy</td>
</tr>
<tr>
<td></td>
<td>Focus strategy</td>
</tr>
</tbody>
</table>

Cost leadership strategies involve firms which aim to obtain lower costs regarding to their competitors, by sustaining product perceived value (Mathé, 2001). Cost leadership strategies orient all firm efforts to an overarching objective which is to minimize total costs (direct manufacturing, conception, marketing, distribution, investment, and administration costs). According to these strategies, the most competitive firms are those which have the lowest costs. These firms’ competitive advantage is depending on their ability to minimize costs (Strategor, 1988). Allaire and Firsiriotu (1993) situated cost leadership strategies in a strategic dynamics as market strategies based on cost advantages’ search and introduction because of buyers’ sensitivity to the lesser price variations. Firm competitive environment (industry volume, market) and firm management methods are favorable conditions to implement cost leadership strategy (Mathé, 2006). Management aims to make the best use of three cost effects: volume effect, scale effect and experience effect (Strategor, 1988; Mathé, 2006).

Differentiation strategies aim to offer product or service perceived as unique and differentiated by customers in the whole sector (Helpher et al., 2006). Firm differentiation strategy is based on perceived value seeking or optimum use product or service value (Mathé, 2001). Thus, firm activity should have industrial positioning on the one hand, and market positioning of the other hand. In addition, differentiation sources are various: product or service (intrinsic value, functionality, performance and design product) and product associated services (rapid response to customers’ needs, installation customers’ advisory, staff competencies, customers’ contact, maintenance service). Firm image is also a source of differentiation using symbols, atmospheres or events. Porter chain value (1985) is a useful element to look for differentiators’ factors. Focus strategy concerns a particular market segment defined as a group of consumers or products. Having a single target allows firm to make use of either cost/differentiation leadership, or both simultaneously (Helpher et al., 2006). It is a niche strategy in which a new firm targets a group of buyers it considers underserved by generalist firms (firms with broad strategies). This new firm has the advantage of being ready to focus on a group of buyers less interesting to product generalist firms. This strategy is based on incumbent’s negligence or indifference or the fact that strategic or operational constraints prevent generalist firms from well serving some buyers or territories segments (Allaire and Firsiriotu 1993). Thus, Porter’s approach considers that strategy is based on firm environment adaptation that is important to all firms. This point of view has been criticized especially regarding to changing environments and the expansion of some emerging markets. The spread of competition had been deterring firm’s competitive advantages making them unable to defend their competitive positions.

Intent strategies

Hamel and Prahalad (1989) were the first researchers to show
limits of Porter's approach and to substitute a new based strategic intent philosophy. In the 1990s, this new way of thinking is built by focusing primarily on firm inside. Its watchwords are intention and movement. In this case, strategy aims permanently to transform competitive and business game (Métais and Saias, 2001). Firm performance is more a possession of strategic resources than careful positioning choice in particular attractive industries. Firm resources’ predominance and internal characteristics define a new way of strategy thinking that places firm as central in strategy formulation, which aim is to change environment game rules and create new competitive spaces.

Intent strategy principle is to build strategy, not by analyzing and reacting to environment, but rather, by creating new competitive opportunities through firm resource and specific skills analysis and exploitation. The emphasis is not on products and activities firm positioning, but on its organizational and human resources as well as their individual or collective know and know–how. This intent strategy philosophy is based on two assumptions: first is to follow a very ambitious long-term vision, and secondly, to expand basing on portfolio core competencies (Métais and Saias, 2001). These firms vision is to set excessive ambitions for the future compared to their current resources state (Hamel and Prahalad, 1994).

To achieve goals, each firm mobilizes unique resources and skills portfolio. Hence, intent strategies involve Resource based view and competence based view.

Resource based view (RBV) is a research theoretical stream structured around the concept of resources. It aims to accurately define resource notion and to understand the resource-competitive advantage link (Métais and Saias, 2001). For Schoemaker and Amit (1993: 35), resources are "the stock of available factors owned or controlled by a firm". Barney (1991: 101) suggests classifying firm's resources into three categories: Physical (technology, plant and equipment, geographical location and access to raw materials), Human (employees' training, experience, judgment, intelligence, relationships, and individual perspicacity) and organizational (structure, formal and informal planning, control and coordination systems) capital resources.

Resources have several characteristics: they are specific to a firm, complex, tacit and based on causal ambiguity. These characteristics make resources difficult to identify and imitate by competitors (Arrègle, 1995). Indeed, firm resources are characterized by imperfect mobility. In fact, more a resource is imperfectly mobile, more strategic it is because it is likely to lead to competitive advantage.

Competence based view considers firms as a set of skills that should not be limited to routines or resources and capabilities. In fact, resource allocation and organizational capacities are not sufficient to create competitive advantage. More specifically, it is through the interaction between knowledge and routines on the one hand, and technology assets and resources on the other hand, that competencies construct was developed. Competencies are based not only on information and knowledge, but also they must incorporate factors resulting from learning processes (know-how) and attitudes (know-being) (Durant, 2000). Quelin (1995) considers that in an organization, there are three levels of competence integration: a basic level, which includes competences related directly to firm operational activities (know-how production, etc. ... ), an intermediate level where specialized competencies are aggregated into functional skills (e.g. marketing), and a higher level, where competencies involving a wide intra- or inter-functional integration and competencies that affect the whole organization (coordination and decision processes). According to competence-based approach, developing strategy is not articulated around all competencies, but around only core competencies. Prahalad and Hamel (1990) defined core competence as collective learning of an organization, particularly, how to coordinate diverse production skills and integrate multiple streams of technologies.

3. Place of technological innovation in business strategies

Relationship between generic strategies and technological innovation

Kim and Choi’s (1994) study on relationship between "strategic types" and Korean SMEs performance, have distinguished sixteen competitive dimensions grouped into four broad strategies (cost efficiency, innovation differentiation, marketing differentiation, asset parsimony). D’Amboise (1993) showed that these concepts have allowed identifying Korean SMEs strategies. Based on Porter’s approaches, Campbell-Hunt (2000) proposed an analytical framework (instead of a normative model) to represent firm strategy. In this “dimensionalist” approach, constituent factors of the three Porter’s competitive strategies (Product originality in differentiation strategy, strict control of production processes in cost leadership strategy) are all “competitive dimensions” which describe firm strategic “design” (Campbell-Hunt, 2000).

In this perspective, Le Roy and Torres (2001) have proposed a set of associations between different “competitive dimensions” and the three Porter’s competitive strategies (Cost leadership, differentiation and focus) (See Table 2):

<table>
<thead>
<tr>
<th>Competitive strategies</th>
<th>Associated competitive dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost leadership strategy</td>
<td>Cost control, innovating production processes, investing in new equipment, reducing direct costs, minimizing indirect costs, economies of scale, full exploitation of production capacity.</td>
</tr>
<tr>
<td>Differentiation Strategy</td>
<td>Product Differentiation</td>
</tr>
<tr>
<td></td>
<td>Product originality, product quality, product innovation, product technology, customer service, R &amp; D.</td>
</tr>
<tr>
<td></td>
<td>Marketing differentiation</td>
</tr>
<tr>
<td></td>
<td>Sales force, advertising, promotion, sales promotion.</td>
</tr>
<tr>
<td>Focus strategy</td>
<td>Focusing on a segment, product specialization, unit margin rate</td>
</tr>
</tbody>
</table>

Accumulating experience allows firms to make product changes, eliminate redundant elements or manufacture with more economic components (Strategor, 1988). Furthermore, firms can gradually replace labor by other production means (capital / labor substitution) to improve manufacture process. Generic strategies-technological innovation relationship is also experienced in sector...
service firms’ that are sensitive to economies of scale, expert in learning effect and can make innovations so that they reduce costs (Détie and Ramanantsoa, 1983). Hence, technological progress have important role in generic strategies –technological innovation link allowing process and product innovations (Helfer et al., 2006; Mathé, 2001) and therefore, decreasing costs . Differentiation strategy may be the result of an innovation management system or product/process innovation. Therefore, this is our first proposition:

Proposition 1: Technological innovation is an adaptive response to environment that is:

a) Technological innovation involves cost leadership strategy
b) Technological innovation involves differentiation strategy
c) Technological innovation involves cost leadership strategy

2. Relationship between intent strategies and technological innovation

Using new resource combinations, resource based view enables firms expanding resources and innovating. In resource-based view, diagnosing consists in assessing firms’ resources to identify products obtained from existing resources, and seeking new ones that could be made from new combinations of existing resource or possibly by linking with additional resources. Penrose (1959) notes that resource combination as defined by firms generates “productive services” those are specific to each firm and source of firm heterogeneity. Highlighting new productive services can be source of new innovations. Resource combinations consist of either new service combination for new product manufacture or new processes to manufacture existing products, or new organization of administrative functions. Durand (2000) considers core competencies as competence recombination’s that allow firms to design, manufacture and distribute new and different products and services for customers in different markets. Karray (2003) and Kammoun (2004) studies’ conducted with French SMEs showed competences’ positive effect on technological innovation. Market-oriented competences enable firms to abandon adaptation defensive - reactive strategy when designing new products and changing towards proactive-aggressive strategy (Hermann et al., 2007). Thus, we can emit a second proposition:

Proposition 2: Technological innovation is resulting from strategic intent

III. Methodology

1. Cognitive mapping

Cognitive mapping is experiencing a growing interest in strategic management research which is increasingly recognizing the role of intuition, judgment, vision and importance of manager’s cognitive universe in business strategy development. Analysis of managers’ cognitive universe allows studying individual knowledge in terms of perception, interpretation, attention, memory and learning. Cognitive mapping method considers that individual cognitive structures are value’s systems and causal thoughts (Langfield-Smith and Lewis, 1989). This method was developed in strategic management field by Eden et al. (1979). It helps developing cognitive maps (Eden et al., 1983) which are modeling of thoughts considered as factor’s networks and guidelines relationships between these factors. Cognitive maps are figures, images, graphic representations of statements or speeches. They can be distinguished from other map types such as strategic maps (study of organizational structures), composite maps (resulting of individual map’s set accumulation) and collective maps (social representations relating to individuals).

2. Sample and data collection

Our sample is composed of six industrial sector managers. We choose industrial sector in which firms are, more than in other economy sectors’, led to innovate to meet globalization context competitiveness requirements. Furthermore, these firms are succeeding both on national and international markets. Respondents were managers or CEO’s committee member involved in strategy formulation. In fact, managers especially in SMEs are strongly influencing conduct of business and are considered as the main actors who choose strategy, initiate and implement innovations. Analyses of manager’s cognitive representations tell us about the place they give to technological innovation. Thus cognitive mapping is very useful in this case.

We used a sample of managers who has agreed in advance to participate in our research; consequently, we employed open-in depth interview method. For this purpose, we simply asked managers the following question: “What is your business strategy”? Such question helps managers to freely and spontaneously express their business competitive environment perceptions and allows us to explore how they develop their business strategy. In addition, open-in depth interview is a well-accepted by managers; it allows obtaining concepts and relationships that are important for managers. In addition, it is widely used by researchers analyzing manager’s cognitive maps (Hackner 1991; Cossette, 2003).

3. Construing cognitive maps

To draw cognitive maps, we used “Decision Explorer” software that helps to organize and analyze qualitative information. Information may be simple and straightforward ideas that require further exploration and examination, or complex ones and concerns events to be structured and analyzed to manage complexity. In both cases, “Decision Explorer” software “provides a framework that “facilitates” decision making. “Decision Explorer” maps are made from short phrases (concepts) whose relationships are indicated by links between these concepts. Concepts and relationships are introduced by the software user; they can be moved, edited, given different views and styles, assigned to groups and we can analyze the whole model. To develop cognitive maps, we followed three phases: Firstly, we analyzed interviews transcripts according to two analytical dimensions which are the concepts describing the firm strategy and innovation and the links between these concepts. Then, we evaluated the importance of each concept for the manager interviewed by relying on four evaluation criteria (Calori et al., 1994). Finally, a map was drawn for each manager explaining business strategy and firm technological innovation type (See figure 1):

According to Jodelet (1989), a social representation is “a form of knowledge socially developed and shared, and which has a practical purpose and competing to build a social group a common reality” (p.36).
VI. Results And Discussion

1. Identifying concepts according to importance degree criterion
We started our research methodology by investigating manager’s perceptions of their business strategies and technological innovation. For this, we analyzed each manager’s cognitive map concepts and we classified the most important concepts in manager’s discourse.

To evaluate each concept importance for managers interviewed, we used four evaluation criteria (Calori et al., 1994) which are: (1) manager’s explicit mention of importance concept, (2) manager’s response spontaneity, (3) manager’s time priority to concept, that is to say, priority given to each subject in the interview and focus on a particular theme, etc. and (4) length of topic discussion. Each concept importance is noted on each map using asterisks: four asterisks mean that the concept meets the four criteria. Otherwise, we use the concepts that have at least one of the four asterisks.

To minimize researcher’s explicit raises biases, concepts that are mentioned after a researcher’s raise (therefore not spontaneous) are not used, except those which meet at least one criterion for the remaining three ones (mention of importance concept, concept’s priority and interview length on the concept subject)(Calori and Sarnin, 1993). Thus, many ideas were generated that figured as prominently in manager’s cognitive world, involving business strategy and firm technological innovation.

Cognitive maps analysis was done using a theoretical framework as presented above (first part of the article). Results is summarized in table 3:

Table. 3 : Managers’ concepts strategy, relative importance and : correspondent strategy type

<table>
<thead>
<tr>
<th>Firms</th>
<th>Concepts related to strategy</th>
<th>Concept relative importance</th>
<th>Correspondent Strategy type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Firm costs and expenses</td>
<td>****</td>
<td>Cost leadership strategy</td>
</tr>
<tr>
<td></td>
<td>Automation equipment</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production capacity</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retain customers and keep the leading position</td>
<td>****</td>
<td>Differentiation strategy</td>
</tr>
<tr>
<td></td>
<td>Technological know-how</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Differentiation strategy</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price adjustments</td>
<td>****</td>
<td>Cost leadership strategy</td>
</tr>
<tr>
<td>B</td>
<td>Actions on raw material and labor costs</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge acquisition (Technical, industrial, artistic)</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Developing human capacities</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time, personnel, manufacturing economies</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improving product line</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>To be the best compared to competitors</td>
<td>****</td>
<td>Intent strategy</td>
</tr>
<tr>
<td></td>
<td>Being present with the best services</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Predicting the future</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Raw material costs</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Product price</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Take advantage of market opportunities</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>competent staff</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Focusing on a customer niche</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Creating a Research &amp; Development laboratory</td>
<td>****</td>
<td>Intent strategy</td>
</tr>
<tr>
<td></td>
<td>Adopting an innovative mind</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manager’s long Term Vision</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To have a good command of technical issues</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Raw material verified and certified by Technology Centers</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To have significant financial capacity</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>To offer a good price-quality ratio of products</td>
<td>****</td>
<td>Cost leadership strategy</td>
</tr>
<tr>
<td></td>
<td>To make investments</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To make economies of scale</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To insure a good profitability</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production capacity of the firm</td>
<td>****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To accumulate experience</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To have tools and equipment</td>
<td>**</td>
<td></td>
</tr>
</tbody>
</table>
Analyzing cognitive maps concept’s according to their relative importance shows three strategy types: cost leadership strategy (three out of six firms) which was the most dominant and adopted by firms A, B and E. These firms’ purpose is to minimize costs to lower prices and also to be competitive. The second strategy is Porter’s differentiation strategy that allows firms to provide different products to stand out from competition (Firm F). Cost leadership and differentiation strategies are not mutually exclusive; a firm can differentiate while keeping the objective of reducing costs for competitive prices. This is what we found in firm A. Therefore, we can say that firms A, B, E and F follow an adaptation strategy (cost leadership and/or differentiation) through which they seek to maintain their market position. Thirdly, intent strategy was founded with firms C and D; with which we discovered totally different concepts such as long-term vision, taking advantage of opportunities, predict future, innovation, etc. These concepts describe business strategy based on strategic intent that mobilizes firm resources and capabilities. Managers in these firms anticipate their environment changes; they are proactive and take advantage of each market opportunity. They make future predictions and try to change or direct their customer’s needs. Similarly, we identified concepts that describe firm’s technological innovation and their relative importance so that we determined firm’s technological innovation type (Product innovation or Process innovation) (See Table 4):

Table 4: Relative importance of concepts related to technological innovation

<table>
<thead>
<tr>
<th>Firms</th>
<th>Concepts related to technological innovation</th>
<th>Concepts relative importance</th>
<th>Type of technological innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To differentiate relative to competitors</td>
<td>****</td>
<td>Differentiation strategy</td>
</tr>
<tr>
<td>F</td>
<td>Developing a business strategy based on product quality</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Concentrating all efforts on product quality</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fluidity of information flow (information management)</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manpower quality</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Product line extension efforts</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>(*) Asterisks’ number indicates criteria number’s for each concept to describe its importance for a manager</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To differentiate relative to competitors
Developing a business strategy based on product quality
Concentrating all efforts on product quality
Fluidity of information flow (information management)
Manpower quality
Product line extension efforts

Firms Concepts related to technological innovation Concepts relative importance Type of technological innovation

A
New Product introduction
Extend the range of firm products by diversification
Retain customers and keep the leading position
Threat of Product’ imitation

B
Innovate and renovate
Using new manufacturing methods
Imagination and creativity rather than copying and imitating
Enter the ISO quality system
Business competitiveness and reputation
Improving the delivery program

C
Being present with new services
Improve business organization
Creation of appropriate activities
Firm adaptability with unforeseen situations
Laboratories of Research & Development
To be the best compared to competitors
To seek competent staff

D
Product innovation
Research & Development Laboratory
Local adaptations of imported raw materials
Adopting an innovation
New product development
Find technical solutions to customers
Adaptation to local customer demands
Having a wide range of products

E
To have new tools and equipment
Complementing and extending the range of products
Having learning mind and being opened mind manager
Research & Development requirements
Making differences on the international market
Recruiting personnel

Differentiation strategy

Product innovation

Process innovation

Process innovation

Product innovation &
Process innovation

Process innovation
From the table above, it appears many differences in manager’s perception of their competitive environment. These differences form two homogeneous groups of concepts; each one reflects a particular conception of technological innovation. The first technological innovation design is represented by firms B, C and E. These firms make process innovations that are either manufacturing or marketing processes. Firms A and F are firms that make product innovations to meet customer requirements. In addition, firm D has adopted the two types of innovation (product and process innovation). Firm D is adapting imported raw material to Tunisian customers’ requirements and introduce new products. It continuously renews production processes to whenever use new inputs. This joins Loilier and Tellier (1999) statements’ that a firm begins with product innovations, and then it goes through a transition phase during which it multiplies its production processes improvements to reduce costs.

2. Exploring the place of technological innovation in business strategy

Having identified and described strategies used by managers on the one hand and technological innovation they have made on the other hand, we will determine the relationship between business strategy and technological innovation concepts, then we will- through manager’s strategies representations- explore technological innovation place in their business strategy. Indeed, we assumed three types of relationships between concepts: (close ties -----), equivalence links (----- = ----- or ---- ≠ -----) and causality links (-----+→ or ---- -→ ).The following table summarizes technology-innovation strategy links and associated advantages (Table 5):

<table>
<thead>
<tr>
<th>Firms</th>
<th>Strategies</th>
<th>Type of innovation</th>
<th>Competitive advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Cost leadership strategy</td>
<td>Product innovation</td>
<td>Market share, product quality allowing to avoid product imitation threats, expanding product range</td>
</tr>
<tr>
<td>B</td>
<td>Process innovation</td>
<td>Gaining customer trust, firm reputation, improving the range of products, lower prices</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Process innovation</td>
<td>Offering a product with an adequate price, to have tools and equipment to increase production capacity, economies of scale</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Differentiation strategy</td>
<td>Product innovation</td>
<td>Corporate image and reputation, to offer a product different from competitors one</td>
</tr>
<tr>
<td>C</td>
<td>Process innovation</td>
<td>To make advantage of opportunities, to avoid competition based on copying and imitation</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Product innovation</td>
<td>To put up barriers to new competitors entry, to have a complete range of products, to have a good corporate image, responding immediately and quickly to customer requirements</td>
<td></td>
</tr>
</tbody>
</table>

Results show that technological innovation is introduced in both generic strategies (as a means of adaptation) and strategic intent. Indeed, firms innovate to improve its competitiveness. Some firms make process innovations (Firms B and E) to reduce costs, have competitive prices or improve their product quality to be conformed to some standards and this is through cost leadership strategy. Other firms (Firms A and F) have introduced new products to expand their product range, gain market share and diversify. However, with regards to growing competition especially of new countries such as China, the cost leadership strategy is quickly proving as insufficient strategy. This explains the growing use of differentiation strategies such as product innovations which allow firms to make products that do not exist on the market and to stand out from competition. Innovation is part of firm adaptation to changing and diversifying customer’s tastes and preferences. Particularly, product innovation is part within differentiation strategy. Both business groups advocate that product or process innovation are integrated into business strategy due to the competitive advantage opportunities they provide, but also, to improve sector firm positioning and exceed competition. A third category of firms (firms C and D) which voluntarily have based their strategies on innovation and creativity mind. Their manager’s vision is to have an innovative firm either in terms of products placed on market or in terms of manufacturing and marketing internal processes. This managers’ vision reflects their ambitions and creates enthusiasm among them and alters the firm-
staff relationship (managers of firm C).
Through managers’ cognitive maps analysis, we observe that results converge to the idea that managers innovate only to adapt to customer requirements and keep their competitive positions. Our first proposition states that technological innovation is an adaptive response to environment through cost leadership and/or differentiation strategy. Thus, our first proposition is confirmed. The second proposition is also confirmed since we found that technological innovation is the result of strategic intent.

V. Conclusions
Recently, strategic thinking background is related to the so called “traditional” conceptions based on adapting and finding adequate product-market positioning, but also to conceptions based on resources and competencies mobilization to operate in business market.
Our objective was to explore—in Tunisian industrial sector—the place of technological innovation in business managers’ strategies.
To this end, we used qualitative study based on cognitive mapping. Our research results showed that firms innovate to improve their market competitiveness. Technological innovation is much more integrated into the framework of cost leadership and differentiation generic strategies than into strategic intent one. For managers cost and quality competitive advantages are very important, they aim to satisfy their customer’s needs at the expense of making new products or processes that might disrupt customers’ habits. Even, technological innovation is integrated into intention strategy context, aims to make advantage of arising opportunities and especially, to adapt products or imported materials to Tunisian context without having a real technological innovation strategy. A shift from a strategic logic defined in terms of “product–market” to a strategic logic defined in terms of intentions, resource and competencies mobilization remains elusive for Tunisian industrial sector firms.
The present research has methodological contributions related to using a qualitative approach based on cognitive mapping method. Empirically, we have explicitly shown to managers the insufficiency of integrating technological innovation in their business strategy, in that; this one was based on adaptation and not on intentions to change customers’ needs and markets. This will encourage managers to take advantage of the opening horizon of development brought by technological innovation. Nevertheless, a principal research limitation has to be noted, related to the firms’ number. Hence, we suggest new research perspectives since it would be particularly interesting to complete it with a comparative analysis of a larger sample of firms.

References


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