Analysis of the Human ware Innovative Capacities of the Food Industry SMEs in the Manufacturing Sector

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Abstract

The contribution of small and medium enterprises of the food industry in the manufacturing sector to the GDP of Mexico is rather considerable, yet they face enormous tasks trying to stay in the market and gain a competitive advantage. For this reason, the authors have tried to develop a comprehensive model, based on previous proposals made by several authors, to allow measurement of innovative capabilities existing in the human ware employed by these companies. The obtained results by applying a Likert scale instrument to companies located in Tehuacan and Torreon show that one of the main aspects is achievement orientation. Additionally, we demonstrate that creativity, ability to take risks, absorptive capacity and strategy, are at a minimum acceptable level, indicating the strong need to elaborate training programs to enable the development of these critical capabilities to truly inspire and boost innovative power

Keywords: Human ware, innovation, technology, SMEs, Manufacturing Sector.

1. Introduction

Small and medium enterprises (SMEs) represent a large majority in the business universe around the world (Padilla, 2008); thus, they are regarded one of the main driving forces of the economy (Philip, 2011); in Mexico indeed, they are the backbone of the national economy. For a company to be considered as an SME, if it belongs in the industrial sector it should have less than 250 workers, while those in the commercial and service sector, it must not exceed 100 workers in the pay role. These businesses represent 99.8% of economic units in the Mexican economy, generating nearly 72% of jobs for the economically active population and contributing 52% of gross domestic product (GDP) (Aguilar and Martinez, 2013).

Regardless of the country, SMEs face serious problems to survive or to obtain a competitive advantage (Khalique et al., 2011). Failure numbers among SMEs are alarming, to say the least; in the case of Mexico, 75% of all new businesses are forced to shut down after only two years of activity; in Argentina 93% do not make it through a second year and 97% disappear before the fifth; in Spain 80% of companies go bankrupt during the first five years; in the United States the average life of companies is six years and more than 30% do not reach a third year; among Chilean SMEs, 25% disappear in the first year and 66% ceased operations during the first four years (Velázquez and Reyna, 2009).

Philip (2011) has proposed that the most key factors influencing success of SMEs include management and *know-how*, the way they do business and cooperation, and the external environment. Khalique et al. (2011) believe that the challenges SMEs must overcome include recession, global supply barrier, low productivity, lack of management skills, lack of funding and access to management and technology; furthermore, he goes on to recognize intellectual capital as a key factor for a successful organization.

According to Ropega (2011), the main problems affecting SME´s include lack of a business plan (21.7%), lack of staff training (20.4%) in the human resources area, and inappropriate quality products or services (34.5%) in technology and innovation. Dong (2010), has pointed out that SMEs cannot develop without technological innovation, underlining the importance of innovation to improve competitiveness in the development of new products and the second innovation. Innovation not only from the technological point of view, but integrating cultural innovation, management innovation and technological innovation, including technology imports, imitation innovation and independent innovation cooperation (Dong, 2010).

Hsuand Sabherwal (2011) suggest that whether the focus is on knowledge or knowledge management capabilities within the company, the effects on performance of the firm will occur through improvements in innovation, emphasizing the fact that the ability of an organization to innovate is closely linked to its intellectual capital or its ability to use knowledge resources. One of the main factors certainly lie within the human element: *human ware,* defined by Sharif (2012) as the art of performing specific tasks in the context of a technological system (skills, talents, ingenuity, creativity, skills, crafts, among others). Human ware is whatever people do at work with the help of technological tools, applying their skills and individual experiences; it invariably includes all tacit knowledge and *know-how,* human labor, ideas, unique skills, creative problem solving and the ability of people for decision-making at work.

Here we describe the capabilities needed by SMEs in the food industry to innovate, from the point of view of the human factor. We present a training model which aims to increase innovative capabilities of human ware in these companies. This tool should allow them to identify the most important skills to be developed, characterize the level they are at, and intervene with the required training to increase innovation capabilities. Economic indicators considered were published in February of 2015 by the National Institute of Statistics and Geography (INEGI 2015). These indicate that over the third quarter of 2014, of the 17.5% (2,939,031 million pesos) contribution from companies in the manufacturing sector to the Gross Domestic Product (GDP) of Mexico, the contribution by the food industry amounts to over 23% (684.794 million pesos).

We also review the state of the art with respect to the elements that define innovation in SMEs, as well as approaches and models of the relationship between human ware and innovation in SMEs; then follows the description of the methodology to carry out the training model and finally, in the last section we attempt some conclusions.

2. Background

Here we wish to bring to attention some of the most influential studies by academics and practitioners who, in recognizing the importance of human ware in generating innovation have hence addressed innovative approaches and models aimed at promoting innovation in manufacturing firms.

Ortiz (2006) describes a management model of technological innovation from the perspective of strategic planning in engineering and technology, applied to the case of small and medium enterprises and adapted to the characteristics of these companies in developing countries validated on Venezuelan manufacturing sector. The model considers the internal aspects that are involved in the innovation process from the perspective of the balanced scorecard. The model focuses on innovative strategy at the operational level-an important part of an overall innovation strategy of the company- to acquire competitiveness. The strategy is to achieve high operational efficiency from investments in processes and human resources. Model design addresses four fundamental perspectives of WCC, putting innovative human resource capacity on the perspective of learning and growth; it identifies relationships between staff training and innovation and establishes a few general guidelines to operate it.

Pittino and Visintin (2009) partially constructed and validated a typology of strategic innovation by applying the model of four postures after Miles and Snow: defender, explorer, analyzer, and reactive. In each case, behavior in product, process, model and business strategy innovation are studied, as well as innovation sources, among which these authors list technical skills shown by employees and external collaborators, although their approach does not deal with how these skills ought to be encouraged.

Coronaet al. (2009) has proposed a model of innovation for SMEs identifying various elements and the role each plays: *Market* and *society* together create needs that SMEs should attend to by means of their *systems for technological innovation. Intellectual capital* refers to the knowledge SMEs have available in their staff.

Science and technology represent the use of scientific knowledge and the use of technological resources to develop new products in collaboration with public and private *research centers* including both, universities and non-government organizations, as well as private institutions. *Economic resources* are the sum of the company's own assets and those at hand from organizations dedicated to funding of *technological innovation*. *Management* is responsible for managing and directing the interrelationship of subsystems. *Environment* is the ambient framework organizations operate in. Finally, *organizational development* is the structure of the organization, both internally and externally. These authors identify the actors and the way they interact among themselves attempting to promote innovation in Mexican SMEs; they quite rightly regard intellectual capital (human ware) as a fundamental pillar of innovation capacity, but fail to come up with a strategy to boost development or reinforcement of the skills involved.

Mejia et al. (2010) have proposed a training strategy oriented toward technological innovation, whose main reference are leading companies in the textile-apparel-design and fashion cluster in Medellin, Colombia. They propose a model of competency-based training in four steps and in four fields. This proposal indicates that, in order to perform step 2 of the training series, its contents should include the challenge posed by technological change to human talent, management of technological innovation processes, technology planning matrix and other such topics. However, the authors provide no indication of how to proceed to incorporate these additions. Another drawback is that the model is limited to the garment industry. Antonioli et al. (2010) suggest several hypotheses on productivity, innovation strategies and industrial relations in SMEs in northern Italy. They speculate that the more cooperative industrial relations climate in a firm, the greater the intensity of innovation; they include technological and organizational components, information and communication technologies, and staff training.

Rosdi and Kok (2010) have proposed a conceptual framework to unveil how strategies of staff management in a company affect organizational learning and the ability of the company to manage knowledge. Their approach effectively grasps how the capacity for knowledge management by the company correlates highly and positively with intellectual capital, which in turn has a positive impact on its ability to innovate.

Since intellectual capital (IC) is an important source of sustained competitive advantage, and since it significantly affects the financial performance and innovation, Hsu and Sabherwal (2011) have constructed the following model: IC → Capacity KM (management of company knowledge) → innovation → robust performance. IC consists in social capital, organizational capital and human capital; this last component has a direct effect on innovation, while social and organizational capital only affect innovation through the two KM capabilities, capacity improvement, which develops and refines knowledge, and capacity utilizationi.e., application of knowledge. They conclude that, despite advances in information technology and knowledge management processes, draft and retention of worthy staff members, remains key to innovation.

Lopez et al. (2012) studied the factors that a company needs to innovate, according to the theory of resources and capabilities. They argue that innovation capacity is a key capability of learning, and the proposed model builds on the activities of Research and Development (R & D) and innovative experience. In their view, a combination of R & D and innovative experience promote a virtuous cycle of learning and innovation capacity which constitute the dynamic skills that a company possess for the generation of new knowledge that may translate into new products and/or processes. In turn, the adoption of advanced technologies in the production area serves to support the innovation process.

Zhixiong and Yuanjian (2010) diagnosed that knowledge is the key factor to maintain continuous innovation of business in China. They suggest absorption capacity is a set of skills and knowledge the company must put in use to absorb, transform and take advantage of external knowledge. As for knowledge absorption capacity, communication and mutual understanding is crucial, so that the structure of the internal organization, cognitive, cultural barriers and other aspects have a profound influence. They described the process of knowledge absorption capacity as a series of four stages: 1) Acquisition,i.e., the ability to identify and judge the knowledge, 2) Absorption, i.e., understanding and interpretation of knowledge, 3) Transformation, i.e., effective integration of knowledge and, 4) Utilization, i.e., new knowledge is developed. Dutse (2013) measured absorption capacity of firms as a percentage of net profits invested in various technological activities such as R & D, design innovation, the acquisition of licensed technologies, staff training, development activities and employment skills. His analysis found that the intensity of investment to develop absorption capacity has a significant impact on innovative capacities of manufacturing companies in the Nigeria Turing sector.

A study in Indonesia by Inrawan et al. (2014) approached human ware training for the transfer of technology by measuring six selected variables: creativity, achievement orientation, ability to take risks, teamwork, efficiency and strategy.

Despite all research conducted to understand and promote innovation in SMEs, so far this remains an open question, since efforts have addressed separately the same areas of opportunity. In our work, we attempt to integrate these models aiming to contribute to the generation of innovation in SMEs. We have designed a training model to develop innovative capabilities of human ware in SMEs in the manufacturing sector.

3. Methodology

The methodology includes the process of validating the training model proposed (Figure 1). As can be seen, we have initially used the capacities defined by Inrawan et al. (2014), Yuanjian Zhixiong (2010), and Dutse (2013); we divided these capacities into the various elements shown. A two-step process was set up to perform the validation of the model, the first of which was to validate an instrument for the diagnosis of the training needs of the company; the second step served validation of observed increase in the capacity for innovation in SMEs studied.

The instrument validated during the first stage of the study was adapted after Inrawan et al. (2014) for application to the process of ratification –correction, and weighting innovative capacities in SMEs in the manufacturing sector. The validity of the instrument tested using the Delphi method, using five experts. The Delphi method is pioneering in developing prospective studies and is highly prized as a method for structuring group communication processes which allows individuals to address a complex problem based on the opinion of a panel of experts on a specific topic (Silvaet al., 2014). Weighting was achieved by the paired comparison method.

The instrument consists of two items for each indicator to measure reliability via split halves method, under which items were split into two equal halves whose scores were compared (Hernández, Fernández and Baptista, 2010); this instrument was applied on two employees of an organization, and the correlation between the two items in the A half and the B half was 1 (0.62), in both cases a strong correlation is observed. A five-category Likert scale was used to determine the value assigned to each item to quantify the level of development among employees with respect to each of the capabilities. A pilot questionnaire served debugging and tuning of the test where required.

The product of the first stage provided the capabilities identified by experts as needed for innovation in manufacturing companies, as well as a diagnosis of the current situation in each company.

For the second stage, a sample of eight SMEs in the food manufacturing industry was selected to which the instrument was applied to diagnose their innovative capabilities. Companies that obtained a higher than a threshold score were excluded; among the rest, five firms were selected randomly to form a control group, while the rest started a training program focused on the needs identified. Six months after, the instrument was used again to assess level of improvement in contrast to the control group to rule out possible interference by other elements.

4. Results

Data collection process was applied to workers in eight manufacture SMEs of the Food Industry, considering they comprehend innovative capabilities related processes. The sample selection was made randomly; data was obtained through a validated questionnaire. The criteria for determining the level of capacity human ware were as follows (Inrawan et al., 2014).

1. Weak capacity: ≤ 1.98 level <2.98

2. Minimum acceptable capacity: ≤ 2.98 level <3.85

3. Good capacity: ≤ 3.85 level <4.48

4. Outstanding capacity: ≤ 4.48 level <5.00

Results of workers' innovative capability (Table 1) showed team work and efficiency at an adequate level, (≤ 3.85 3.95<4.48 and≤ 3.85 4.12 <4.48, respectively); thus, these capabilities may be further enhanced and exploited by the SMEs. However, the results also showed that creativity, achievement orientation, ability to take risks, absorptive capacity and strategy, are at a minimal acceptable level, indicating the need for an intense training program to develop these skills, so that human ware may become a key factor in generating innovation.

5. Conclusions

A model for developing innovative capacity in the human ware of SMEs in the manufacture sector of the food industry should contribute to generate innovation within the organization,

The capacity for innovation is a key asset in SMEs, composed of staff skills oriented toward innovation, enterprise technology and processes that foster innovation. This capability allows SMEs to be more competitive (Roadsteads & Bozic, 2009), as their small size gives more flexibility to seek new markets or to meet specific market needs through new products or processes. Innovations generated are supported by the company infrastructure, processes, systems, databases and patents. Regarding to innovation in a company, one refers to innovative capabilities in Human ware; thus, it is necessary to measure the level at which these are present to enhance or develop them to full extent. Empirical studies have demonstrated that innovative capabilities in employees do affect the level of innovation in enterprises. Dong (2010), for one believes that SMEs cannot develop without technological innovation.

The model proposed here to detect the training needs to increase innovation capacity of human ware of the SMEs involved in this study allowed to identify the level at which these are found, the following results are worth highlighting:

a) The ability to risk, creativity, achievement orientation, absorption and strategy are at an acceptable minimum level.
b) The ability for teamwork and efficiency are at an appropriate level.
c) None of the capacities that integrate the innovative capacity is at an outstanding level.

Given the above, we conclude that the companies studied should strengthen teamwork capacity, for which building relationships, empathy, ethics and integrity, as well as the pursue of high efficiency standards, will demand from management a permanent commitment to quality, clarity in the task, performance and adequate administration of resources. These companies should also benefit from an effort to develop the creativity, the orientation to the achievement, to take risks and a strategy to increase innovative capacity.

We conclude that SMEs in the manufacture sector of the Food Industry in México should establish training programs which allow their employees to increase their innovative capabilities to have greater potential for innovation and help the firm meet market demands.

Fostering the development of SMEs should be a priority, considering how important they are in globalization because they are distinguished by their productive flexibility, their high potential for job creation, their adaptation to market changes and their outstanding ability to reconvert strategies (Pavón, 2010). Furthermore, as pointed by Siu, Nieto and Santamaría (cited by López et al., 2016), the growth of the economy in most countries is due, to a high degree, to innovation realized by SMEs, which has a great positive effect on the growth of these companies.

This model can be applied to a specific area of the company or to the entire organization to detect the levels at which its capabilities are found and to determine the training required to improve the capacity for innovation.

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Tables and Figures

Figure 1

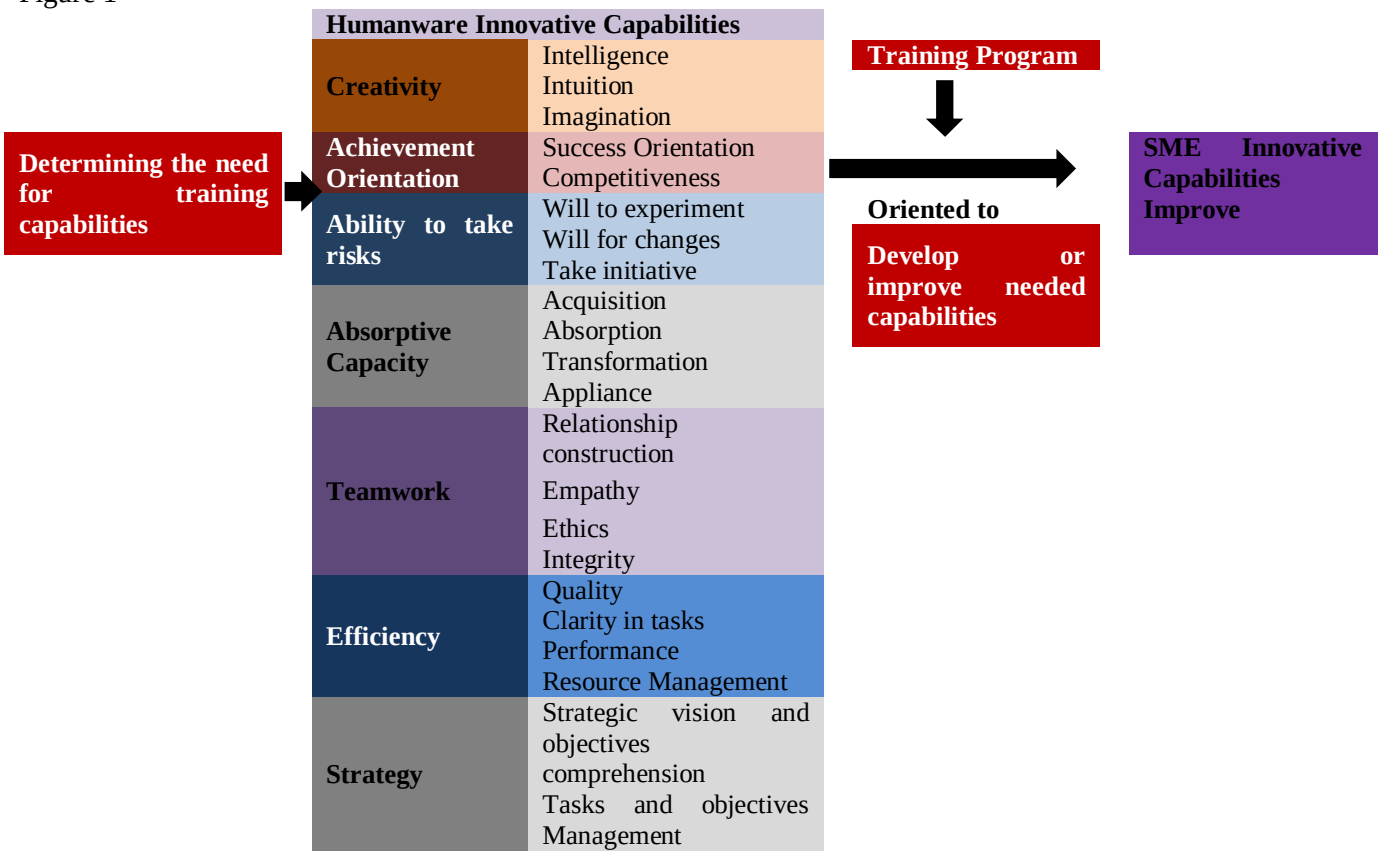

Figure 1: Training model for improving Human ware innovative capabilities in SMEs of the manufacture sector of the Food Industry. Source: Elaborated by authors.

Table 1: Measurement of Human ware innovative capability in SMES in the manufacturing sector of the Food Industry

Innovative Capability	Items	Results	Levels (1-5)
Creativity	1. Intelligence	3.98	3.79
	2. Intuition	3.57	
	3. Imagination	3.82	
Achievement Orientation	4. Success Orientation	3.19	3.38
	5. Competitiveness	3.56	
Ability to take risks	6. Will to experiment	4.15	3.78
	7. Will for changes	3.68	
	8. Take initiative	3.51	
Absorptive Capacity	9. Acquisition	3.74	3.80
	10. Absorption	4.04	
	11. Transformation	3.65	
	12. Appliance	3.77	
Teamwork	13. Relationship construction	4.12	3.95
	14. Empathy	3.87	
	15. Ethics	3.95	
	16. Integrity	3.85	
Efficiency	17. Quality	4.44	4.12
	18. Clarity in tasks	4.36	
	19. Performance	3.85	
	20. Resource Management	3.83	
Strategy	21. Vision comprehension	3.84	3.84
	22. Strategic objectives comprehension	3.90	
	23. Tasks management	3.86	
	24. objectives management	3.75	

Source: Elaborated by authors.