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MANAGEMENT OF INNOVATION, PERFORMANCE AND ADDED VALUE: A CASE STUDY IN THE AGROBUSINESS CHAIN

Buttenbender P. L.; Zamberlan L.; Sparemberger A.; Wagner A.

UNIJUI – Universidade do Noroeste do Estado do RS – Brazil.

Departamento de Estudios de Administración.

RS 344 - 39 Km – Cx.P: 489 98,900-000 - Santa Rosa – RS – Brazil.

Email: pedrolb@unijui.edu.br

"Visión de Futuro" Año 6, Nº2, volumen Nº12, Julio- Diciembre 2009

SUMMARY

This paper describes the innovation management and the added value through the study carried out in a metal-mechanics, manufacturing agricultural machines, member of the agro businesses chain. In the first stage, there was a diagnosis and an analysis of the learning processes and the trajectories of the accumulation of technological competences, based on existing analytical structures in literature, adapted to this type of industry. The technological competences were studied in the functions of the processes and organization of the production, products and equipment. In the second stage, the impact of the accumulation of competences in the performance of production of the industry is studied, evaluating: the final conformity of the product; performance of the components of the final product; monthly and annual execution planning; work productivity; time and resources motivated by the product delivery outside the terms; security in the information and rotation of stocks; loss due to obsolescence of the components; and implementation of the manufacturing program. The results suggest that innovation

management, acquisition and socialization of new knowledge and accumulation of technological competences, play an important role and influence positively on the improvement of the production performance.

KEY WORDS: innovation management, performance, added value, mechanical-metal, agro businesses.

INTRODUCTION

"Visión de Futuro" Año 6, Nº2, volumen Nº12, Julio- Diciembre 2009

The advances and the technological transformation have forced the enterprises to look for alternatives of improvement of their technological competences and the competition in increase. In order to face the leaders, on one hand, they pay an increasing attention to the innovating strategies. On the other hand, the researchers have looked for a better understanding about the role of the learning processes and the accumulation of technological competences and their implication in the technological development

In the last decade, the studies of the corporative strategies reaffirmed the roles of the internal and external resources to the enterprises and the role of the technological competences as source of innovation and competitive advantage as affirmed by Hamel and Prahalad (1990), Teece & Pisano (1994), Pavitt (1991) and Pisano (1994). These studies were different from the conventional perspective that searched to explain the competitive advantages of the enterprises by its capacity of positioning with respect to certain forces of the external atmosphere, as Porter writes (1999). Many studies in the 90s, like Nonaka and Takeuchi (1997), Leonard –Barton (1998), Lansiti (1998), emphasized the importance of the acquisition and diffusion of knowledge as a strategy so that the enterprises create and maintain their technological competences, and compete in markets at world-wide level. While, the empirical studies, based on analytical struc

tures are recent which explore the learning processes and the implications for the accumulation of technological competences, mainly in the context of the enterprises on the way to industrialization. One adds to these studies the implications in the improvement of the technological performance. To be centered in enterprises on the way to industrialization, the approach of the analysis of this work differs from most of the previous studies about knowledge and technological competences in industrial enterprises. In them innovating the technological competences already exist. Enterprises on the way to industrialization, nevertheless, enter a branch of businesses with base in technology that they acquired from other enterprises, or other units of the same enterprise, in other countries. Therefore, in their initial stage, the basic technological competences for the innovation are limited. In order to become competitive and to become the enterprises of advanced technology, these need, in the first place, to acquire knowledge to create and to accumulate its own technological qualification. In the end, to evaluate and to describe, the implications as the accumulation of technological competences, in the improvement of technological performance.

The expression, technological learning is, in general, understood in two alternative ways. The first, the trajectory, or way throughout which, it follows the accumulation of technological qualification. The trajectory can vary through time: the technological qualification can be accumulated in different directions and speeds. The second one, talks about the diverse processes by which the individuals acquire knowledge and it is transformed for the organizational level. In other words, the processes, by which individual learning, becomes organizational learning. In this paper learning is approached according to what mentioned in the second direction.

In recent studies, Figueiredo (2001 and 2003) develops and applies structures and analytical models to study the learning processes and their influence in the accumulation of technological competences. In them, he also approaches the influence and differences between enterprises in terms of improvement of the performance. In recent studies, these models were adap

ted by enterprises of paper pulp and paper, mechanical-metals, furniture, and others, like for example, Buttenbender (2001), Tacla (2002), Ben (2001), Marin (2001), Denicol's (2001) studies. Although these studies, do not analyze in detail the implications of the accumulation of technological competences for the improvement of the technological performance. These limitations are also expressed by Loures & Figueiredo (2006), when they offer a critical reflection about the measure of technological capacity, particularly in the context of recent industrialization.

The present study searches, in an innovating and differentiated way to relate the learning processes and the accumulation of technological competences to the improvement of the technical and economic performance. This improvement in the performance, mainly as a result of the investments in the learning processes and the accumulation of technological competences in the mechanical-metal manufacturing industry of agricultural machines, making it possible, inclusively, to future comparative studies.

Basing the study on an individual case, this article focuses in the learning processes, the accumulation of technological competences and the implications in the improvement of the technological performance at enterprise level. The indicators of production performance used in the study are: quality and final conformity of the global product; total performance of the components of the final product; planning and monthly and annual execution, delivery performance; work productivity; time and resources motivated by the product delivery outside of supply PPM; security and trustworthiness of the information of stock; inventory turns; supply and obsoleted /per unit); and implementation of the program lean manufacturing.

This report is analyzed in a mechanical-metal industry, manufacturing machinery and agricultural equipment, in the chronological trajectory, involving two periods. The first, studying the learning processes and the trajectories of accumulation of technological competences, that includes the period from 1970 to 2000. The second, studies the implications in the technological performance initially focusing on the period from 2000 to 2006. In section two there appears a

brief revision referring the conceptual references and of previous studies. In section three methodologies are detailed. In section four, the description of the accumulation of technological competences, and the learning processes, including the period from 1970 to 2000. In section five the implications for the technological performance are treated, during period 2000 to 2004. At the end of the paper, figure the final considerations and the bibliographical references.

DEVELOPMENT

1. Conceptual references and previous studies

The first studies on the accumulation of technological competences appeared in the 70s, they were led by Katz (1986 and 2005), Dahlman and Fonseca (1978), Lall (1987), Bell, Scott-Kemmis and Satyarakwit (1982), showed not only the incidence of the innovating activities in the enterprises on the way to industrialization, but also the importance of certain mechanisms of learning for the development of technological competences. Although, these were limited to describe, a trajectory of the accumulation of technological competences, within the enterprise without a systematic examination, of the role of the different learning processes in the accumulation trajectory.

During the 80s one verified an enormous shortage of studies of accumulation of technological competences and learning processes. Only as from the mid 90s, there began to arise new studies on these matters. For example, Kim (1995, 1997) analyzed the successful experiences in the automotive and electronic industry of South Korea, exploring the role of leadership in the construction of the knowledge through the crisis creation, equipment useful for the coordination of the learning efforts. Dutrénit (2001 and 2003) mainly reconstructed the trajectory of accumulation of technological competences in a great glass enterprise in Mexico, focusing towards the problems found by itself to develop a knowledge base that made possible the construction and

"Visión de Futuro" Año 6, N°2, volumen N°12, Julio- Diciembre 2009

the accumulation of competences throughout the years. A step forwards, Figueiredo (2001 and 2003) analyzed the implications of the underlying learning processes for the differences between two of the greater iron and steel enterprises of Brazil in terms of form and speed of accumulation of technological competences. These studies provided new explanations about the role of technological competences and the learning processes in the enterprises strategies, particularly those which operate in emergent economies, like Brazil.

The technological competition is defined as the resources necessary to generate and to manage the technological exchange, and these are incorporated into individual and organizational systems (Bell & Pavitt, 1995). The technological change at enterprise level is defined as a continuous process to absorb or to create technological knowhow, determined by external factors to the enterprise and the accumulation of abilities and knowledge intra-enterprise (Lall, 1992). The technological competences were conceptualized by Bell (1984), Katz (1986), Scout-Kemmis (1988), Lall (1992), Dahlman, Ross-Larson and Westphal (1987), Kim (1997), Pack (1987), Enos (1991) and Bell & Pavitt (1995). These conceptualizations are discussed in depth in the works of Dutrénit (2000) and Figueiredo (2001 and 2003).

The technological competences are analyzed here by the structure developed by Figueiredo (2001), adapted by Lall (1992) and Bell & Pavitt (1995). For the study in the mechanical-metal industry, manufacturing agricultural machines, the analytical structure was adapted by Buttenbender (2001). The analytical structure details the technological competences by functions and difficulty levels. The technological functions examined are: processes and organization of the production, products and equipment, detailed in Buttenbender (2001).

Following Bell & Pavitt (1995) and Figueiredo (2001 and 2003) this structure distinguishes the routine competences and the innovations. The routine competences are defined as the resources to produce goods and services in certain efficiency levels, using a combination of factors: abilities, equipment, specifications of products and production, organizational systems

"Visión de Futuro" Año 6, Nº2, volumen Nº12, Julio- Diciembre 2009

and methods. The innovating competences incorporate additional and different resources to generate and to administer innovating activities. In this structure, the activities referred to the different technological functions are disposed in increasing levels of complexity and technological competence, distributed in seven levels. Both first levels concentrate the routine activities and the other five add innovating activities.

In agreement with Bell (1984), learning is defined here as several formal and informal processes by means of which the individuals, and through them the enterprises, acquire additional abilities and technical knowledge. Learning is also understood, according to Figueiredo (2001 and 2003), as a set of processes that allow the enterprises to accumulate technological competences throughout time. The learning processes allow the enterprises to accumulate their own technological competences. Dosi (1990) defines that the challenge of the enterprises on the way to industrialization is to administer the technological learning, with the objective to reach such parameters of competitiveness of the enterprises of countries with first class technology.

The structure for the description of the learning processes, in conformity with Figueiredo (2001 and 2003), organizes and classifies them into four characteristics and it distributes them in four different levels. The characteristic key in the learning processes is discriminated according to variety, intensity, functioning and interaction. The levels of the learning processes are organized according to internal acquisition, external acquisition, socialization and knowledge codification. These four levels are studied in two groups: the first one is formed by the processes and mechanisms of knowledge acquisition, considering the individual context. The second group is formed by the processes and mechanisms of conversion of knowledge, considering the organizational context.

The technological proceeding involves a set of variables of technical performance, production/productivity of the enterprise and by the adoption of innovating practices of management, of security and health, environment and social responsibility. The technological performance in this

"Visión de Futuro" Año 6, Nº2, volumen Nº12, Julio- Diciembre 2009

study is defined by the performance of the enterprise in relation to its historical evolution and in comparison with other enterprises of the industry.

This paper recognizes, on the one hand, that the accumulation of technological competences in an enterprise can be affected by enterprise external factors, such as governmental, macroeconomic, technological and industrial policies, as Lall (1987), Bell and Pavitt write (1995). On the other hand, as Argyris and Schon (1978) and Senge (1990) write, the paper also recognizes that the learning processes can be influenced by the characteristics of the enterprise, e.g., the behavior of the leadership and the beliefs, norms and culture of the enterprise. These factors are beyond the objective of this study and, therefore, they could be object of new studies.

2. Methodological procedures

In order to analyze, if and how, the development of the technological competences happened in this mechanical-metal industry, manufacturing of machines and agricultural equipment, the study method of individual cases, as defined by Yin (1994) was used. The first part of the study was structured to analyze the following matters: (i) development of the accumulation of technological competences in this enterprise relative to the activities of development, execution and implementation of industrial projects for the mechanical-metal industry (1970 to 2000) and (ii) the role of the learning processes in the form and speed of accumulation of technological competences in the enterprise throughout time. The analytical structures were adapted for the mechanical-metal industry, manufacturing machines and agricultural equipment, and evaluated by researchers of the area and engineers and technicians of several enterprises, of excellent technological and economic impact in this industry.

The second part of the study has as objective to analyze the implications of the learning processes, the accumulation of competences for the improvement of the technological performance during 2000 to 2006. The analysis of the improvement of the technological proceeding is

based on a set of indicators, emphasizing: the total production of harvesters, productivity, relationship employees and total production, levels of conformity and loss in relation to the quality in production levels, reduction of the noxious levels of impact to the environment, among others. In order to analyze these matters, empirical qualitative and quantitative evidences within the context of both periods were looked at, in the enterprise under analysis, including both periods (1970 to 2000 and 2000 to 2006). These evidences were obtained through formal sources, such as technicians, engineers, managers and directors of the enterprise (including former employees); meetings, analysis of documentation and information (procedures, technical file, historical data, etc.), and direct observation.

"Visión de Futuro" Año 6, Nº2, volumen Nº12, Julio- Diciembre 2009

3. The accumulation of technological competences and learning processes

This section details in the first subsection the accumulation of technological competences in the technological functions in the organization of production, products and equipment. In the second subsection, the learning processes are detailed in the period from 1970 to 2000.

3.1 Accumulation of technological competences

The evolution of the accumulation of technological competences to carry out the most complex activities in each one of the three studied technological functions followed one another at different rates, speed and periods. The beginning of the manufacture of harvesters on behalf of the enterprise, at the beginning of the 1970s, occurred during a period of little technological complexity, also identified as industry childhood Bell, Ross-Larson and Wesphal, (1984).

The enterprise began to operate in precarious conditions, if compared with the present technological references for the three studied functions. The technological compound, available at that time, adding the initiative, creativity and enterprising vision of the pioneers generated, however, the conditions necessary to create and to maintain technological competences for the manufacture of harvesters from the beginning of the 70s. The accumulation of technological

competences, as Figueiredo (2001) and Dahlman Ross-Larson and Wesphal, (1987), write followed the definition production-investment-innovation.

The empirical evidences demonstrated that the enterprise accumulated competences quicker to develop activities of the function of processes and organization of the production, in comparison with the activities of the functions of products and equipment. This accumulation was from the combination and sequence of internal technological efforts and a set of external alliances. The position to prioritize production, investment and innovation, suggests the investments contributed to the acceleration of the accumulation of technological competences and to reach, after thirty years, high competitiveness indicesf.

The number of year, that it took the enterprise to accumulate the different levels of competence, in each one from the three studied technological functions are detailed in Table Nº 1. The basic levels (1) and renewed (2) are considered routine activities, whereas the other levels represent innovating activities. The speed of accumulation of technological competences was evaluated by the number of years (n) that the enterprise needed to manage to make activities of this level of competences and the respective period.

In the course of the thirty years, the enterprise accumulated technological competences of intermediate superior level (level 6) for the function of processes and organization of the production and the product function and of the intermediate level (level 5) for the function of equipment. The enterprise managed to accumulate technological competences to carry out innovating activities in the three technological functions only as from the 1980s. The empirical evidences suggest that the enterprise accumulated technological competences to develop some activities of the advanced level (7) in the functions of the process and organization of the production and of products.

Table 1 Number of years (n) of permanence in the competence levels Technology in periods 1970 to 2000

Technological Functions and related activities			
Levels of Technological Competence	Processes and Organization of the production	Products	Equipment
(1) Basic	n = 4 (1970-1974)	n = 7 (1970-1977)	n = 3 (1970-1973)
(2) Renewed	n = 3 (1974-1977)	n = 3 (1977-1980)	n = 5 (1973-1978)
(3) Extra-basic	n = 7 (1977-1984)	n = 10 (1980-1990)	n = 12 (1978-1990)
(4) Pre-intermediate	n = 6 (1984-1990)	n = 4 (1990-1994)	n = 6 (1990-1996)
(5) Intermediate	n = 6 (1990-1996)	n = 3 (1994-1997)	n = 4 (1996-2000)
(6) Superior Intermediate	n = 4 (1996-2000)	n = 3 (1997-2000)	Non-reached level
(7) Advanced	Non-reached level	Non-reached level	Non-reached level

Source: Research in the Enterprise (Buttenbender, 2001)

The empirical evidences suggest that the enterprise, due to the significant interaction with the world-wide center of development of harvesters of the enterprise (Denmark) generated, as from 1996, an acceleration of the speed and in the rates of accumulation of competences in the three studied technological functions, which convergs with Ariffin and Bell's (1996) definitions. It demonstrates the capacity of the enterprise to create, to maintain and to improve the innovating activities and to develop more complex activities, suggesting a stage of industrial maturity, a companying Figueiredo's (2001) definition.

The detail of the speeds and rates of accumulation of competences for the performance of the more complex technological functions in the functions of process and organization of the production, of products and equipment, is described in Buttenbender (2001 and 2005). In it, bonds and convergences with Tremblay (1998), Kim (1997), Hobday's (1995), contributions are suggested

3.2. Learning Processes

This section analyzes characteristic key of the learning processes and its implications in the trajectory of accumulation of technological competences in the enterprise during the period included from 1970 to 2000, seen through the analytical structures and the empirical evidences in detail described by Buttenbender (2001 and 2005). The learning process is presented and analyzed in the three phases of the evolution of the enterprise, that is, the 1st phase includes

from 1970 to 1978 (8 year-enterprise X), the 2nd phase includes from 1978 to 1996 (18 year-enterprise Y) and 3rd phase includes from 1996 to 2000 (4 year-enterprise Z).

3.2.1. Variety of learning processes

The variety was evaluated in terms of absence or presence of the learning processes. The criteria define the variety as absence when no process arose from learning during the evaluation period. The variety is defined as present when the existence of learning processes takes place during the period and, quantitatively, are classified in the following way: limited with one or two processes; moderate with three to five; diverse with six or more. The present learning processes in each one of the three phases of the evolution of the enterprise are described in detail in Buttenbender (2001 and 2005) and quantitatively demonstrated in Table 2.

The processes of external acquisition of knowledge were concentrated in few mechanisms of acquisition that were in low levels of technological competence, i.e., routine or not renewed levels. The increase in the variety of the processes of knowledge acquisition was in generating and diffusing activities from knowledge (Leonard-Barton, 1998). The processes of internal acquisition, of socialization and codification of knowledge are complemented by Nonaka and Takeuchi (1997) when they treated knowledge at individual level, of group and organization, the forms of interaction of the tacit and explicit knowledge and the knowledge transfer processes from the individual level towards the group and organizational levels.

The variety of learning processes suggests the positive influence of the learning processes in the definition of the trajectory of accumulation of technological competences. Studies of this nature were also carried out by Kim (1995 and 1997), exploring the role and the positive influence of the corporative leadership (to construct crisis and to generate consensus). The learning processes, implemented throughout time, help to dominate and to develop more complex activities, as defined by Hobday (1995), Kim (1995) and Dutrénit (2000). Also, to generate resources necessary to reach better standards of competitiveness, to develop new strategic aptitudes that

"Visión de Futuro" Año 6, N°2, volumen N°12, Julio- Diciembre 2009

are in competitive advantages, as Dosi (1990) and Leonard-Barton write (1998). These technological competences strongly could be imitated, because they are integrated to the system of activities, in the physical systems, the bases of qualification and knowledge, in the management systems of instruction and compensation, among others.

Table 2: Variety (n) of the learning processes. Period from: 1970 to 2000.

Phases and Periods of the Trajectory of the Enterprise			
Learning processes	1ST Phase: 1970 to 1978	2ND Phase: 1978 to 1996	3RD Phase: 1996 to 2000
External acquisition	n = 5 (Moderate)	n = 10 (Diverse)	n = 6 (Diverse)
Internal acquisition	n = 4 (Moderate)	n = 5 (Moderate)	n = 2 (Limited)
Socialization	n = 3 (Moderate)	n = 4 (Moderate)	n = 3 (Moderate)
Codification	n = 2 (Limited)	n = 5 (Moderate)	n = 3 (Moderate)
Total	n = 14	n = 24	n = 14

Source: Research in the Enterprise (Buttenbender, 2001)

3.2.2. Learning processes Intensity

The intensity of the learning processes, evaluated by the repetition of such throughout every period, is classified in the following way: once, when it happened just once; intermittent, when it happened two or three times; or continuous, when it happened four or more times. In table 3 the analysis of the intensity of the learning processes in each one of the phases of the enterprise is detailed.

The processes of external acquisition demonstrated the influence in the accumulation of technological competences to develop new and more complex technological activities. The leaders, technicians and engineers, participated in courses and external training, which also contributed to the intensity of the processes of internal acquisition, socialization and codification of knowledge, incorporating itself to the almost daily routine of the enterprise, as an example of Garvin's (1993) the study

Table 3: Learning processes Intensity. Period from 1970 to 2000.

Phases and Periods of the Trajectory of the Enterprise			
Learning processes	**1st Fase:1970 to 1978**	**2nd Phase: 1978 to 1996**	**3rd Phase: 1996 to 2000**
External acquisition	Intermittent	Continuous	Continuous
Internal acquisition	Once	Intermittent	Intermittent
Socialization	Intermittent	Continuous	Continuous
Codification	Once	Intermittent	Continuous

Source: Information in the Enterprise (Buttenbender, 2001)

The intensity of the learning processes has contributed to the understanding, on behalf of the employees, of the importance and the principles involved in the technology, and of the necessity of innovation and improvement. It has contributed also in the flow of socialization and codification of knowledge, describing the processes as conversion of the individual learning to an organizational learning. The study suggests the learning processes tend towards the creation, maintenance and improvement of knowledge. The priorities tended towards the form by which the industry began to create and to fortify its own competences, as a example of the contributions of the studies of Hobday (1995), Kim (1995), Dutrénit (2000), Leonar-Barton (1998) and Nonaka and Takeuchi's (1997).

3.2.3. Learning processes functioning

In the functioning the how and the form, by which the enterprise evaluated organized and operated its learning processes throughout time and its contributions to variety and intensity. The evaluation of the functioning, that is of qualitative and subjective nature was constructed during the interviews, direct observations and the findings. The functioning was classified in four parameters: bad, moderate, good and excellent. The evaluation of the functioning is detailed in Table 4.

Some characteristics of the functioning of the learning processes positively influenced the variety and the intensity, e.g.: the repetition, the presence throughout time and the interaction of the learning processes, according to table 4. Initially made to solve technical-operative problems

(1970 -1978), the priorities concentrated in knowledge acquisition of other regions or countries, incorporating them to the processes and organization of the production, products and equipment. In the second and third phase, the functioning was good, considering for example, the total of 180,000 internal and external courses of the enterprise in the period included from 1992 to 2000. The processes of internal acquisition of knowledge were marked more by the method of learning by doing more than by the method of learning before doing. The form by which the enterprise organized the learning processes was the critical element in the construction of competences, being able to be dysfunctional and/or to deteriorate itself through time, as an example of Leonard-Barton (1998) and Figueiredo's (2001 and 2003) contributions

Table 4: Functioning of the learning processes. Period from 1970 to 2000.

Phases and Periods of the Trajectory of the Enterprise			
Learning processes	1st Phase: 1970 to 1978	2nd Phase: 1978 to 1996	3rd Phase: 1996 to 2000
External acquisition	Moderate	good	good
Internal Acquisition	Bad	Moderate	Moderate
Socialization	Bad	Moderate	good
Codification	Bad	Moderate/Good	Good

Source Information in the Enterprise (Buttenbender, 2001)

3.2.4. Learning processes Interaction

The interaction was evaluated on the basis of the form and how the learning processes influenced one another and how the processes of acquisition and conversion of knowledge interacted. The interaction was classified on the basis of the criteria: weak when it strongly influenced another process of learning; moderate when it influenced two or three learning processes; or strong when it influenced four or more learning processes. The evaluation of the interaction of the learning processes is detailed in Table 5.

In spite of constituting a priority of the enterprise in the 70s, the processes of external acquisition presented a weak interaction. As from the 90s (second phase) the processes of extern

al acquisition improved the interaction with the other learning processes, specially, with the processes of socialization and codification of knowledge, which suggests a moderate and strong classification in the second and third phase. The strong interaction of the learning processes influenced positively in the speed and the rates of competences to develop more complex activities in each one of the three studied functions.

Table 5: Interaction of the learning processes. Period from 1970 to 2000.

Phases and Periods of the Trajectory of the Enterprise			
Learning processes	**1st Phase: 1970 to 1978**	**2nd Phase: 1978 to 1996**	**3rd Phase: 1996 to 2000**
External acquisition	Weak	Moderate	Strong
Internal Acquisition	Weak	Moderate	Moderate
Socialization	Weak	Moderate	Strong
Codification	Weak	Moderate	Strong

Source: Information in the Enterprise (Buttenbender, 2001)

"Visión de Futuro" Año 6, Nº2, volumen Nº12, Julio- Diciembre 2009

4. Indicators of performance and impacts in the development

This section has the purpose of identifying and of relating some implications in the proceeding of the production of the mechanical-metal industry, considering the data related to one of the leader enterprises of the industry, relating the amounts of production and commercialization of harvesters. On the other hand, it must relate some impacts in the development of the region.

4.1 – Performance Indicators

In the study that includes the period 1970 to 2000 one verifies that the mechanisms of acquisition and conversion of knowledge played an important role in the accumulation of new technological competences in the enterprise, involving the functions of process and organization of the production, product and equipment. The speed with which the enterprise accumulated new competences oscillated throughout the trajectory. In this section some empirical evidences of the

implications of the accumulation of technological competences, for the improvement of the proceeding of the production, including the period from 2000 to 2006, are detailed.

The production of the enterprise, as from second half of the 90s, obtained a growth in two directions. One characterized by the increase of the production of harvesters (Table 6). The other expressed by the increasing technological complexity of products made in the harvesters' plant, as well as its diversification. In this aspect, the unit of the studied enterprise happened to produce in addition to harvesters, new components for the manufacture of tractors and components for other agricultural equipment. This production takes care of the demands of other manufacturing plants of machines and equipment of the enterprise in Brazil and other countries. It established a relationship business to business in its productive chain. The increasing production of the enterprise in the market is expressed by means of the participation, in 1997, in the 10.17% of the national market of production of harvesters (378 units) and in 23.5% in 2004 (2,460 units). This growth represents an increase of 550.78% in the volume produced in the period. The goal of the industry presented for the next five years is to reach a 30% (thirty percent) of the national production of harvesters. In 2005 and 2006 there was a significant reduction in the national production of machines and agricultural equipment. This reduction was caused, among other things, due to the retraction of the national agricultural market, by the overvaluation of the Real currency in comparison with the Dollar, generating a loss of external competitiveness, and by the restriction of the credits of ICMS (Tax on Circulation of Merchandise and Services) to the exporter and to the increase of the tax aliquot in some sectors. The reduction of the production was generated by the diminution of the demand and the consequent reduction of the programming and planning of the production.

Considering the oscillations in production and commercialization of agricultural machines, the enterprise intensified the development of new support mechanisms and verification of the performance in the period included from 2000 to 2006. Many of them developed in the enter

prise and/or transferred from its other units. In spite of the relevance of the mechanisms, it produces a limited contribution for this present study, as it does not display historical series of information. Thus, it allows a limited comparative analysis throughout the period.

Table 6: Brazilian Industry Annual production of Harvesters, with the main manufacturers, from 1995 to 2006.

ENTERPRICES/YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
MASSEY FERGUSON	398	415	330	492	555	814	1.023	1.355	1.906	2.312	892	NI*
AGCO ALLIS	-	-	-	21	94	29	50	64	256	148	164	410
IDEAL	97	137	48	90	30	-	-	-	-	-	-	-
CNH CASE	-	-	-	45	100	13	4	253	532	617	296	294
CNH NEW HOLLAND	859	897	1.296	1.380	1.351	1.692	2.046	2.448	3.112	3.147	811	545
JOHN DEERE	1.017	1.082	2.041	2.035	1.630	1.748	2.073	2.731	3.389	4.219	2.066	1.065
TOTAL	**2.371**	**2.531**	**3.715**	**4.063**	**3.760**	**4.296**	**5.196**	**6.851**	**9.195**	**10.443**	**4.229**	**2.314**

Source: Yearbook of Brazilian Automobile Industry - ANFAVEA, 2006 * NI – not yet informed.

The mechanisms of support of the resulting performances of the technological functions of process and organization of the production, product and equipment, are characterized through different support instruments: the quality levels and final conformity of the global product (harvesters); total results of the components of the final product; relationship between the planning and the monthly and annual execution (Delivery performance); levels of productivity; levels of lack of components per season; levels of loss of time and resources motivated by supply on time delivery/performance); levels of nonconformity by million components, supply PPM; levels of security and trustworthiness of the information of stocks; levels of inventory turns; levels of loss due to supply and to obsolete/per unit; among others.

The improvement of the performance in the management of the people is expressed by means of diverse mechanisms developed by the unit or acquired from other units and adapted to the reality of the enterprise. In complement to the conventional practices of the strategic management of the people and the established reports, the enterprise has been equipped with innovating experiences in the personnel management, where one highlights:

a) Participation mechanisms of the people, of diverse levels of the organization, with the superior directors. One highlights: Keep informed, where the directors carry out meetings with all the unit employees, coffee with the directors, through which the employees of the operative levels participate in meetings with the higher directors; Gathering ideas, where the employees can suggest improvements and receive participation in the results of these implemented ideas; periodic analysis to verify the levels of satisfaction of the subjects in the work; among others.

b) Program of identification of new talents and support in programs of internal and external qualification of the enterprise, e.g.: talent hunting, through which the enterprise looks for and identifies new collaborators, and/or evaluates potentials for functions of additional responsibility; schooling help, through which the enterprise stimulates the formal education at high school, upper and post graduation level; training programs; among others.

c) Life quality programs and projects of social responsibility, with an ample external recognition, e.g.,: Prizes during several consecutive years in the Top Human Being, promoted by the ABRH (Brazilian Association of Human Resources); Prize for the certification of Social Responsibility, granted by the Legislative Assembly of the State of RS; Golden Trophy in the Program of Quality and Productivity Gaucho (PGCP); Prize per time of service (fidelity) and of anniversaries; Implementation of OHSAS system (Occupational Health and Safety Assessment Series) 18.000; Fishing Project, for needy young people, with the objective to rescue the citizenship and to prepare them for the work market; Emergency Brigade, with an equipment and structure to take care of internal emergencies and support to the community; Project of Human Valuation that has as its objective the insertion of those who have special necessities.

The improvement of the performance in the mechanisms of management and their support is developed through diverse programs and actions. Some of these with involvement of more ample equipment, and other programs, focused in the directive team as main people in charge by its implementation. Some programs stand out: Program Six Sigma, implementation and certi

"Visión de Futuro" Año 6, Nº2, volumen Nº12, Julio- Diciembre 2009

fication of system ISO 9000 and ISO 14000 (first Brazilian mechanical-metal enterprise of machines and agricultural implements certified by ISO 14000); implementation of the innovation Area, as space of socialization of experiences and innovating practice; mechanisms of follow up of the evolution of the qualification and productivity of the human resources, associated at production levels; adoption of a set of follow up indicators of production, productivity, quality and results of the diverse areas of manufacture; among others.

In the set of improvements revealed in period 2000-2005, the implementation of new technologies of equipment, processes and organization of the production stand out. This improvement has a strong impact in the improvement of the final quality of the product, in the rationalization of production structures, in the standardization of the quality, the reduction of harmful levels of impact to the environment and in the improvement of the quality of life. One highlights the acquisition and implementation of a high performance equipment, with numerical command, identified as Viradeira CNC System (Numerical Commando by Computer), and the implementation of the System of Pintua in Powder.

The most recent program and of high impact in the internal organization and technical performance, is characterized by the Lean Manufacturing Project. Through this project it is planned to rationalize the excesses of stock and movements, to improve the levels of ergonomic risk, to reduce the time waste, and to elevate the levels of satisfaction in the work. Through the implementation of the Project the enterprise looks for the reduction of stocks, reduction of the physical area of manufacture, to increase the continuous flows of production, to reduce the levels of ergonomic risk, to action the production via Kankan, and the elevation of the flexibility levels, to reduce the lead-Time.

The initiatives undertaken in the region for the technological qualification and the contribution of knowledge in technology are limited. The National Service of Industrial Apprenticeship – SENAI/RS, through centers of professional formation installed in Santa Rosa and Horizontina, is

responsible for the development of programs of qualification of human resources and benefit of technological services. The Uijuí – Regional University has generated a specific contribution in science programs and technology in the mechanical-metal area. Its main approach Zawislak, Lima, and Ruffoni (2002), has been concentrated in areas of development of projects of innovations in processes, materials and some products. Recent initiatives, directed to studies and contributions of innovation in technological management have generated important results for the accumulation of new technological competences in the industry.

4.2 – Development Impacts

The impacts of the mechanical-metal, manufacturing industry of agricultural machines in the development of the region, as well as in the added value can directly be stated by the participation in the generation of employments and rent, in the value added as well as tributary contributions to the municipal, provincial and national municipalities.

The development of the studies on the impacts in the development and the added value was strongly affected by the difficulties experienced by the mechanical-metal, manufacturing industry of agricultural machines in 2005 and 2006. The study approaches of and the attention led more towards the contributions and ideas of the project of research in the advising of the organization of the enterprises and their leadership, in the conduction of local, regional, provincial and national mobilizations, visualizing to revert the public policies that negatively affected the sector.

The coordination and the equipment of information in the period of preparation and reduction of the production flows was involved directly in meetings, events and mobilizations of the industry enterprise leadership, and political representatives of the sector and community, with the intention of constructing productive, technological and mercadology alternatives for the difficulties faced in the period. Happily, after some changes in the scenes of the national and international markets, the volumes of production were retaken, which resulted, in pointing towards a positive perspective for 2007.

As emphasized by Dallabrida & Buttenbender (2006), the forms of mobilization and society mediation between what is public and what is private, constitutes an historical strategy so that the region faces its challenges. The agglutination of the diverse leaderships of the political, economic, academic and social spheres around the common interests has generated positive results for the problems experienced. The diagnosis displayed in this paper details the socioeconomic evolution of the recent history of the region. Directly the regional movements can be mentioned, be led by the Northwest Regional Council of Border Development – COREDE Northwest Frontier, with the advising of the Institutions of Higher Education – and the IES and the participation of the regional community in the definition of the strategic planning for the development of the region.

"Visión de Futuro" Año 6, Nº2, volumen Nº12, Julio- Diciembre 2009

CONCLUSIONS

The evidences described and analyzed in this study suggest and recognize that the accumulation of technological competences and the improvement of the technical and economic proceeding, also are affected by the external factors of the enterprise, e.g.: governmental, macroeconomic, technological and industrial, as example of the contributions by Lall (1987), Bell and Pavitt's (1993) studies. Underlying studies to this article of Buttenbender's (2001 and 2005) suggests that the learning processes were influenced by characteristics, such as: behavior of the leadership and the beliefs, norms and culture of the enterprise, as indicated by Argyris and Schon (1978) and Senge (1990). One highlights, however, that these external factors and the behavior of the leadership, the beliefs, norms and culture of the enterprise are beyond the objective of this study and that it will be able to motivate other new studies.

One verifies from the analysis of the data, that the enterprise increased its technological competences and its productive capacity and the development of technologically more complex

activities. The comparative analysis of the data between the indicators, and of its own indicators throughout the time, will allow generating important information and references for the qualification of the technological performance of the manufacturing industry of agricultural machines, and its impacts in the chain of agro business.

The preliminary analysis of the data suggests a positive report between the learning processes, the accumulation of technological competences and the improvement of the technical and economic proceeding. This type of study is not only aligned to the studies that focus on the exploration of the more and more significant role of learning and development of the technological competences in the corporative and enterprise strategy, but also in the implication of such, in the improvement of the economic and technical performance.

Studies with these characteristics and matters contribute to the understanding of how, enterprises that operate in Brazil incorporate the learning processes, the accumulation of technological competences and improve the technical and economic performance. This improvement of performance is established as a strategy to acquire competitive advantages in its market. The accumulation of new technological and economic competences and the perspective of internationalization of technological competences, according to what suggested by Ariffin and Figueiredo (2003), Spot (2005) and Katz (2005), will be able to subsidize the industry, to the chain of agro-businesses and also to the governmental policies, planning to heighten the levels of competitiveness of the emergent countries. These contributions corroborate with the studies by Neves (2000) and Neves & Castro (2003).

One highlights importance of continuing the studies in the enterprises and the industry to verify the effective contributions in the accumulation of new competences, the improvement of the performance and the impacts in the development and the added value of the chain of agro-businesses. The depth and continuity of these studies, and the exploration of new subjects, by the light of the structures referred to here, will be able to motivate comparative studies between

industries of different segments, in order to deepen the knowledge on the processes of innovation in Brazilian enterprises. This study suggests and emphasizes the importance of the stimulation of the public policies that stimulate a greater autonomy in the production and the exploration of technologies and the promotion to the national investments in highly strategic I&D for the acceleration of the accumulation of technological competences, as far as to the improvement of the performance and to development promotion.

BIBLIOGRAPHY

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