

# **Knowledge Management in a Steel Company: A case study of the Gerdau Group**

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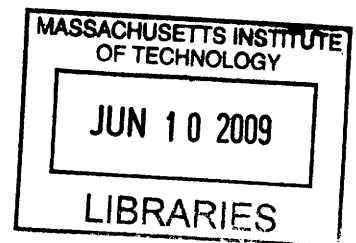
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# **Knowledge Management in a Steel Company: A case study of the Gerdau Group**

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## **ABSTRACT**

Knowledge Management has become part of the business strategy of many corporations all over the world. Their ability to manage and take advantage of their intellectual assets is providing them with and sustaining their competitive advantage. This thesis assesses the Knowledge Management System implemented in a steel company: The Gerdau Group. A literature review, combined with a survey administered to users of the system in the company, provide insights to evaluate to what degree the company is succeeding in achieving its goal: capturing and disseminating technical knowledge among employees from different sites. My evaluation does not examine the software used to manage the system, but rather focuses on the strategic and practical aspects of the knowledge management process. From these materials, I develop a set of recommendations to assist Gerdau in enhancing the quality of its knowledge sharing process.

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## **CHAPTER 1: INTRODUCTION AND A BRIEF HISTORY OF THE GERDAU GROUP**

The choice of topic for this thesis is based on personal interest. I am curious about the “knowledge sharing” problems faced by big companies and, in particular, the “knowledge sharing” problems faced by the company I work for, the Gerdau Group.

Before joining this company, I worked for seven years as a Project Manager for an engineering firm specialized in assisting steel producer companies. The Gerdau Group was our major client and, during the development of projects, I had the opportunity to visit several of its plants in Brazil and Uruguay. The goal of these visits was to observe some problems in the production line and then try to develop solutions. Problems could be about the running of a machine, the physical efforts required to operate equipment or the capacity of a production line. Solutions ranged from designing a new machine to changing the mode of operation. What I realized doing this job was that workers from one plant did not know that the solutions for many of their problems had already been discovered and implemented in another Gerdau plant. There was no organized way of publishing and communicating these findings. It seemed impossible to exchange knowledge among workers from different sites.

After joining the Gerdau Group, six years ago, I realized that this problem was even worse than I previously believed. The corporation has grown enormously in the last decade, mainly by acquisitions. The challenge to quickly boost the operational performance of the new plants to make them profitable was huge. Located in many countries around the world, the acquired companies were often technologically outdated and had operational problems. Once again, Gerdau lacked a formal way to transfer knowledge across its plants.

Working for the Rolling Mill sector, I did not have the opportunity to participate in a project that was started two years ago at Gerdau to implement a Knowledge Management

System. The goal of the project was to solve the problems suggested above by making possible the sharing of knowledge among workers of any Gerdau site. By taking advantage of the existing knowledge and the diversity of this knowledge across plants, the project team believes that it is possible to improve the operational performances of all units. This thesis is therefore my opportunity to study knowledge management in depth and contribute to the Knowledge Management System at the Gerdau Group.

## **1.1. Thesis Overview**

The remainder of this chapter describes Gerdau's history and its products. Chapter 2 defines Knowledge Management and explains the importance of and the advantages brought to organizations by a system dedicated to managing intellectual assets. The chapter also introduces those who must participate in a knowledge management system and analyzes the incentives they have to participate in a knowledge transfer process. Typical problems of this process and possible solutions are also discussed.

Chapter 3 covers the knowledge generation processes. I summarize a theory elaborated by Nonaka and Takeuchi (1995) that explains how a firm can benefit from creating an innovative environment which allows new knowledge to emerge. The organizational conditions which enable knowledge creation are explored and a model of the organizational knowledge-creation process is presented. Additionally, other sources of generating knowledge inside corporations, identified by Davenport and Prusak (1998), are presented.

Chapter 4 explains why a Knowledge Management System was implemented at the Gerdau Group and how it is organized. The problems that the company currently faces and why such a system may help to solve them are discussed. The chapter also describes how the implementation process is going thus far and what benefits and challenges have been observed.

Chapter 5 reports the results of a survey I administered to users of the Gerdau Knowledge Management System. A questionnaire was sent to members of various “communities of practice” in the company in order to see how the system was being used and where it could be improved.

Chapter 6 draws conclusions about the effectiveness of the Gerdau Knowledge Management System. It also assesses the way the system is currently working. Finally, recommendations are presented that might help attract more users to the system and improve the quality of the knowledge shared throughout the organization.

## **1.2. Corporate History**

The Gerdau Group is the largest producer of long steel in the Americas and the world's 13th largest steelmaker in the world (see Appendix A for a list of the 20 largest steelmakers). The company has 45 plants in 14 countries (Brazil, Argentina, Uruguay, Chile, Peru, Colombia, Venezuela, Guatemala, Dominican Republic, U.S., Canada, Mexico, Spain, and India) and has over 46,000 employees around the world. Currently, Gerdau has an installed capacity of 26 million metric tons of steel per year.

In 2008, the Gerdau Group's sales revenues were US\$ 20 billion from the production of 19.6 million metric ton of steel. Net profits were US\$ 2.1 billion. Its products are split into five lines (long carbon steel; specialty long steel; flat steel; sheets, blocks and billets; and forged and cast parts) with direct applications in the civil construction, industrial, and agricultural sectors and also serving as a raw material for the transformation industry. Some examples of products are reinforced bars, wires, nails, I-beams, long profiles (squares, rounds, angles, flats), and specialty steels utilized in the manufacturing of auto parts.

The company was founded in 1901 when João Gerdau and his son Hugo opened the Pontas de Paris nail factory in Porto Alegre, State of Rio Grande do Sul, Brazil. The

company was successful but grew only moderately until the late 1940s. At that time, Hugo Gerdau's son-in-law, Curt Johannpeter, took control of the company and directed it through a era of business expansion.

In 1948, the Gerdau Group acquired Siderurgica Riograndense, a local steel company that was facing financial difficulties. The company began to produce rebars (reinforcing bars) which are used in most major concrete structures, from roads to buildings.

The company's expansion in Brazil began with the purchase of the São Judas Tadeu wire factory in São Paulo in 1967 and continued until 1979. Taking advantage of the "Brazilian Economic Miracle" of 1968-74, during which the economy grew at more than 10% per year, Gerdau acquired four other plants: Açonorte in the state of Pernambuco in 1969; Cosigua in the state of Rio de Janeiro in 1971; Guaíra in the state of Paraná also in 1971; and Comesa in the state of Alagoas in 1974. During this period, the government of Brazil undertook large infrastructure projects that consumed rebar. Industry relevant to these projects – transport, machinery and electrical equipment – grew at more than 13% per year. The automotive sector alone grew 22% annually from 1968 to 1974, and became a leading contributor to Brazil's manufactured exports. At the end of the decade, Gerdau's five plants were producing more than one million tons of steel. Exports represented 13.3% of the sales.

In 1980, the Group took its first step toward internationalization. The company acquired the Laisa mill in Uruguay. Meanwhile Gerdau continued expanding within Brazil and took an active interest in the privatization process. In 1988, it began production in the biggest steel-making center in Brazil, the state of Minas Gerais, when it bought the Barão de Cocais mill. In 1989, the Gerdau Group arrived in the Brazilian state of Bahia when Usiba was privatized. By the late 1980s, Gerdau produced more than two million tons of steel and exported 835,000 tons to forty countries. In the late part of this decade, Gerdau

took its first step outside of South America, extending its international growth to Canada with the purchase of the Courtice Steel mill in Cambridge, a province of Ontario.

In 1992, Gerdau started to produce steel in Chile through the AZA steelmaker and in February of the same year entered the specialty steels sector with the purchase of the Aços Finos Piratini mill in the state of Rio Grande do Sul. In 1994, Gerdau expanded its presence in the state of Minas Gerais with the acquisition of Pains mill. Throughout its expansion at home, Gerdau continued to focus on its primary business of continuously casting long-steel products in mini-mills near its customers. In 1995, Gerdau strengthened its position in Canada with the purchase of MRM Steel in Winnipeg in the province of Manitoba. Continuing to expand abroad, its participation in the Argentinean long steel market was increased by its association with Sipar Rolling mill.

Açominas was the last company of the steel sector to be privatized in Brazil in 1997. Two years after its privatization, Açominas faced serious difficulties and its employees, who were also minority shareholders, started to look for new partners. At that time, the employees attracted interest from NatSteel, Belgo Mineira and Gerdau. The latter, supported by NatSteel and employee groups, bought 8% of Açominas shares. Thereafter, Gerdau consistently increased its stake in Açominas and acquired the total control in 2002. This plant is strategically located near some of the lowest-cost mines in Brazil, enabling it to procure raw materials at low costs. Rail and road transport to São Paulo and Rio de Janeiro facilitates access to the domestic market.

The evolution of the steel market in Brazil confirmed the strategic potential of acquisition. Gerdau was able to add Açominas' high-quality semi finished steel products to its own product line. Those semi finished steel products could be used in the production of flat and structural steel, railroad tracks and spikes.

In 1999, Gerdau acquired Ameristeel, the second largest rebar producer in the United States, with four mini mills in the states of Florida, Tennessee and North Carolina.

In 2002, Gerdau acquired a fifth mill in the U.S: The Birmingham Southeast mill, located in Cartersville, state of Georgia. In the same year, Gerdau and Co-Steel completed the merger of their North American steel-making operations, forming Gerdau Ameristeel Corporation. At the end of 2004, Gerdau Group expanded its international activities to yet another South American country, Colombia. The company signed an agreement to purchase shares of the companies Diaco S.A and Sidelpa as part of a staggered acquisition of the holdings of their controlling shareholders. In 2005, Gerdau consolidated its shareholder control of the long steel rolling mill Sipar Aceros, located in the province of Santa Fe, Argentina and also announced the acquisition of Corporación Sidenor S.A, Spain's largest producer of specialty steels and forged and cast products.

In 2007, after continuously increasing in the company's steel market share with more acquisitions around the world, the Gerdau Group signed a definitive agreement to acquire U.S. company, Chaparral Steel. This represented the largest transaction in Gerdau's 106-years history. The offer price evaluated the Chaparral Steel company assets at US\$ 4.22 billion. The steel company is the second largest structural steel manufacturer in North America and is a major producer of steel bars. The acquisition reinforced the Group's strategy to diversify its portfolio to include products of greater added value and reaffirmed its strategic participation in the international steel sector consolidation process.

\* \* \* \* \*

Considering the enormous growth and diversification that has occurred at Gerdau, particularly over the past two decades, it is no surprise that "knowing what the company knows" is something of a problem. Hence an effort to develop a workable way of

discovering and transferring knowledge is a priority in the company. The next chapter looks generally at what knowledge management is, what knowledge management systems can do, and why they are of crucial importance to large companies spread out across the world.



## **CHAPTER 2 – DEFINITIONS AND VALUE CREATION**

Since the 1990s, companies from all over the world have been spending money in order to manage and take advantage of their intellectual assets. The process through which these organizations generate value from their intellectual assets is called Knowledge Management. As an established discipline in many universities, Knowledge Management is included in courses in the fields of Business Administration, Information Technology, Strategic Management, Computer Science, and Public Policy, among others. There have been a large number of studies and many papers and books have been written to determine the value of Knowledge Management. Large corporations and non-profit organizations have dedicated efforts to this subject as part of their Business Strategy. Consulting Firms, as well, try to help companies create strategies to build Knowledge Management systems and to formulate ways to use them to generate competitive advantage.

Knowledge Management attempts to identify and map knowledge inside an organization. It tries to capture knowledge, opening up information channels to distribute knowledge, disseminate best practices and technologies, and generate new knowledge. The goals are multiple and include:

- Improve performance;
- Foster innovation;
- Promote continuous improvement;
- Enhance competitive intelligence;
- Provide information to the workers;
- Improve internal collaboration;
- Diminish redundant work;
- Reduce training time for new employees;

- Decrease product development cycle times;
- Reduce the time required to make a right decision; and
- Retain intellectual capital when a turnover happens.

However, to achieve the goals is not easy. To create a system to manage the information in a practical and competent way, an environment to stimulate knowledge sharing must exist. Certain knowledge management concepts must be deeply understood inside the organizations in order to sell the idea to the involved employees and to collect all the possible benefits and advantages.

## **2.1. Defining Knowledge Management**

Before defining Knowledge Management, it is necessary to differentiate among some basic concepts. Misunderstandings about data, information and knowledge are widespread.

*Data* can be defined as “a set of discrete, objective facts about events. In an organizational context, data is most usefully described as structured records of transactions” Davenport and Prusak (1998:2). Other authors define *data* as just a meaningless point in space and time, without any reference. It is an event or fact without context and therefore without a meaningful relationship to anything else. Data alone is worthless. But it is important to organizations as raw material for the creation of information. Examples of data are numbers, words, sounds or images.

*Information* is “a message, usually in the form of a document or an audible or visible communication...meant to change the way the receiver perceives something, to have an impact on his judgment and behavior. It must inform; it is data that makes a difference” Davenport and Prusak (1998:3). *Information* is a set of compiled, refined or organized data in order to add meaning and make it useful. Computers can be helpful in

this process. But humans are essential if valuable information is to be created. Reports, graphs, drawings and projects can be listed as examples of information.

*Knowledge* is “a fluid mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers...” Davenport and Prusak (1998:5). In other words, *knowledge* is the expertise and skills acquired by a person through practical experience or theoretical education. This knowledge empowers persons in organizations and allows them to take decisions that lead to measurable gains or efficiencies in product development and production.

Figure 2.1 captures the interaction among the three concepts described above: data, information and knowledge.

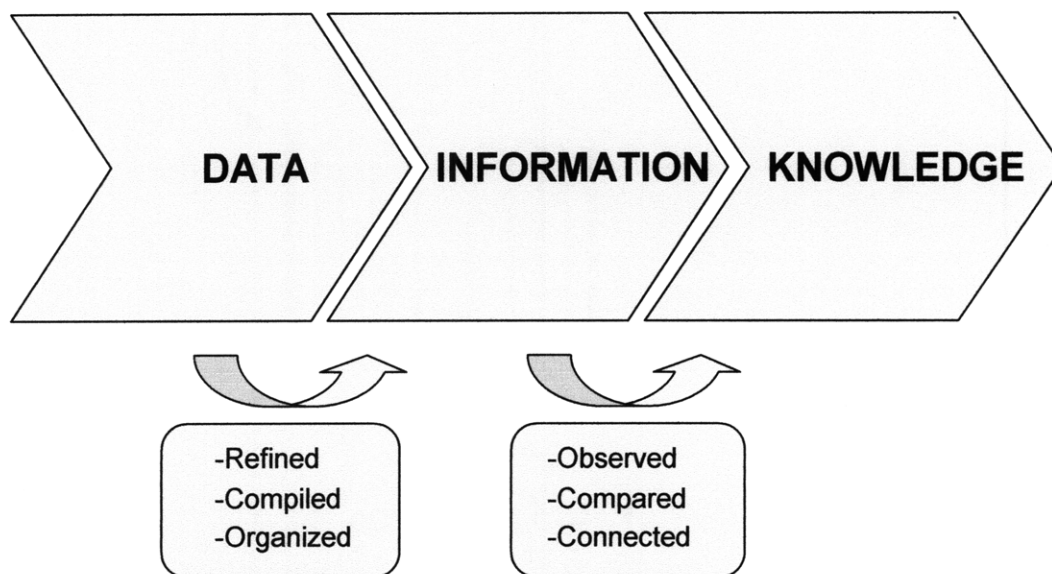


Figure 2.1: Interaction among Data, Information and Knowledge

It is also important to differentiate between two types of knowledge: explicit and tacit. *Explicit knowledge* is contained in manuals and procedures and is formal and systematic. Nonaka and Takeuchi (1995:8) note: “Explicit knowledge can be expressed in words and numbers, and easily communicated and shared in the form of hard data,

scientific formulae, codified procedures, or universal principles.” *Tacit knowledge* is learned by experience and acquired through practice. It is communicated indirectly through stories, analogies and in close relationships. It is expressed as “subjective insights, intuitions, and hunches...is deeply rooted in an individual’s action and experience, as well as in the ideal, values, or emotions he or she embraces” (Nonaka and Takeuchi, 1995:8).

*Knowledge Management* is defined most broadly as practices used by an organization to identify, capture, distribute and create explicit and tacit knowledge. In the literature, it is possible to find other different definitions for Knowledge Management, normally related to its value for companies:

“Any process or practice of creating, acquiring, capturing, sharing and using knowledge, wherever it resides, to enhance learning and performance in organizations”

(Scarbrough, Swan et al., 1999);

“A discipline that seeks to improve the performance of individuals and organizations by maintaining and leveraging the present and future value of knowledge management”

(Newman and Conrad, 1999);

“The process of acquiring, storing, distributing, and using information within a company”

(Business Dictionary, 2009);

“The panoply of procedures and techniques used to get the most from an organization’s tacit and codified know-how”

(Teece, 2000).

Each author has a distinct definition. But basically all definitions include similar ideas about Knowledge Management:

- It is a process of connecting people;
- It is a system to capture knowledge;
- It is a way to disseminate good practices;
- It is a form to organize practical experiences and ideas.

Analyzing the importance of Knowledge Management, Davenport and Prusak (1998) point out that firms need to “know what they know” and, in order to use such

knowledge effectively, a good Knowledge Management system is essential. Such a system represents an opportunity to realize significant savings, improve employees' performance, and create competitive advantages. Knowledge exists within individuals and groups. It is part of routines or systems of specific sectors or divisions, as well as of manuals or books. But, it must be shared, multiplied and accessible to all organizational levels. In a small company it is easy to identify and access workers with experience in particular parts of the business. But in big corporations, this seems almost impossible. Davenport and Prusak (1998) argue that informal knowledge management can work in companies of two hundred to three hundred people. For bigger corporations, some sort of formal system is required.

Macintosh (2009) identified some factors that explain why companies are currently worried about knowledge management. He points out the following:

- Marketplaces are increasingly competitive and the rate of innovation is rising;
- Reductions in staffing create a need to replace informal knowledge with formal methods;
- Competitive pressures reduce the size of the work force that holds valuable business knowledge;
- The amount of time available for acquiring knowledge has diminished;
- Early retirements and increasing mobility of the work force lead to loss of knowledge;
- There is a need to manage increasing complexity as small operating companies are trans-national sourcing operations;
- Changes in strategic direction may result in the loss of knowledge in a specific area.

Barclay and Murray (2009) further explain the reasons for the increase investment that organizations are making in Knowledge Management:

- Most of the work is information based;
- Organizations compete on the basis of knowledge;
- Products and services are increasingly complex, endowing them with a significant information component;
- The need for life-long learning is an inescapable reality.

In brief, knowledge and information have become more important for organizations in a world that is passing into an “information era” and where any company that does not update its knowledge base continuously is easily surpassed by its competitors. As a result, managing knowledge efficaciously is critical.

## **2.2. Knowledge Management Value Creation**

Individual and collective benefits that Knowledge Management can provide to a company and, as a consequence, to everyone involved with it, are huge and include:

- Enhancing internal collaboration;
- Capturing and sharing best practices;
- Improving the organization’s customer relationship management;
- Enhancing competitive intelligence;
- Improving the ability to access, share and distribute knowledge assets;
- Reducing time required to acquire the correct information or the knowledge needed to make a decision.

However, when sharing knowledge is necessary and a company decides to implement a Knowledge Management System, a simple question arises: What really motivates individuals to share their knowledge with one another? On this matter the difference between the Western and the Japanese cultures is instructive. As Lesser and Prusak (2003) suggest, the way academic institutions provide formal education leads

westerners to believe that sharing knowledge is a form of “cheating”. Westerns concentrate their efforts on achieving personal goals. This stimulates competition and discourages collaboration among students. Transferring these ideas to the corporate environment, the same kind of behavior is reinforced by the way that individual performance is evaluated and compensated. But, as pointed out by Nonaka and Takeuchi (1995), the Japanese ideal is different. It exalts harmonious existence and the collective way of thinking. For the Japanese, to work for someone and with others is the same as working for oneself.

Contemporary practices in the West are changing however. Organizations are trying to give more value to results attained by groups instead of those reached by single workers. In many companies, practices have been created to foster collaboration and improve the relationships among employees. The concept of “coach,” for instance, has been introduced to promote the transfer of knowledge between seniors and less experienced partners. Lesser and Prusak (2003:184) explain that “a number of studies have found that individuals who are mentored perform better and are promoted more rapidly, presumably because they have learned and absorbed knowledge from their mentors.” However, as noted by Nonaka and Takeuchi (1995), the Japanese tradition has emphasized this practice for centuries and, because of this, they are still more able to share their knowledge than in the west. The authors cite an example from the Zen Buddhist training where trainees are required to devote themselves to the learning process. Masters are recognized when they succeed in transmitting all their knowledge to their students and making them equal to or more competent than they.

To be successful in today’s business environment (east or west), no organization can allow its employees to work in isolation. If sharing knowledge is not currently a part of the organizational culture, the motivation to foster must be created. The huge quantity of available information and the speed of change make it impossible for any company to

position itself as a leader in any business and to compete in global markets without going beyond the formal boundaries established within the organization to gather information. As best stated by Nonaka and Takeuchi (1995:59):

“In a strict sense, knowledge is created only by individuals. An organization cannot create knowledge without individuals. The organization supports creative individuals or provides contexts for them to create knowledge. Organizational knowledge creation, therefore, should be understood as a process that organizationally amplifies the knowledge created by individuals and crystallizes it as a part of the knowledge network of the organization. This process takes place within an expanding community of interaction which crosses intra- and inter-organizational levels and boundaries.”

To answer the motivation question I asked at the beginning of this section, it is important to understand that people look for knowledge because they need to solve problems inside corporations and want to succeed professionally. Those who offer knowledge do not receive direct financial compensation but expect to benefit in some way. Some others benefit from the knowledge transfer process itself. Davenport and Prusak (1998) explain that knowledge, even if intangible, can be considered a good. Thus, the process of exchanging and transferring knowledge inside organizations follows rules, has the same elements, and is affected by the same forces that are present in a market for tangible goods. Some knowledge management processes fail because they ignore the existence of this market and are based on the idea that people will share what they know without worrying about what they will gain or lose.

The knowledge transfer process involves three major role players in any transaction: the buyers, the sellers and the brokers. During a transaction, it is easy to distinguish among the three roles but they are not rigid. The same person can play overlapping roles in different transactions.

Knowledge “buyers” are people who have a problem but don’t know or are not sure about the answer or solution. In modern organizations, in order to reduce costs while keeping competitive, companies reduce their labor force and require from those that



remain multi-tasking and complementary skills. This forces them to face, on a daily basis, highly complex problems often beyond their skills. Trying to find solutions for their problems or execute a required assignment, these people must look around for experienced colleagues or someone with expertise in the related area.

Knowledge “sellers” are people who have acquired expertise and have experience in a particular problem area. They normally have prestige inside organizations and are able to help others depending on their own interests. They can “sell” tacit or explicit knowledge but must be able to express themselves in a clear way to create value for the buyer.

Knowledge “brokers” are people who connect the buyers with the sellers and make possible the transfer of knowledge. Brokers are usually people with an extensive social network - for example, those who prefer to sit with a different person in the cafeteria everyday or those who are eager to know about everything that is happening inside their corporation. They know who is looking for information and also who is able to help with the solution. Brokers want to benefit from this process either by learning together with the buyer and adding new knowledge to their portfolio or by simply enhancing their own social network.

After identifying the role players and understand the rules in a knowledge market, it is important to know how they interact and what incentives are involved. Knowledge inside organizations has a price. But such price is not usually expressed in the form of money and the exchange of knowledge is not rewarded by cash. Davenport and Prusak (1998) theorize that there are essentially three non-monetary exchanges for information in organizations: reciprocity, reputation and altruism.

*Reciprocity* is based on the help that a seller expects to receive back when they share knowledge with someone. Since knowledge is difficult to measure, knowledge sellers can occasionally share something that is not valuable to them but is important to

knowledge buyers in order to obtain future benefits. Another way to understand *reciprocity* is to think about the value creation into a corporation as a whole and the advantages that everyone inside the company obtains when problems are solved. When a knowledge trade happens and the buyer uses this knowledge to solve a problem, the firm's profitability is improved and all employees benefit indirectly. In corporations where the employees are also shareholders, the advantage is greater.

*Reputation* gains occur when the knowledge seller, who is recognized for expertise or wisdom, is also able to help others to solve problems inside the corporation and, as a result, gains prestige. This person is considered important in the company and can use this reputation to obtain promotions, better remuneration, and perhaps guarantee their job security. As dissemination of information about "who knows what" inside an organization occurs through the informal network, persons with a good reputation may take pride in the fact that their colleagues recognize their ability and wisdom.

*Altruism* operates when the knowledge seller passes his knowledge to a knowledge buyer without expecting anything back. This is often the case for passionate professionals who simply want to inform and help others. The passionate professional wants to abbreviate others' efforts by transmitting everything he knows. This *altruism* can be stimulated and fostered if the corporation has a culture which honors a group spirit.

It is well worth noting that *trust* is essential in the knowledge transfer process. In a market where there are few formal contracts, the *sellers* must believe that *buyers* will use knowledge to the benefit of the company rather than take advantage of the knowledge passed on for their own individual gain. *Trust* underlies reciprocity. *Trust* can be developed. The culture of the company and the attitude of leaders are important in this regard. For instance, a firm that revokes the use of the time clock is showing that it trusts its employees. Trust is built also through the promotion of personal contacts among the employees. An employee is more likely to share knowledge with a friend or a known

colleague than with someone he or she does not know. This helps to explain why some knowledge management systems based solely on impersonal software seldom acquire the expected benefits. The *buyer*, the one who downloads a document from an application system, does not have any responsibility toward the *seller*, the worker who posted the information. In big conglomerates, software to manage knowledge is essential but cannot be viewed as the only way to share knowledge.

The Figure 2.2 shows the interactions in the knowledge market.

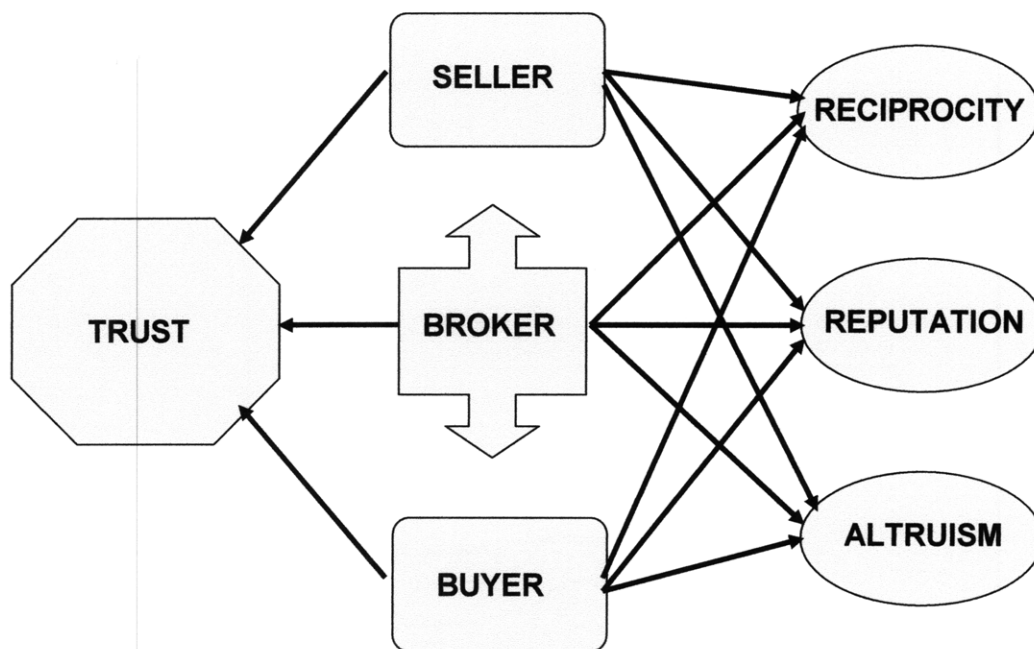


Figure 2.2 – Knowledge Market Interactions

After understanding what incentives people have to share their knowledge, it is important to realize that in markets for tangible goods, the price can be easily evaluated and the value of a service can be estimated even before it has been delivered. Sellers offer their goods and buyers search for something to meet their needs. In a knowledge market, the flow is not so straight forward. Sometimes, for example, a buyer does not know who can help him or even that he/she needs help. Or, a potential seller may have knowledge but be unaware that his/her knowledge can be used by another person.

Three typical problems of a knowledge market are: incompleteness of information, asymmetry of knowledge, and localness of knowledge. The solution to these problems is crucial to bring buyers and sellers together and to make a Knowledge Management System works efficiently.

*Incompleteness of information* occurs when a firm does not know what it knows or how to access this knowledge. This is common in big corporations with many plants where the employees in one plant do not know what employees in other sites know.

One way to solve this problem is to first conduct a Social Network Analysis (SNA). This analysis aims to uncover the informal network inside a sector or organization, identify the owners of knowledge (knowledge sellers), and recognize those who normally seek this knowledge (knowledge buyers). Figure 2.3 shows the formal organization and Figure 2.4 represents the informal network structure in a sector of a petroleum company.

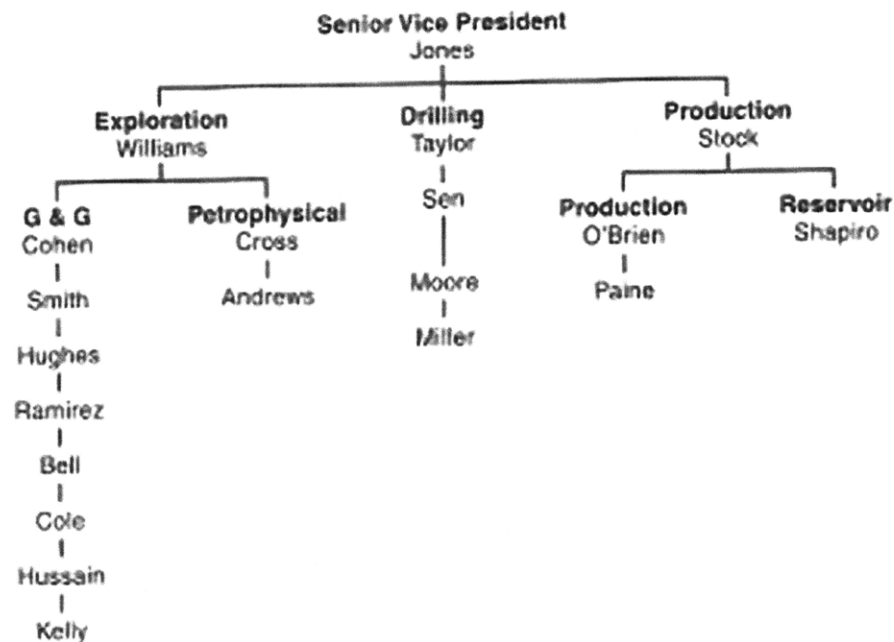


Fig. 2.3 – Formal Structure in a Petroleum Company

(Source: Lesser and Prusak, (2003:66))



is to create virtual spaces and web pages dedicated exclusively to internal knowledge exchange. In these spaces, employees can post, download and access knowledge without leaving their offices. Forums and web pages dedicated to specific subjects are ways to approximate colleagues who have similar interests and are, consequently, potential knowledge sellers and knowledge buyers. To promote the use of the tool, the company must allow employees to take the time to learn about, search and explore this space. If employees are too deeply involved in daily tasks, they will not have time to look for knowledge and the tool will be ineffective.

Having first done the Social Network Analysis and having created a virtual space to promote knowledge trades, it is now possible to create a knowledge map that ties specific people to specific knowledge domains. Such maps are often called “Yellow Pages” and work as guides for knowledge buyers looking for knowledge sellers. These work in the same way as the yellow pages in a telephone book and are found inside the virtual space dedicated to knowledge management. “Yellow Pages” help the firm answer the questions “Who knows what?” and “Where is the knowledge?” This is an important piece of a knowledge management system but it is impersonal and does not have a price structure.

*Asymmetry of knowledge* occurs when knowledge is concentrated at some level in the organization but does not flow elsewhere. As in any market, a shortage of knowledge in certain places is common and varies by activity. For example, directors have more knowledge about the strategies and financial situation of the company than workers in the production line. Similarly, technical professionals have more expertise in their domains than their bosses. Yet important information must pass from one level to another in order for all to be informed. A CEO ought to be aware when a serious problem slows down the production line and blue collar workers should be informed when market conditions change or when the firm is entering a bad financial situation. Relevant players in this process are mid-level managers. They have access to both upper and lower levels

employees and are responsible for implementing the decisions taken by the directors. They often know well the resources available in the firm and how conditions that affect the achievement of goals are changing. In modern corporations, direct channels of communication joining the CEO and blue collar workers have been created. There are regular forums where workers are kept informed about the company's plans and market forecasts, and the workers have a chance to ask the CEO whatever they want.

*Localness of knowledge* occurs when knowledge transfer is restricted to some sectors or units. Knowledge sellers tend to supply knowledge to people they know and rely on and those people are most often their organizational neighbors. In order to disseminate knowledge into the organization and encourage trades among those from different levels, professions, sectors, or plants, "*communities of practice*" can be built. Lesser and Prusak (2003:107) define such communities as "group(s) whose members regularly engage in sharing and learning, based on their common interests." Based on the Social Network Analysis and by observing those that share a similar interest or are involved in related projects, it is possible to formalize such communities, provide them with a group name, register them in a dedicated virtual space, and organize periodical gatherings, such as fairs, congresses or contests. Face-to-face meetings are an important part of this process because they reduce the distance between potential sellers and possible buyers. These events may enhance the level of trustworthiness and awareness among members in *communities of practice* thus enabling future knowledge transactions.

Sometimes such communities allow less experienced members access to the most senior members. Each *community of practice* must have a *moderator* – a person who will play the role of a broker, matching knowledge buyers and knowledge sellers and organizing the posted materials, forums and meetings. Using the resources of a knowledge management web space, it is also possible for the moderator to regularly send out emails and newsletters to update community members. In some communities, "ask-

the-expert” sessions are held in which members post questions and receive answers from a person with high expertise in a subject. According to Lesser and Prusak (2003), well-functioning *communities of practice* provide:

- Decreases in the learning curve for new employees;
- Faster responses to customer needs and inquiries;
- Reductions of rework and preventing “reinventing of the wheel”;
- Spawning of new ideas for products and services.

\* \* \* \* \*

In conclusion, there are different reasons why people share knowledge. It can be part of the culture or be fostered inside corporations. There are also a number of ways to overcome the common problems of incompleteness of information, asymmetry of knowledge and localness of knowledge that occurs in the knowledge sharing process and build an effective Knowledge Management System. Some have been discussed in this chapter with a view to insuring that knowledge flows freely in the organization and benefits the entire corporation.

Next chapter discusses the idea that knowledge, besides being shared, can be created inside a company. Based on the ideas of Nonaka and Takeuchi (1995) and Lesser and Prusak (1998), it is explained how this process can occur.



## **CHAPTER 3 – KNOWLEDGE GENERATION PROCESSES**

In the previous chapter, the advantages to a modern corporation of developing a Knowledge Management System were discussed. I noted also that the knowledge transfer process inside an organization often follow market rules. I identified those who might take part in a knowledge market and what their incentives to share knowledge might be. I also pointed out some of the problems related with knowledge sharing and how they might be overcome.

In this chapter, based on the work of Nonaka and Takeuchi (1995) and Davenport and Prusak (1998), I explain that knowledge can be intentionally generated inside a firm. This innovative procedure adds value and become an important competitive advantage to a company.

Nonaka and Takeuchi (1995) note that knowledge is created through the interaction of tacit and explicit knowledge. They named this interaction “knowledge conversion.” In this chapter, the modes of knowledge conversion are identified and the organizational conditions enabling knowledge creation are provided. The result is a model to foster the knowledge creation process inside a company. Davenport and Prusak (1998) identified other sources of generating knowledge inside corporations. These sources are presented in section 3.4.

### **3.1. The Modes of “Knowledge Conversion”**

Nonaka and Takeuchi (1995) assume, as noted, that the innovation process occurs through interaction between tacit and explicit knowledge. Knowledge conversion can occur in four distinct ways: from tacit to tacit knowledge, or “socialization”; from tacit to explicit knowledge, or “externalization”; from explicit to explicit knowledge, or “combination”; and from explicit to tacit knowledge, or “internalization”. All these modes of knowledge

conversion provide important contributions to the firm. Figure 3.1 shows the four modes of knowledge conversion.

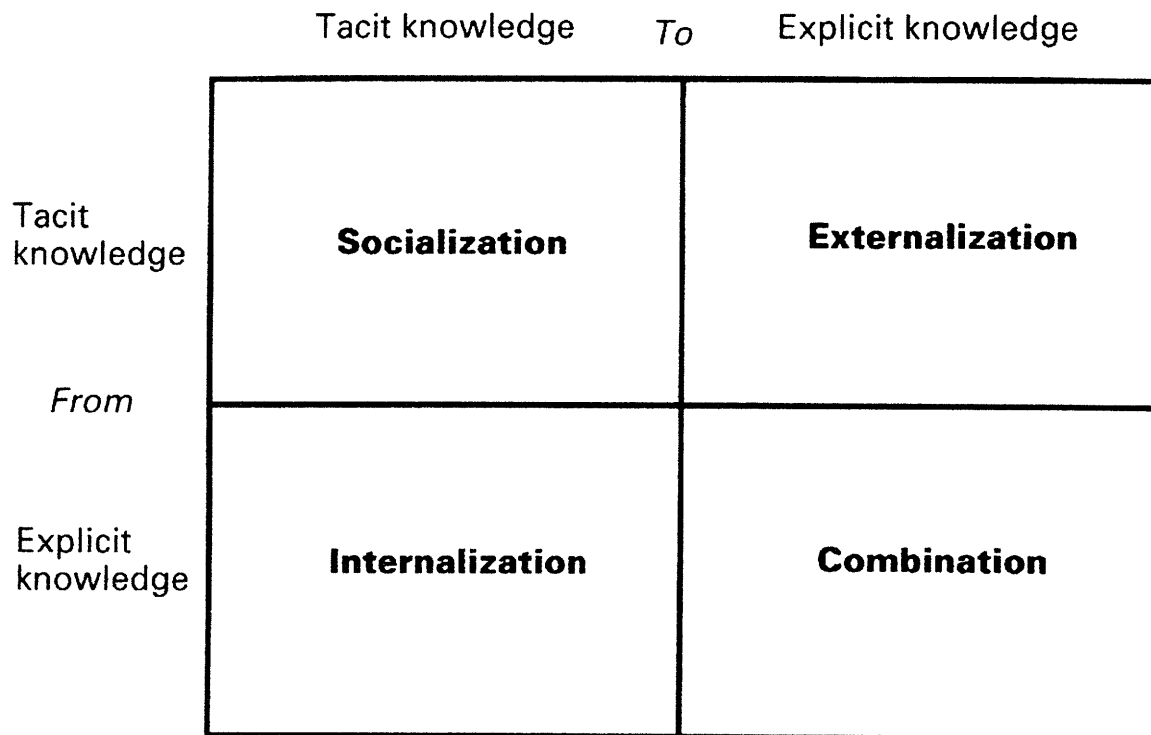


Fig. 3.1 – Four Modes of Knowledge Conversion

(Source: Nonaka and Takeuchi (1995:62))

*Socialization: from tacit to tacit knowledge* – Insights and experiences are shared by people through working together and conversations and, as a consequence, new ideas and tacit knowledge are created. For example, a professional that is hired and starts his new job (or someone transferred from one sector to another) does not have enough knowledge to perform in the same way as a more experienced colleague. It will take the person time to master the new assignment. For the newcomer, self perceptions and the context where the activity is performed are more relevant than manuals and formal training. This process of acquiring experience or tacit knowledge is lengthy but can be accelerated by the process of *socialization*. By working with a more experienced colleague and

observing, mimicking, and executing the same tasks, the new professional may be able to capture in days what the other spent years to learn. And, based on his own experience, the newcomer also has the opportunity to contribute new ideas and perhaps, improve the quality of the job that is being accomplished. *Socialization* processes can therefore generate new knowledge - innovation - inside a company.

One example of *socialization* comes from corporations that have intensive, one-on-one, trainee programs. These programs allow for a single task to be performed by two persons. One is a senior professional who has done the activity for a long time and the other is a junior employee who has just started on the job. The goal is to transfer one person's technical skills to another through a period of shared practice. At the same time, new ideas and, new ways of doing things come up based on this interaction.

Another example might be a successful entrepreneur with a family business preparing his son or daughter to take his position when he retires. Often, the heir-to-be is encouraged to work for another corporation for a period of time in order to learn different ways of doing business. When returning to the company, the future successor comes with new insights and yet is also able to learn from his parent's expertise while providing new ideas based on his own unique experience, thus generating innovation and contributing to the growth of the firm.

*Externalization: from tacit to explicit knowledge* – This occurs when a vision, a concept, an image, an idea or a perception is transformed into something practical or physical. Some examples of this process can be easily identified in our daily life. When we write, we are converting our ideas into a text; when we draw, we are expressing our feelings in a drawing. These practical results (the text and the drawing) may generate ideas in others, thus promoting new knowledge and innovation. The *externalization* mode of knowledge conversion is common in corporations. For example, a new product is developed on the basis of a perceived market need. Based on this deficiency, a concept is

created and various designs begin to be formulated. Through the exchange of ideas among the members of the product design group, the concept progresses and the product evolves until a final version is sent out into the market.

One example of externalization concerns the physical safety of corporate employees. Corporations provide equipment for individual protection such as hard hats, heavy gloves, safety glasses and ear plugs. But, in many situations, the way some employees perform their tasks is exactly what puts them in danger. The only way to always avoid accidents is to create standard operating procedures for the execution of each task. Manuals are written based on observations of the way veterans with sterling safety records execute each task and then discussions are held to determine the safest way to do. The discussions generate innovations and, as a consequence, many dangerous tasks are changed or replaced and the lessons learned are compiled and disseminated.

Another example of *externalization* is presented by Nonaka and Takeuchi (1995). The concept for the creation of the model car “City” by the automobile manufacturer Honda came from a slogan created by its project team leader, Hiroo Watanabe. His slogan was: “Automobile Evolution.” By this, he meant that car design should evolve. His team discussed and captured his idea, transforming it into another slogan: “man-maximum, machine-minimum”. This meant the new concept should privilege comfort rather than appearance. Based on that idea, a car was designed with more internal space to the driver and passengers than had been previously the case.

*Combination: from explicit to explicit knowledge* – This mode of knowledge conversion occurs when different kinds of explicit knowledge are combined in order to create new knowledge. Identification, organization, or the categorization of existing documents, for instance, may generate a new explicit knowledge. In a business environment, *combination* may occur when concepts, such as those which are in books

and are taught in school, are put in practice. This application of theories will lead to a test of the concepts and may generate new ideas and innovation. This conversion from explicit into explicit knowledge may also be exemplified by post-sales services. The marketing staff, for example, analyzes the impressions, requirements and complaints of their clients or customers and drafts a report. Then the technical professionals can use this information to improve and change products to better satisfy the customers. These changes will lead to new manuals or procedures.

A Knowledge Management System in a corporation can also be seen as an example of *combination*. When documents, practical experience reports, and technical manuals are cataloged and, become available to all the employees, they become potential sources of new ideas. More than capture and disseminate knowledge; the grand goal of combination is to create innovations.

*Internalization: from explicit to tacit knowledge* – This conversion process is based on the incorporation of explicit knowledge into tacit knowledge. It is directly related to the other processes: socialization, externalization and combination. *Internalization* is a process by which knowledge is absorbed and becomes a “professional asset.” In the conversion of explicit knowledge into tacit knowledge, is it often helpful to verbalize. By telling stories and reporting practical experiences, we can promote the creation of new mental models and help shape the ideas in the speaker's mind. Another way to internalize is to repeat a task or activity a number of times. By doing the job frequently, an employee – professional or blue collar - develops a special skill.

The practice of writing a book to describe an individual experience is a process of converting explicit knowledge into tacit knowledge. Travelers who pursue great adventures such as climbing the Mount Everest or navigating across the Antarctic Ocean often translate their sensations and feelings into accounts of their trip. At the organizational

level, successful CEO's and business men also frequently write books and articles to divulge their stories and represent the culture of the company they work for to others.

Another example of *internalization* comes from the sports world. When a soccer team used to playing at sea-level has a game in a field located at high altitude (above 10,000 ft), it must practice before the official match. The players are aware of the fact that at high altitude the air is rarer and it is more difficult to breath and run. But, they need to actually feel this difference and have a bodily experience in order to adjust to their new situation.

### **3.2. Organizational Conditions to Knowledge Creation**

What characterizes the existing knowledge base in an organization is the constant and active interaction between explicit and tacit knowledge passing through all the processes: socialization, externalization, combination and internalization. Socialization creates the conditions for interaction and makes possible the sharing of experiences; externalization converts ideas and concepts into practical products or services; combination provides conditions for existing knowledge to be transformed into new knowledge; and internalization crystallizes all the received information into operational knowledge through physical experience. Thus the innovative process in a company can be defined as a cycle that congregates all the modes of knowledge conversion transcending the limits of sections, divisions or plants.

But to obtain all these benefits, a corporation must provide the conditions which enable the system to work. There are five main conditions according to Nonaka and Takeuchi: intention, fluctuation, autonomy, redundancy, and requisite variety.

*Intention* – A company must define its goals. From an organizational point of view, intention normally comes from the creation of a company's vision and, its activity plan for how to reach this vision. The most difficult part of this process is to capture the ideas

explicit or implicit in the vision and transform them into an operational system. To disseminate its *intention*, a firm must look for employees' commitment at all levels. The people in the organization, from top-level managers to blue collar workers, must believe in the vision and help the company by formulating and putting into practice the defined strategies.

*Autonomy* - all employees at different levels of the organization must be allowed, within limits, to act independently. By permitting them to act autonomously, the corporation creates one of the necessary conditions for innovation. An employee who can "think" may be able to come up with unexpected ideas and create knowledge. This feeling of freedom also increases motivation. This functions as fuel for the creative process. Carried to an organizational level, this creativity may grow exponentially if all parts of the organization are engaged. Multi-functional teams, which are created to develop a project or create a product, are examples of an autonomous group where creativity is amplified and innovation emerges through the interaction of members with different backgrounds.

*Fluctuation and Creative Chaos* – This condition must exist to stimulate interaction between the organization and the external environment. Individuals inside corporations need to be open to rethink their positions or beliefs and get out of their so-called "comfort zones". The world is dynamic and a firm that remains unchanged over time is easily surpassed by the competitors. A process of constant questioning and reviewing concepts and procedures is fundamental for the evolution of a business and will foster organizational knowledge creation. The role of corporation leaders must provoke and challenge employees and encourage them to develop new solutions to old problems and achieve better results. By defining more and more difficult goals, leaders develop "controlled discomfort" among the employees. This can feed an innovative process.

*Redundancy* – This condition does not imply repetition or duplication of information. *Redundancy*, in this case, means the intended circulation of information beyond that which

is merely required for operations. For the creation of knowledge, one idea developed by one professional must be shared, even with colleagues who may not need it to execute their tasks. Redundancy of information stimulates the exchange of perceptions, the refinement of concepts, and may speed up the innovation process. One way to build *redundancy* inside a firm is to purposely rotate employees through in different functions and sectors, enabling them to better understand the business as a whole and to expand their network. This supplemental knowledge obtained by individuals will help the corporation in the knowledge creation process.

*Requisite variety* – Ashby (1956) notes that the internal diversity in an organization must match the variety and complexity of the environment in which the organization operates to deal with challenges posed by that environment. In order to create this *requisite variety*, those in the organization must have access to the same information and hence be able to interact in equivalent conditions. From this interaction, there will arise new knowledge and, as a result, innovation. One way to deal with the diversity of the environment is to keep a flat and flexible organizational structure in which the sectors and divisions are connected by an information networks and in which the hierarchy is reduced.

### **3.3. A Model of the Organizational Knowledge-Creation Process**

After analyzing the modes of transferring knowledge and the conditions for corporations to enable the innovative process, it is possible to build a model of the organizational knowledge-creation process. Nonaka and Takeuchi (1995) have such a model and is one commonly used by Japanese corporations. This model identifies five phases in the knowledge creating process: sharing tacit knowledge; creating concepts; justifying concepts; building an archetype; and cross-leveling knowledge.

*Sharing tacit knowledge* – The knowledge-creating process starts by disseminating tacit knowledge held by individuals to the whole organization. This kind of knowledge is not



only the most valuable but also the most difficult to be transferred. To translate insights and abilities acquired during a long history of work and dedication into documents or explanations is complicated. The best way to do this is to provide opportunities for people to be together and interact with one another. The creation of groups composed of employees from different backgrounds or working in separate sectors on a project is an example of a situation where *sharing of tacit knowledge* is encouraged. Motivated by a goal defined by the company, the group members interact intensively among themselves and with the external environment. Tacit knowledge then grows and spreads.

*Creating concepts* – Tacit knowledge shared in the first phase must be converted into explicit knowledge. All the reflections and ideas generated by the exchange of experiences are documented into concepts, cataloged, stored and translated into actions. The different backgrounds and experiences of individuals helps a group rethink its premises and look at problems from different perspectives. The normal divergence among members facilitates the creative process. By explaining one's own point of view in order to convince colleagues, members also consolidate their own understanding of ideas acquired in previous experiences. Changes in the group members and interactions with the outsiders also contribute to further improvement of tacit knowledge sharing.

*Justifying concepts* – After concepts are created, they must be validated by others in the company. All new ideas must be evaluated in order to check whether they are good or bad and whether they are or are not aligned with the goals of the corporation. Normally, these aims are expressed by profits or market share increases or by cost reductions. Return on investment must also be analyzed. But these justifications need not be based on concrete criteria. Sometimes, a project or investment does not bring a direct return but is aligned with an abstract value of the company. When a corporation invests to provide more security for its employees, for instance, it is not seeking direct improvement in profits

or reductions in cost. But, rather, it is acting according to the beliefs of organizational members.

*Building an archetype* – In this phase, concepts are transformed into tangible prototypes or models. This building process merges new explicit knowledge with existing explicit knowledge to produce a better good or service. The goal in this stage is to prove the idea and check whether it will provide all the supposed benefits. This phase is usually complex, and interaction with other departments is essential. Multi-functional teams are able to create the concepts but may not have all the resources needed to implement their ideas. This new stage of interaction and testing provides more learning and generates more tacit knowledge.

*Cross-Leveling of Knowledge* – This is the last phase of the knowledge-creating process. A new concept, after being created, modeled, and tested, constitutes now an asset for the company and serves as inspiration for new ideas and updates. Depending on a customers' first reaction to the new concept, a new cycle of development should be started. Thus, when the project is finished and the working team dismantled, all members return to their original sectors with new explicit knowledge. The exchange of ideas in the discussions within the groups may have created new insights that can be used to improve the quality of work of each employee "back home". To take advantage of this process, the structure of the company must allow for the creation of such groups and give autonomy to its employees. Freedom to disseminate explicit knowledge across all levels of the corporation may well motivate employees to participate in such groups.

### **3.4. Other Sources of Intentional Knowledge Generation**

As noted in the previous sections, Nonaka and Takeuchi (1995) state that Japanese companies foster the creation of knowledge by merging people from distinct backgrounds into groups, and promoting the interaction and exchange of experiences

among these individuals. In this section, based on the ideas of Davenport and Prusak (1998), other ways in which corporations can generate knowledge intentionally are presented. These are: acquisition, rental and dedicated resources.

*Acquisition* – Knowledge generation is not only restricted to that which occurs inside the company but can also be expanded to that which is acquired from the outside. Acquired knowledge does not refer only to breakthrough ideas. Acquired knowledge is merely that which has value for a firm. Acquisitions may increase profits, leverage market share, gain access to new markets, or to improve technical capabilities. Firms acquire other firms for many reasons but if the intention of acquiring knowledge is explicit, a premium value may be paid. The expertise and the intellectual assets inside a corporation are usually worth more than its buildings or equipment. In this evaluation process, the benefits expected from a “knowledge acquisition” must also consider the way such knowledge is organized. Sometimes a company is good at developing knowledge but uses a peculiar mode of application that is not easily adaptable to the way the other company works.

Knowledge acquisition may also take place within a given corporation, for example, from one plant to another. Some companies encourage employees to find and copy projects from other plants and employ in their own. Based on networking or by searching databases, employees within a firm may be able to reproduce colleagues’ best practices to improve the performance in their own areas.

*Rental* – When a corporation financially supports an university or a research institute and benefits from the results of the work, it is leasing knowledge. Drug companies, for example, support research in hospitals hoping that the findings may lead to the development of new drugs. Manufacturer firms support research in universities aiming to take advantage of the findings to improve their products and/or processes. Yet, the value of leasing efforts is usually quite uncertain. It is not easy to predict the results.

Another form of knowledge rental is to hire a consulting firm to help the company implement a project or determine what projects should move ahead. In this case, the value of the service is based on the ability of the consulting firm to benefit the company.

Although the knowledge source is provisory, the experience acquired by those who participated in the project (as well as the explicit knowledge produced in form of reports and recommendations advanced by the consultants) stays with the firm.

*Dedicated resources* – A final way to improve the generation of knowledge inside an organization is to create a dedicated department for this purpose. Normally, the R & D department is responsible for the innovative process. In companies that base their business on the constant creation of products, these R & D departments are essential and their success in the innovative process determines the success of the whole organization. In big corporations, in order to reduce costs and provide an integrated innovation process that can benefit the whole company, these R & D sectors are centralized and the knowledge generated by them is, in theory, shared with all the sectors. The important role of the R & D department is to ensure that the intellectual property inside the corporation is being protected and that all the new products or systems created are patented.

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Thus, different ways to generate knowledge inside a corporation were presented in this chapter. Based on the theory of Nonaka and Takeuchi (1995), corporations create knowledge through interactions between tacit and explicit knowledge. Other sources for generating knowledge, such as acquisition, rental and dedicated resources were also identified based on the ideas of Davenport and Prusak (1998).

In the next chapter, Gerdau's Knowledge Management System is presented. The reasons why it was established and how it was organized are discussed. Moreover, the way Gerdau is using this system to foster the sharing and creation of knowledge inside the corporation is analyzed.

## **CHAPTER 4 – KNOWLEDGE MANAGEMENT SYSTEM AT GERDAU**

### **4.1. Gerdau's Organizational Structure**

Gerdau Group is an ambitious company. Its vision is “to be a global steel company and one of the most profitable in the sector”.<sup>1</sup> To the Gerdau Group, success of the corporation is based on constant sustainable growth and continual improvement in its functional processes to generate value to Shareholders, Clients, Employees, and the Community.

As noted, the consolidation of its operation in the Brazilian market took place during the “Brazilian Economic Miracle” in the 70s’ and the privatization process that followed in the country during the 80s’ and 90s’. The Gerdau Group expanded its operations in South America in the 90s’ and reached the U.S market in 1999. At that time, the steel market was being restructured. The severe economic problems in Asian countries in 1997, together with a worldwide overcapacity, led to a global steel crisis. Because of the limited prospects to increase prices, big firms in the steel industry began to view mergers and acquisitions as the only way to improve earnings. The Gerdau Group has been participating actively in this process of market consolidation by becoming a global company. It now has operations in fourteen countries in the Americas, Europe and Asia.

Gerdau Group's fast expansion was based primarily on acquisitions. In the last ten years, it has acquired several companies. Today, it has plants geographically spread around the world. These plants are organized by products specialties. Similar processes in plants around the world are organized into Technical Committees. These committees are responsible for coordinating decisions and leading technical projects. For instance, investment and technical decisions related to all rolling mills located in distinct plants are

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<sup>1</sup> Gerdau website – [www.gerdau.com](http://www.gerdau.com) – (02/23/2009)

based on the decisions of the Rolling Mill Committee. All resolutions concerning Health & Safety processes are taken by the Health & Safety Committee. The judgments made by the Technical Committees are based on the standard rules established by the GBS<sup>2</sup>. The main goal of these committees is to reduce the gap between the operational results of each plant and internal benchmarks established at high levels by the company. These committees, however, have experienced some problems:

- Low interaction among Technical Committee members who rely on biannual face-to-face meetings and sporadic informal contacts;
- Sharing of knowledge occurs mainly at managerial level, not at the technical level;
- Low use of shared goals among similar mills;
- Low level of integration across mills from different countries;
- In many cases, process experts do not have formal roles;
- Succession of professional specialists, critical in some areas, was rare (example: roll pass design);
- IT systems, especially for knowledge sharing, had neither a structure nor a defined information architecture;
- There are no global rules for access to information.

Gerdau's Directors and the leaders of the Technical Committees were convinced that the solution to these problems and, hence, the enhancement of operational performance in some plants was possible. They believed that the knowledge that existed inside the corporation was vast but not effectively used. They felt the company lacked an efficient tool to capture, organize and disseminate knowledge. Such a tool was necessary to integrate the business units and take advantage of the diversity across plants. Therefore,

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<sup>2</sup> GBS, or Gerdau Business System, is a consolidation of all internal management systems, policies, metrics, and best practices. It became an essential tool for the development of current operations and future businesses.

top management authorized the creation and implementation of a Knowledge Management System in 2007. The main goal of this project was to raise the company's profitability through reducing the operational performance gap among plants. Sub goals and complementary benefits exist as well and are identified below:

- To create an environment for sharing best practices;
- To expand employees' global perspective;
- To capture synergies across processes;
- To improve the benchmarking and sharing;
- To take advantage of the knowledge obtained from acquired companies by disseminating it to the others;
- To bring the performance of the new mills up to the same level as old mills;
- To create a learning process inside the corporation;
- To obtain faster ROI (Return on Investment);
- To increase productivity;
- To identify, give visibility, and provide easy access to specialists;
- To create a knowledge network by similar processes;
- To prepare Gerdau Group for future expansion.

#### **4.2. Alignment with Company's Strategy**

In order to help the company to reach its aims and not lose focus, Gerdau's executives formulated a Strategy Map<sup>3</sup>. This is a tool to govern actions, align procedures, and guide the decision making process inside the corporation by linking the long-term

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<sup>3</sup> The concept of strategy maps was introduced to the business world by Robert S. Kaplan and David P. Norton as a means to illustrate and elaborate their earlier concept, the balanced scorecard. The standard reference for the strategy map is Kaplan and Norton (2001). A further standard reference is Kaplan and Norton (2004).



goals with all the operational activities. The Strategy Map also provides a macro-view of the corporation's strategy.

Figure 4.1 is Gerdau's Strategy Map. It displays the connections among the processes in all spheres of the organization and shows how they interact. The adoption of a Knowledge Management System may improve the performance of some processes such as: "Developing leaders and well-trained technical staff", "Disseminating the best practices (GBS) and streamlining knowledge management", and "Developing synergies among the Businesses." By examining the map one can conclude that the improvement of these processes will help the corporation to achieve its goal of "Generating sustainable value to Shareholders, Clients, Employees, and the Community."

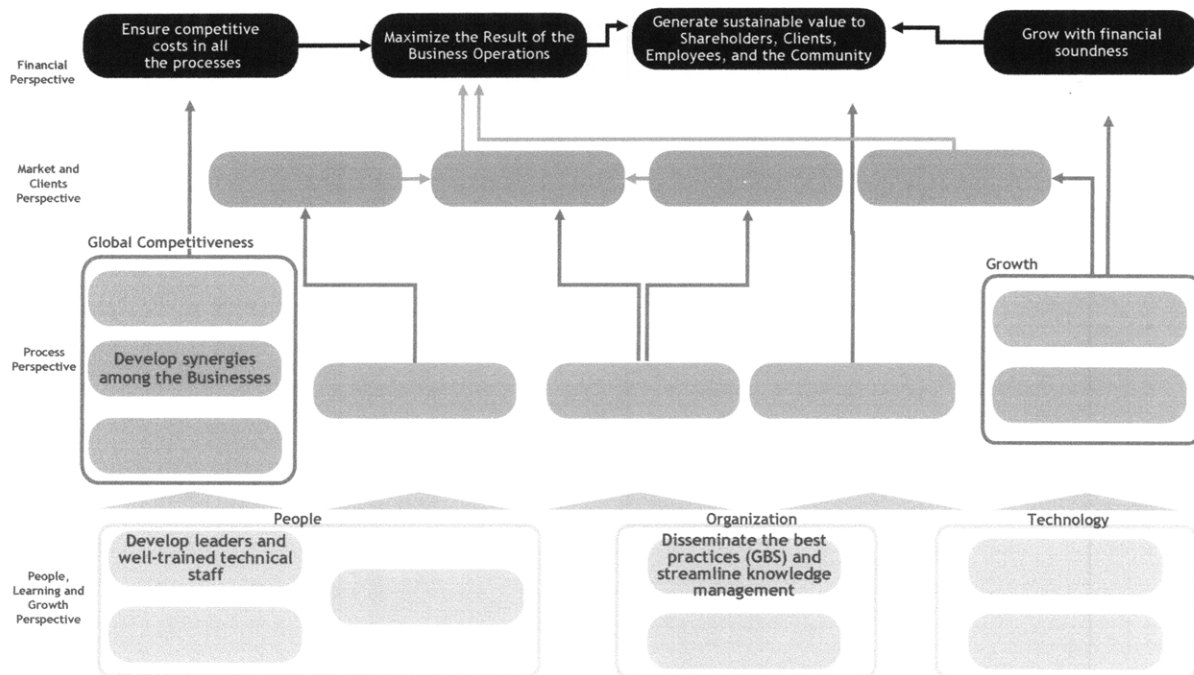


Fig. 4.1 – Gerdau's Strategy Map <sup>4</sup>

<sup>4</sup> Document provided by Gerdau Group – other processes not related with the Knowledge Management System were omitted in accordance with company's policy.

### **4.3. The Knowledge Management System**

Informal networks of people who share information, knowledge, and best practices in specific areas and processes always exist within a company environment. “Communities of Practice” represent the recognition and formalization of these networks within the organizational structure. As discussed earlier, globalization and more competitive environments have led many organizations to recognize and formalize the Communities of Practice as a way to organize, disseminate and create knowledge. Through interaction among peers, these communities foster a collaborative learning process of sharing knowledge and ideas. The benefits of such communities are huge not only to the organization but also to employees. Some are listed below:

#### **For the Company**

- To serve as a way to solve operational problems;
- To eliminate duplication of projects / processes;
- To decrease re-work and improve productivity;
- To document and transfer best practices and process know-how;
- To connect people and reduce barriers between functional areas and divisions;
- To foster skill development;
- To sustain employees' commitment;
- To create a critical mass of employees and thus insure that knowledge is not lost when individuals retire or otherwise leave the company;
- To promote process innovation.

#### **For Employees**

- To allow continual knowledge updating;
- To provide quick answers and focused information;
- To offer the quick location of specialists;

- To give employees a chance to test their own beliefs and knowledge;
- To foster skill development;
- To create a knowledge network;
- To contribute to social integration;
- To grant recognition;
- To provide global exposure.

The conception of the project at Gerdau Group was based on the creation and implementation of specific Communities of Practice. Each process was split into sub-processes. Each sub-process has its own community. Each community allows for the sharing of knowledge among its members and also supports the Technical Committee under which it falls. For example, the Rolling Mill Process, which congregates all Rolling Mills in the various plants around the world, was split into eight sub-processes:

- Reheating;
- Rolling;
- Heat treatment;
- Finishing end;
- Roll pass design;
- Automation;
- Roll shop; and
- Quality inspections.

Each one of these sub-processes already has or soon will have a dedicated Community of Practice.

Figure 4.2 shows how the Communities of Practices are inserted into Gerdau's organizational structure.

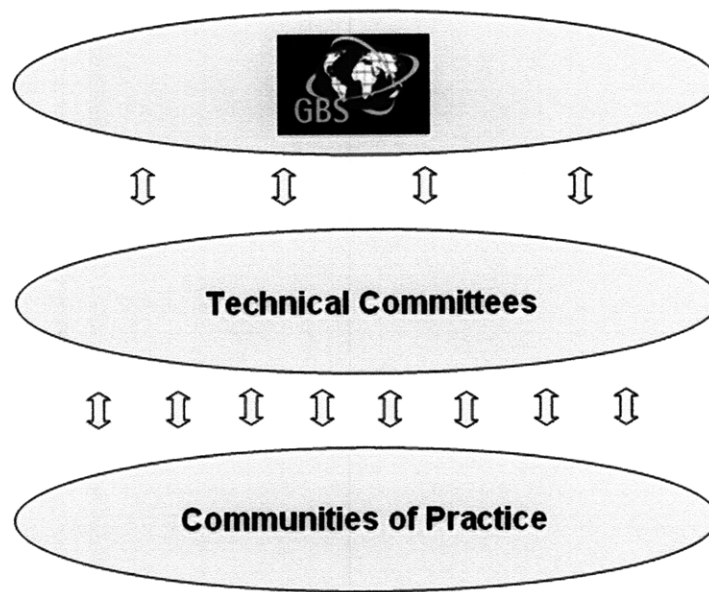


Fig.4.2 – Gerdau's Organizational Structure for Communities of Practice

(Source: Document provided by Gerdau Group)

The communities of practice are comprised of three types of employees: members, moderators and specialist.

*Members* are those who take active ownership in the community by participating in its events and activities.

Their roles are:

- To share their knowledge and practices;
- To ask and to solve questions;
- To engage in discussions and propose improvements and innovations.

Their required skills are:

- Communication and team work abilities;
- Technical knowledge

*Moderators* are those who connect community members and keep the community active.

Their roles are:

- To manage the community's participation and resource allocation;
- To foster and facilitate discussions;
- To request the participation of specialists in specific discussions;
- To organize and manage the content and subjects of the discussions;
- To communicate to members about desired and non-desired documents and behaviors;
- To identify and invite new members into the community;
- To report community results.

Their required skills are:

- Communication and team building skills, to make people enthusiastic about participation and contribution;
- Negotiation skills to get people to participate and obtain resources;
- Technical knowledge;
- Comfort with IT tools;
- Language skills (Portuguese, English and Spanish).

*Specialists* are those who have expertise in subjects related to the community's technical domain. They are the sources of specialized knowledge.

Their roles are:

- To explain best practices;
- To visit units in order to transfer practices and to solve problems;
- To improve the knowledge within their area and search for and identify benchmarks;
- To foster discussions about emerging technologies.

Their required skills are:

- Deep technical knowledge;

- Strong methodological competence;
- Communication capability;
- Language ability (Portuguese, English and Spanish).

In order to help identify community of practice members, Social Network Analyses (SNA) were conducted with employees in each sub-process. As discussed in Chapter 2, Social Network Analysis is a methodology used to discover the relationships and interaction patterns within a specific group by using questionnaires and mapping methods. This kind of analysis helped the company identify those who hold and seek knowledge in different plants inside the organization.

In an analysis that was conducted with employees of Rolling Mills, for instance, a survey was sent to 409 workers in various plants (with a 70% response rate). In this survey, people were asked to indicate who they look for (inside or outside their mills) when they have a problem related to the Reheating Furnace or to Roll Pass Design. Based on the answers, diagrams representing the SNA for the sub-process Reheating and Roll Pass Design were drawn and are shown in Figures 4.3 and 4.4.

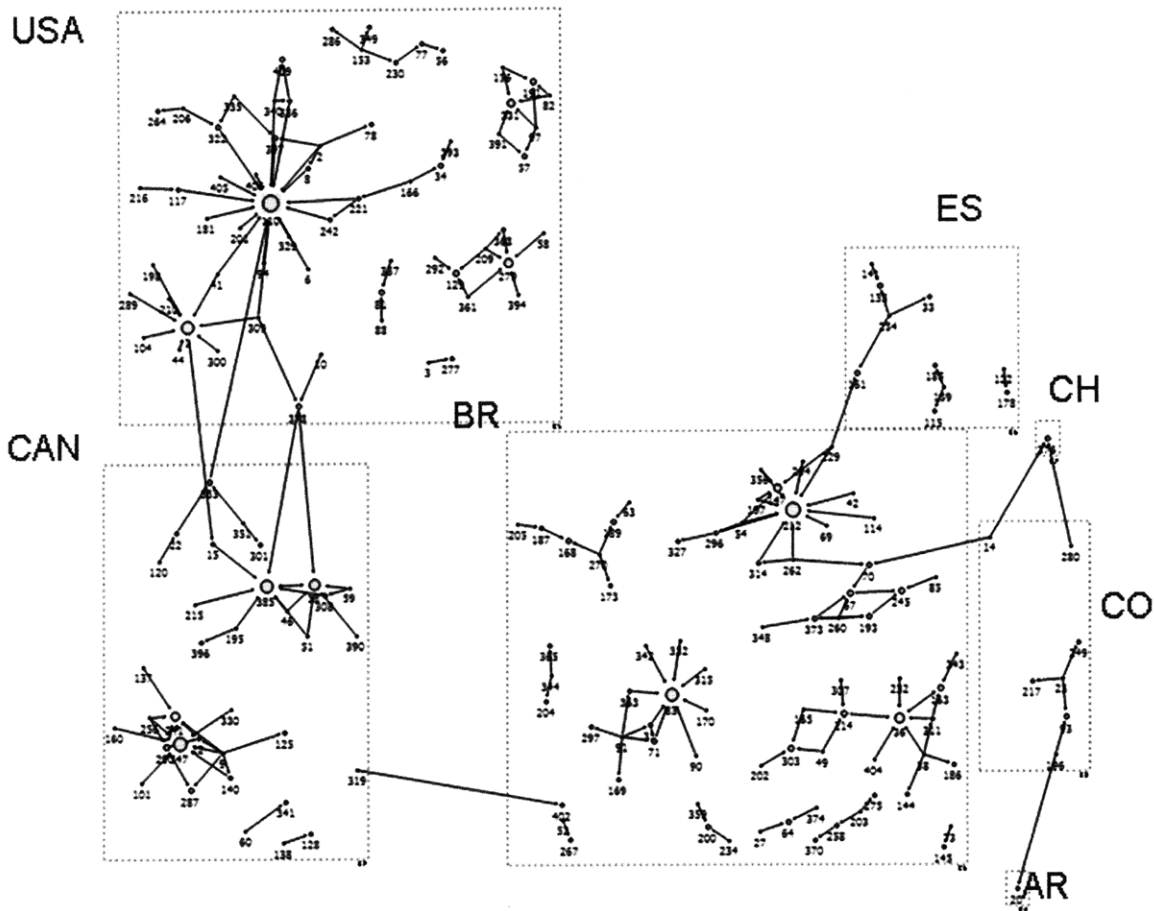


Fig. 4.3 – SNA of the Reheating Sub-process <sup>5</sup>

It is apparent in Figure 4.3 that there is a low knowledge exchange across countries. Most knowledge exchange is within countries and within plants.

<sup>5</sup> Document provided by Gerdau Group. The size of the node represents the number of indications, and the abbreviations represent the countries. The numbers represent individuals.

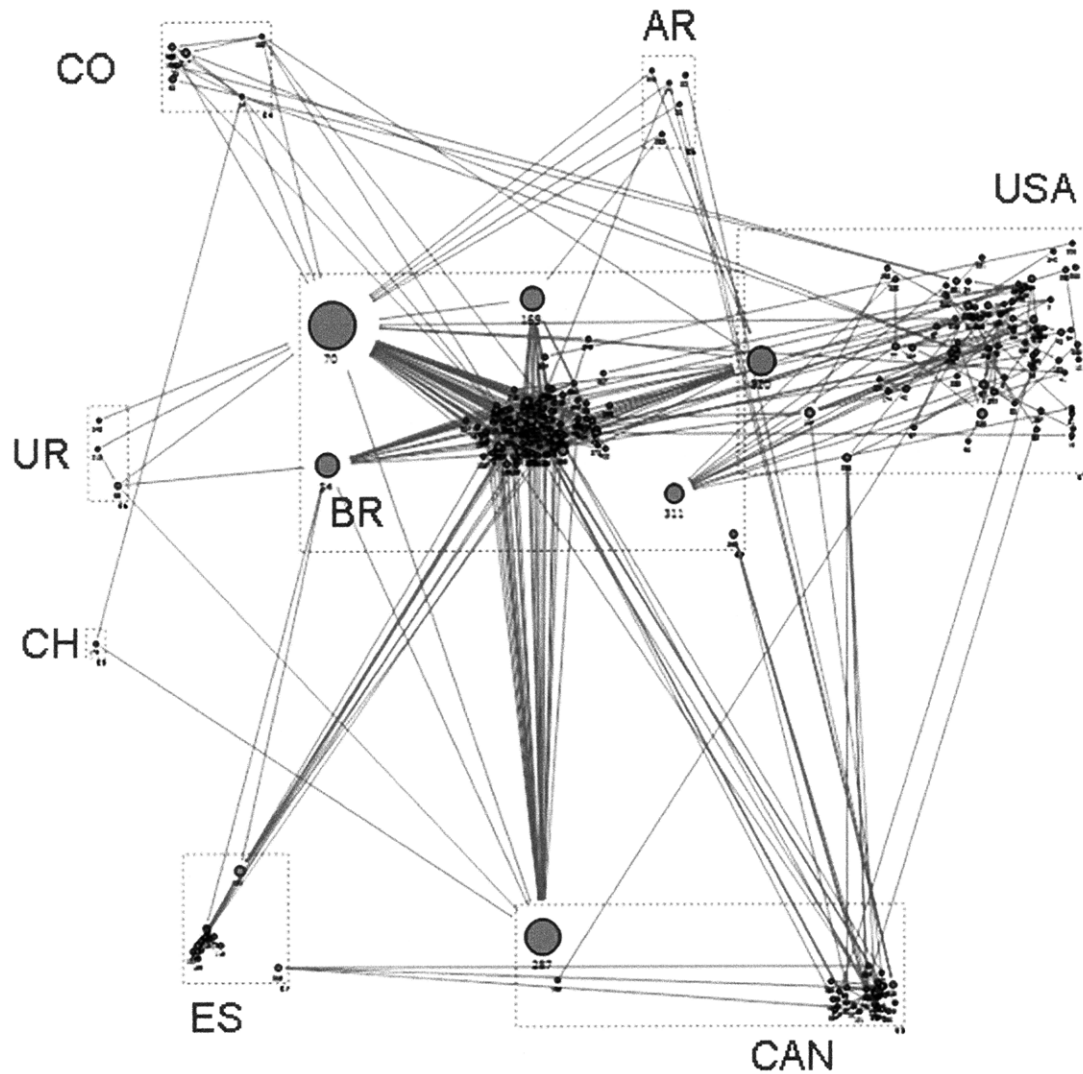


Fig. 4.4 – SNA of the Roll Pass Design Sub-process <sup>6</sup>

Figure 4.4 reveals a different picture than Figure 4.3. Here there is an intensive internal exchange within Canada, USA and Brazil and there are several contact points among these countries.

The same kind of study was done for other sub-processes. Based on these studies, the Community of Practice Project Team invited members, nominated moderators, and identified specialists for each community.

<sup>6</sup> Document provided by Gerdau Group. The size of the node represents the number of indications, and the abbreviations represent the countries. The numbers represent individuals.



The mechanisms for sharing knowledge within each community were identified as:

- Documents in the knowledge base;
- Virtual discussion (blog and forum);
- Audio conferences;
- Scheduled visits by specialists;
- Task-forces;
- Face-to-face meetings as needed.

The knowledge to be shared within the community was to address specific matters identified as:

- Problem solving;
- Locating best practices;
- Sharing initiatives and actions;
- Producing technical documents;
- Fostering innovation.

Having established the goals, the players, and the domains of the communities, it was then necessary to create a space where knowledge within a community can be shared. Gerdau wanted to capture the knowledge spread throughout its plants around the world. It was impossible to create a physical location where people could regularly meet for this purpose. Thus, a virtual space was developed on Gerdau's intranet system. This space is dedicated solely to knowledge exchange. Using this IT tool, *members* can search for information, ask questions, participate in discussions, and look up other members in the "yellow pages". *Specialists* can ask questions and post articles about new technologies. *Moderators* can manage community participation, organize forums, store documents, and stimulate discussions. Figure 4.5 shows this virtual space.



Fig. 4.5 – GerdaU Knowledge Management Webpage

(Source: GerdaU's intranet)

The assessment of each community is based on the quantity and quality of participation. Members receive emails from moderators encouraging them to access the web space frequently even if they do not have an immediate question or a contribution to post. By reading others' discussions, the hope is that they will identify similar situations in their own plants and use this information to improve the performance of a process or generate innovative ideas. The software which manages the Knowledge Management System is able to track each community member's frequency of access. The system generates a report at the end of the month. The quality of members' participation is evaluated through a survey of community peers. All members are asked to identify those who contribute to and use the community. The overall objective is for employees to share knowledge and implement actions that contribute to the success of the company. In recognition, the most collaborative member in a community has his success case

communicated globally and is invited to participate in meetings with the Technical Committees. Some may be invited to participate in external technical seminars. Visits to his/her plant by members of the Technical Committee may occur to view the implemented project and to check for the possibility of replication in other sites. He/she may also be seen as a potential new moderator or specialist in the community.

Moderators are evaluated by the community's bottom line results – active participation, exchange of best practices, and project implementation. Community members, Industrial Directors and Technical Committees are responsible for this assessment. In recognition, the most successful moderators are invited to participate as special guests in the GBS Committees and receive an "Honor Appointment."<sup>7</sup>

Specialists are evaluated by "breakthrough projects" initiated within communities, by valuable technical knowledge exchange projects, and by publication of business cases related to the community. Their assessment is done by the Industrial Directors and Technical Committees. As a reward, they present the best cases to their respective Technical Committees and receive an "Honor Appointment."

#### **4.4. The Implementation Process**

The implementation of the system follows three distinct phases. During the first three months of a community, the most important aspects are members' participation and the creation of initial content. In order to become familiar with the new IT tool and to be aware of their new responsibilities, moderators, the specialist and some members (20 to 30) are invited to get together with a support team for a two-day training exercise. After this period, moderators play the most important role. They are responsible for posting interesting materials and motivating members to ask questions and start discussions in the

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<sup>7</sup> Honor Appointment is a distinction given to the most remarkable employees. Their names and their work are published in the internal communications as a way of providing public recognition for their efforts.

forum. The role of specialist is also critical at this stage. He/she must share best practices with the group and encourage members to start using the new tool.

In the second phase, from the third to sixth month, participation is supposed to increase and the community is spread to more plants. Other members are invited to join, the discussions are to become more interesting, and the value created for the company rises. Moderators are responsible for integrating the new members and managing discussions. Specialists must solve problems and update members on emerging technologies.

In the third phase, after the sixth month, the community is to develop projects based on knowledge sharing. Members are now familiar with the tool and presumably understand better its potential benefits. Moderators should be able to collect successful implemented projects and identify members whose performance is good. Specialists visit units and transfer best practices from one plant to another.

The Knowledge Management System was initially started at Gerdau Group in three pilot communities (Reheating, Rolling Mill and Roll Pass Design) in March 2008. During 2008, Gerdau focused its efforts on implementing the Communities of Practice for Rolling Mill, Health & Safety, and Melt Shop Processes. After one year, it has more than 590 employees connected through 16 communities around 57 sites in 11 countries.

Some good results have been reported and improvements in processes have been obtained based on knowledge sharing. In the Reheating Community, for instance, members from the AZA plant in Chile were unsure about a current procedure and posted a question: "Is it economically favorable to turn off the furnace when there are shutdowns in the production line for short periods of time (less than 8 hours)?" Members from four different plants in Brazil, Chile and U.S. debated the subject for thirteen days and concluded that the best option was to keep the furnace in operation at a temperature around 1330°F. Calculation proved that the fuel consumption to reheat the furnace was

larger than the fuel saved. Moreover, previous experiences in some plants showed that constant changes in the internal temperature of the furnace damaged the refractory bricks which are the raw material of the internal walls, reducing wall life by 25% which represent losses of US\$ 25,000 by furnace. In December 2008, Gerdau had fifty Rolling Mills that were operating with shutdowns periods and could take advantage of the suggested strategy.

Another example comes from the Rolling Community. Workers from the Riograndense plant in Brazil were having problems with the operation of the Laying Head (a machine which forms the wire coils in the Rolling Mill process). They asked for help in the community forum and received answers from members of three other plants. The Açominas plant, also in Brazil, showed how they operated the machine with fewer problems. Workers from Riograndense visited Açominas' plant in order to find out what was being done differently. After observing a day of operation and maintenance procedures, the workers noticed a difference in the shape of one internal component. This change was implemented in Riograndense's laying head, leading to a better performance of the equipment. Product quality was improved and the shutdowns in the production line were reduced, generating a gain of US\$ 70,000 / year.

In the Pass Design Community, members of the Knoxville plant in the U.S. were in doubt about the possibility of rolling 5" and 6" billets in the same passes they currently rolled the 5.1/2" billet, and posted a question. They received four responses within a week and could learn from the experiences of other colleagues.

Despite these (and other) improvements in processes, the Project Team is aware that Gerdau's Knowledge Management System is not yet mature. Although many communities promote discussions at a high technical level, the conversion of this knowledge into real actions and implemented projects is still limited. Member participation is another problem. In December 2008, just 5% of the 192 members of Reheating

community, which has operated for 10 months, have participated by posting questions, answers, comments or articles on the web space. Twenty-nine percent of the 204 members of the Rolling community, which has operated for 9 months, accessed the web space during December 2008, but just 1% effectively contributed. On the other hand, 63% of the Health community's 35 members have contributed actively to the community just after 2 months.

\* \* \* \* \*

On the basis of these observations, questions arise. How can one motivate more members to participate actively in these communities? How can one convince some members to add this new way of communicating to their routines? Why do some communities have more participation than others? How can good ideas be transformed into implemented projects? What factors are preventing participation from some members? Has training achieved its goals?

To help find answers to these and other questions and help the company with the implementation and use of the new Knowledge Management System, I administered a survey to members of several communities of practice. The methodology, questions, and results are presented in Chapter 5.

## CHAPTER 5 – THE SURVEY

### 5.1. Scope

As stated in Chapter 4, the Knowledge Management System at the Gerdau Group was created only one year ago. As with any new system, the one at Gerdau needs improvements. To achieve good system performance, members must become familiar with the new tool and adaptations are required. Those who are already using the system are perhaps the most qualified to analyze how things are going thus far and to suggest improvements. For this purpose, a survey instrument was developed and submitted to them. The results of this survey are reported in this chapter.

### 5.2. Methodology

#### 5.2.1. Survey Sample

In most multi-user and online communities, the majority of users do not participate actively. Most contribute very little. Typically, a small minority of users account for almost all the content and system activities. Jakob Nielsen (2006) defines those who just read or observe as *lurkers*; those who contribute from time to time as *intermittent contributors*; and those who frequently add materials and contribute to the content of the community as *heavy contributors*. According to the author, this participation inequality can be usually expressed in a 90-9-1 proportion, which means that 90% of the postings are done by just 1% of the users. Figures 5.1 and 5.2 represent these relations.

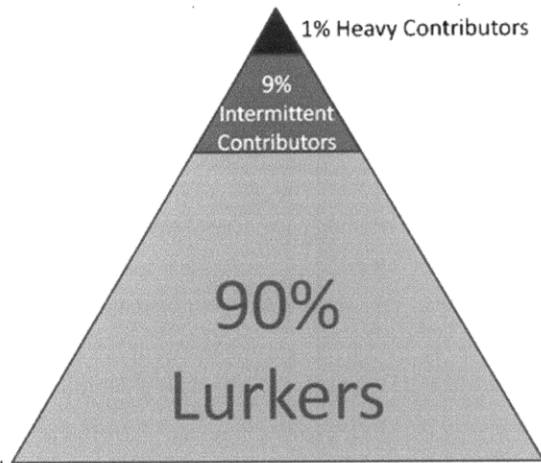


Fig.5.1 – Participation Inequality

(Source: Nielsen, 2006)

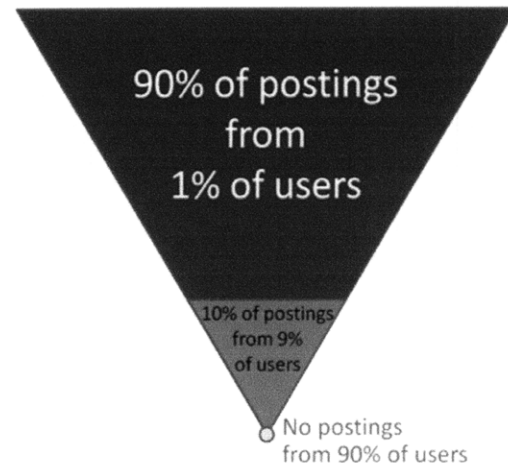


Fig.5.2 – Real Contribution

(Source: Nielsen, 2006)

This phenomenon is not necessarily bad. The ratio appears to be similar in Gerdau's communities of practice. Depending on the job, people have more or less available time, more or less technical expertise, and different interests in participating. Problems arise when this ratio is not considered and one wants to collect opinions from the entire community by posting questions directly in the web space. The answers tend to come from those who participate more actively.

To try to avoid this problem, 97 people at Gerdau were directly invited to complete a survey about their own communities of practice. Respondents were selected from a variety of Gerdau plants (36 in 7 countries), from different communities of practice (13 of the 16 currently existing), diverse hierarchical positions (from trainees to directors), and from distinct levels of participation - *lurkers*, *intermittent contributors* and *heavy contributors*. The number of interviewees represents approximately 16% of the 590 members of Gerdau's communities of practice.

Gerdau plants are distributed across three main regions. Employees in each region share similar cultural characteristics. The regions are:

- Brazil;



- South America (not Brazil) plus Spain (note, just “South America” will be used to represent this region);
- North America (U.S. and Canada) (note, just “North America” will be used to represent this region).

Mr. Fábio Tomé Schmitt, in charge of the Knowledge Management System at Gerdau Group, sent out emails explaining the goals of the research and asking those selected, to participate in the survey through a link which led respondents to the questionnaire. They were given two weeks to post all answers. At the beginning of the second week, a second email was sent out to remind those who had not yet responded to the survey to do so. After the contracted period, answers from 79 members (approximately 81% of the 97 people invited) were obtained.

### **5.2.2. Questionnaire**

The questionnaire (see Appendix B) had 17 questions. Some were multiple choice questions and others allowed for open answers. The survey was written in three different languages (English, Portuguese and Spanish).

The survey has five different parts, each with a distinct goal. The first section (questions 1 to 6) identifies and segments the respondents. The second section (questions 7 to 12) asks the respondents to assess the knowledge system and identify problems. The third section (question 13) asks respondents to evaluate the incentives they have to participate in their respective communities. The fourth section (questions 14 to 16) asks respondents to evaluate how comfortable they are using the system. The last section (question 17) asks respondents to identify potential improvements that could be made in the current system.

### 5.3. Survey Findings

The data and findings presented in this chapter cover all 17 questions of the survey in the same order as they appeared in the questionnaire. The answers to some of questions were cross tabulated in order to seek correlations. These are reported below.

#### Section 1 – Identifying the Respondents and Segmenting the Sample

The answers to questions 1 to 6 identify respondents with respect to their organizational unit, the region in which they work, their age and position, their specific communities, and for how long time they participate.

Question 1 - What unit / plant are you located in?

Fig 5.3 shows the response rates in the three regions that were sampled. Each has a similar rate around 80%.

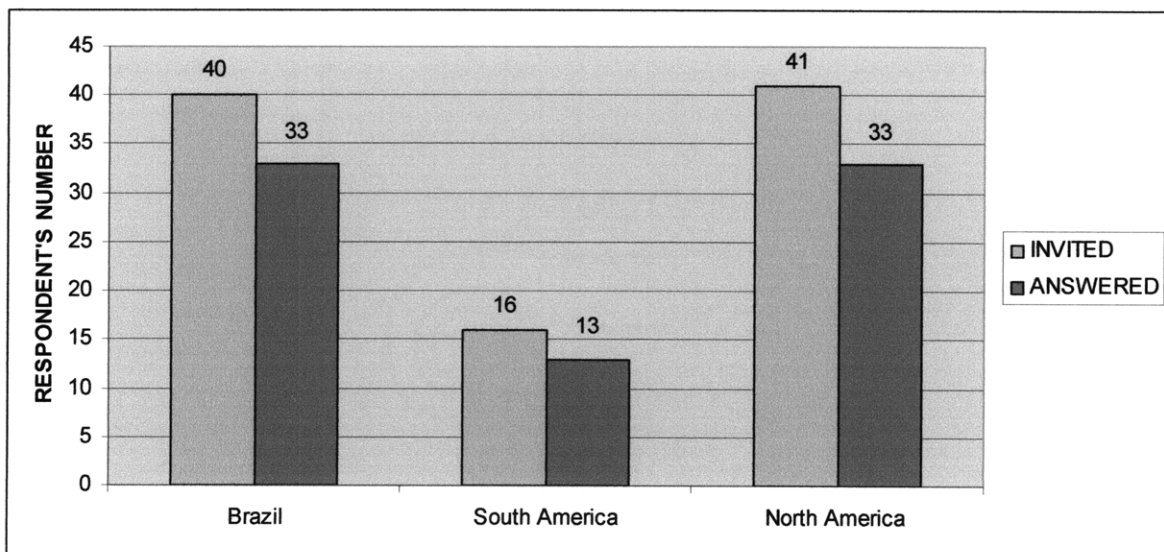


Fig. 5.3 – Response Rates by Region

## Question 2 - How old are you?

The data collected show that respondents represent all age groups within the company. (See Fig.5.4)

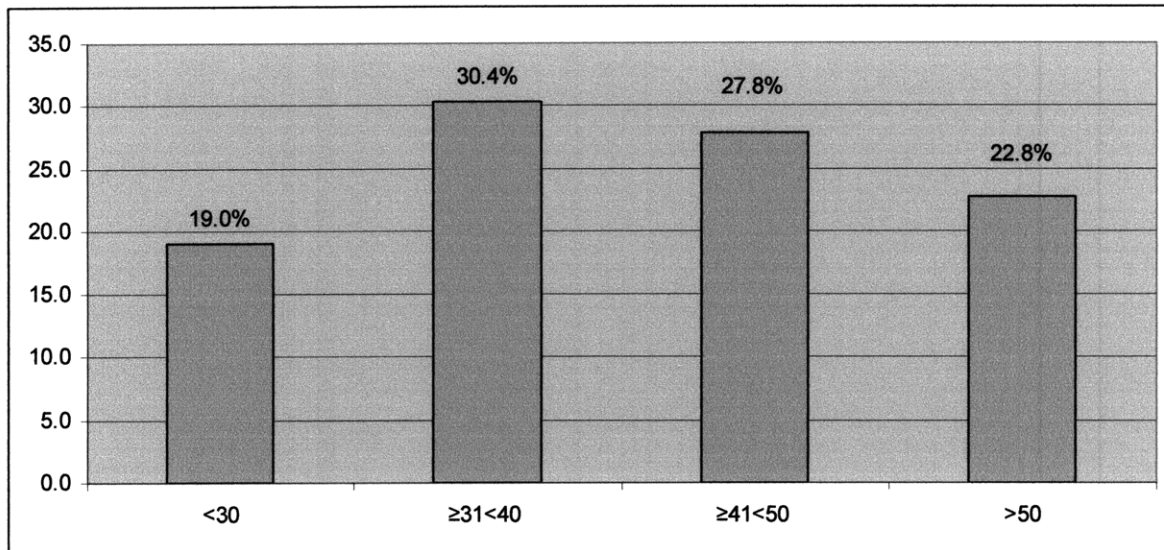


Fig. 5.4 – Respondents' Age Distribution

## Question 3 - What is your current position?

88.6% of the respondents are in managerial or supervision positions. This is in accordance with the distribution of communities' members. To date, few employees in lower levels (operators) have been invited to participate as members of communities. (See Fig.5.5)

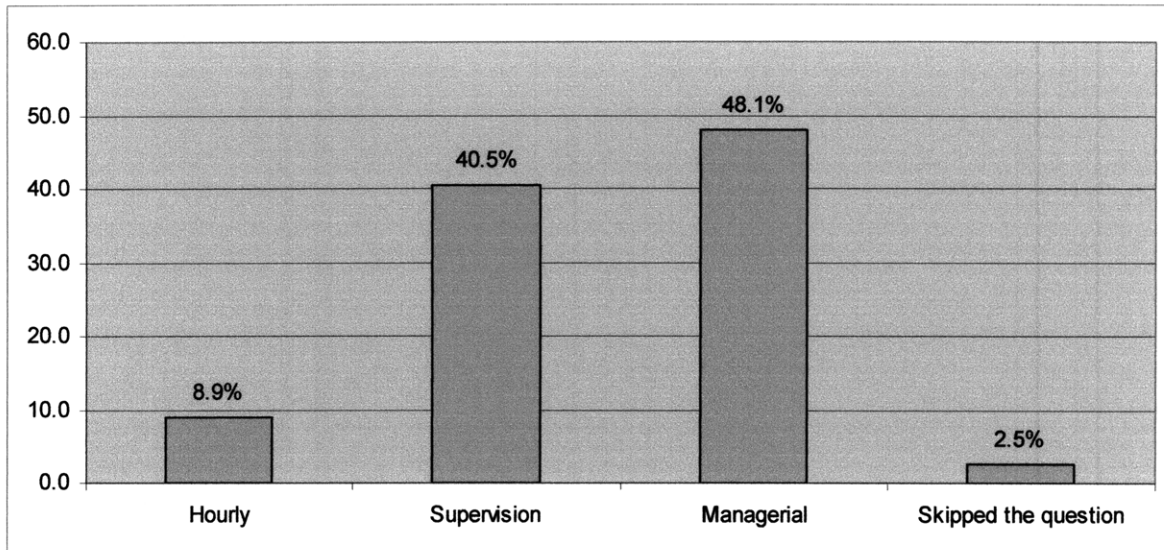


Fig. 5.5 – Respondents' Position Distribution

#### Question 4 – Which communities of practice are you a member of?

The majority of respondents come from the Rolling Mill, Roll Pass Design and Reheating communities of practices (see Fig.5.6). These communities have more members because they were part of the pilot project and have been active for a longer period of time than other communities. It is important to note that it is possible for a respondent to be a member of more than one community. Communities associated with Hydraulic Systems, Predictive Techniques and EAF – Water Cooling Systems were considered in the analysis but were not sampled because they were recently created and still have few members.

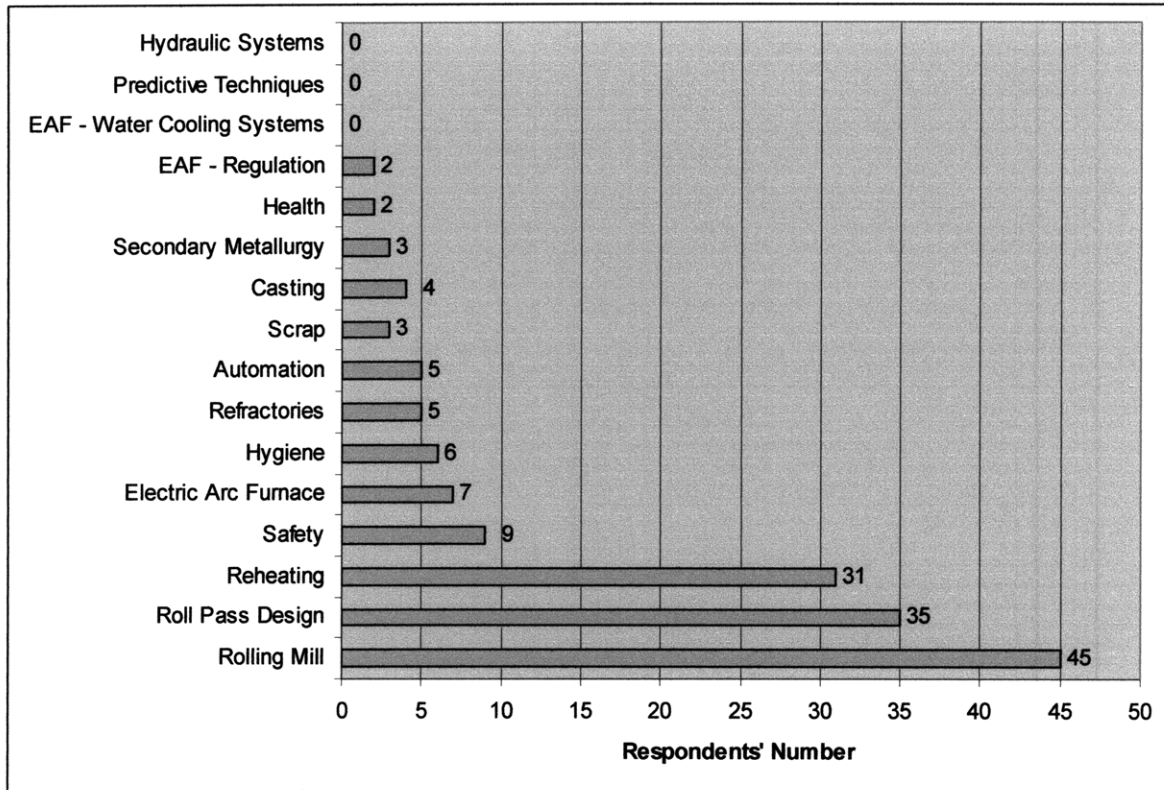


Fig. 5.6 – Respondents' Communities of Practice

Question 5 – How long have you been participating in these communities?

60.8% of the interviewees have participated in the communities of practice for more than 6 months. 21.5% from 3 to 6 months and 15.2% from less than three months (See Fig.5.7)

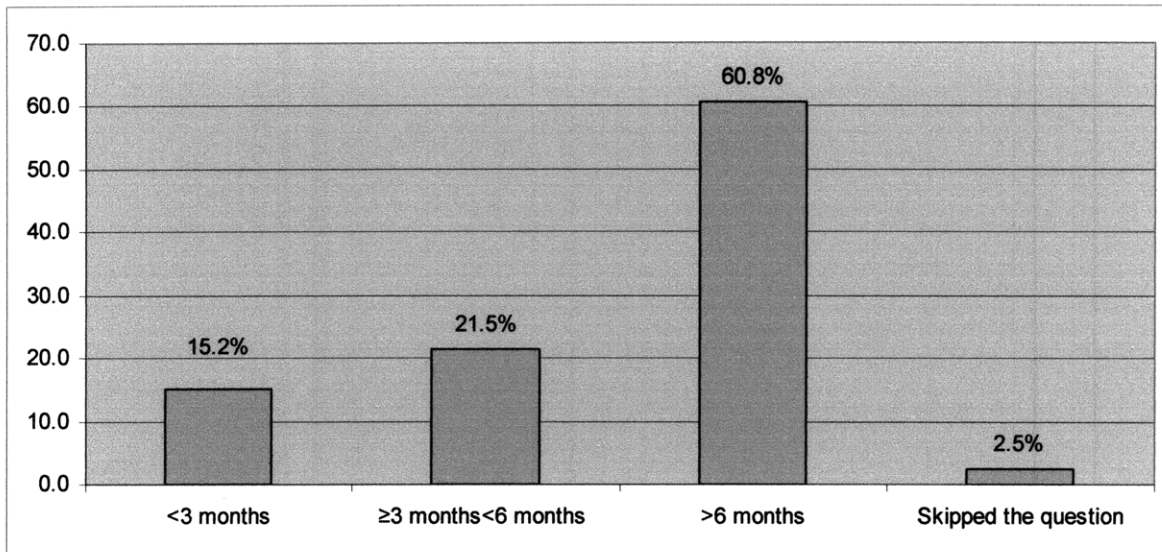


Fig. 5.7 – Length of Time as Member of the Community

Respondents from Brazil have participated longer than those from other countries. The plants from North America have the most new users (participation of less than 3 months). (See Fig.5.8, 5.9 and 5.10)

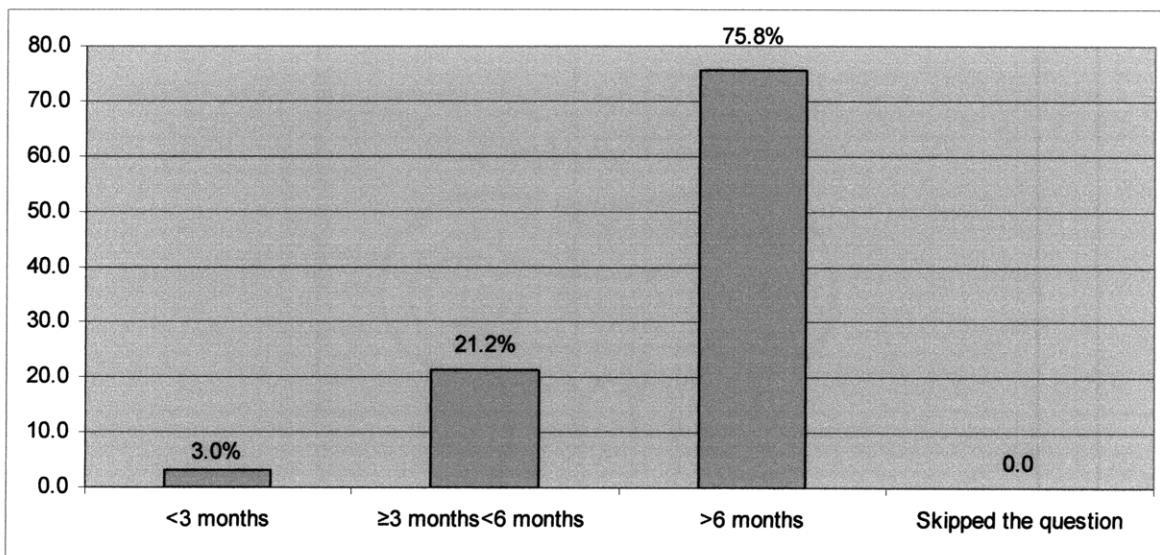


Fig. 5.8 – Length of Time in Community – Brazil

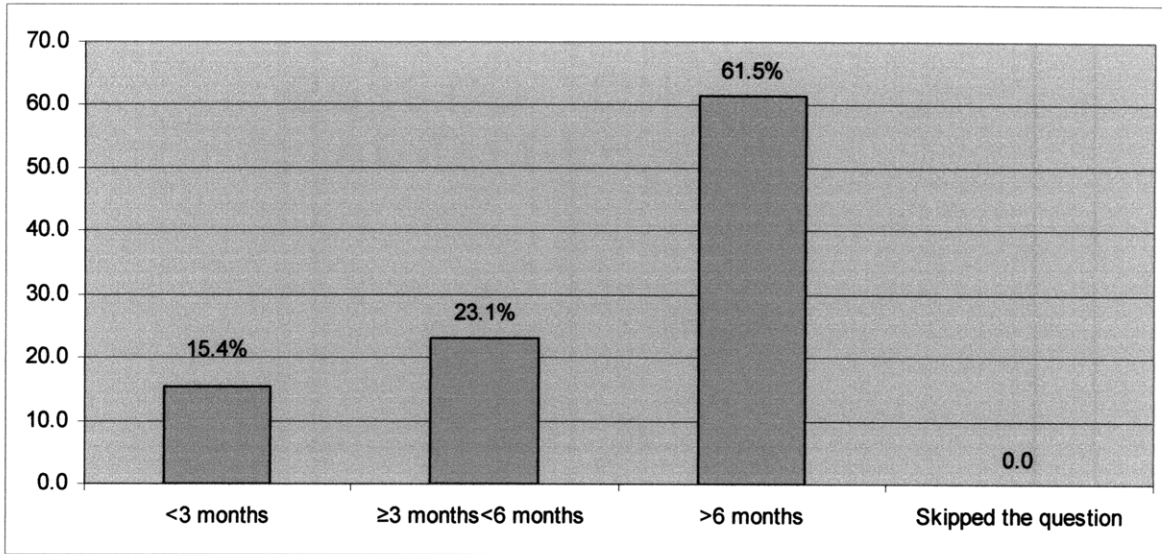


Fig. 5.9 – Length of Time in Community - South America

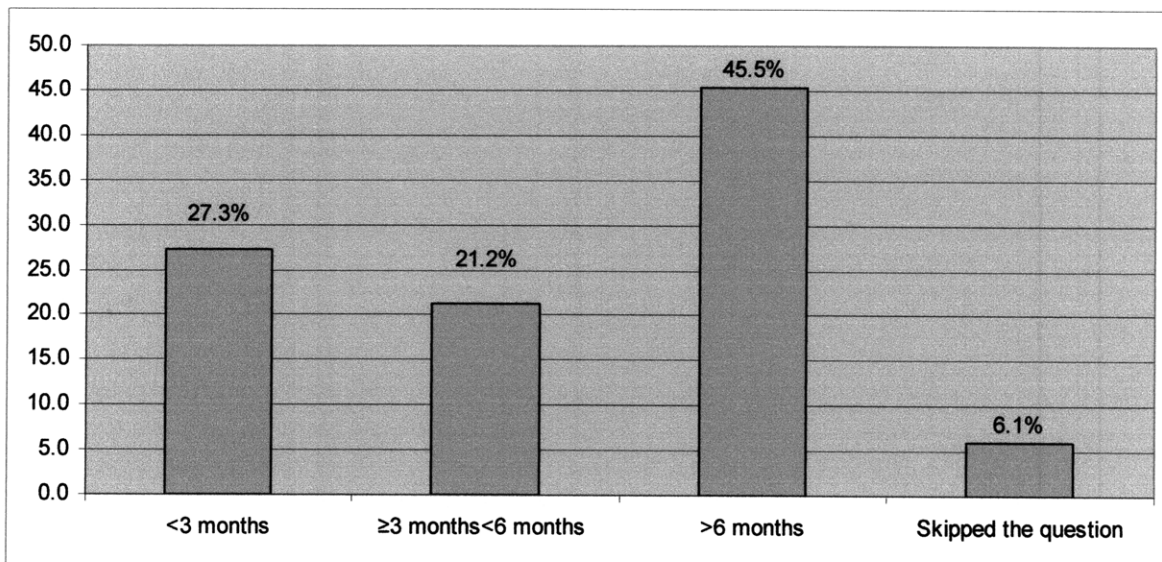


Fig. 5.10 – Length of Time in Community – North America

**Question 6 – Do you usually participate in blogs, forums, or other kinds of digital collaboration outside of the company?**

38.0% of communities' members say they usually participate in blogs or forums outside of the company (see Fig.5.11)



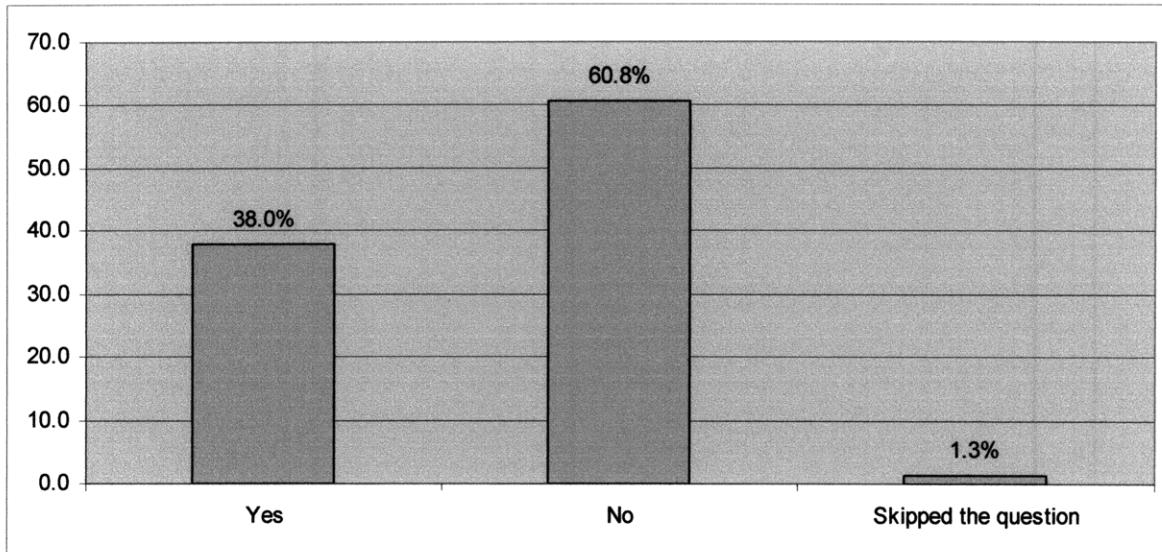


Fig. 5.11 – Participation outside the Company

## Section 2 – Assessing the Knowledge System and Identifying Problems

Question 7 – How much time a week do you spend participating in communities of practice?

The majority of the respondents (57%) say they spend less than 1 hour a week participating in their community of practice. A very small number say they spend more than 4 hours a week (1.3%). (See Fig.5.12).

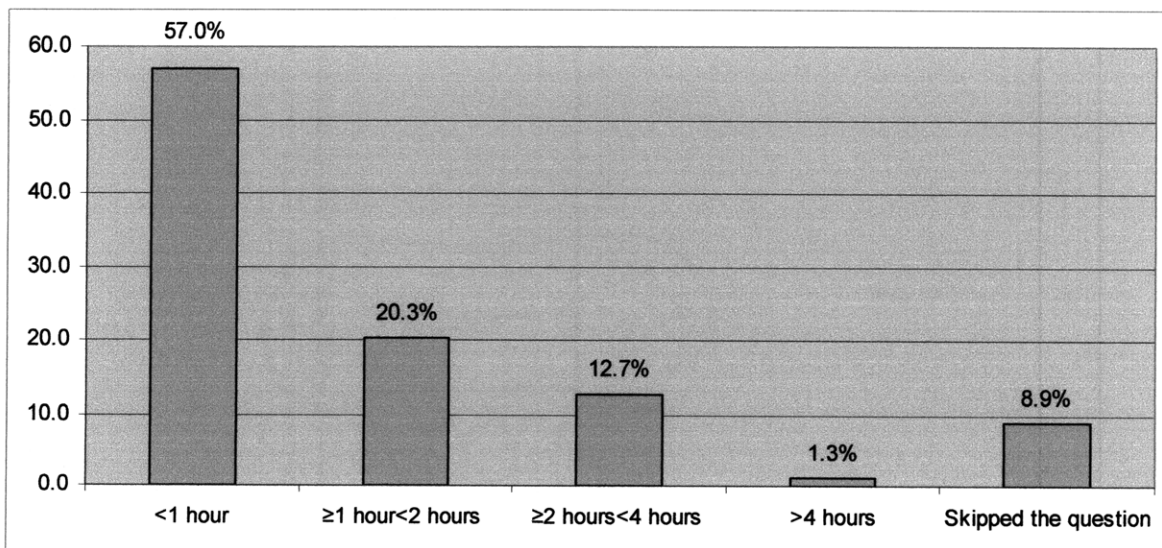


Fig. 5.12 – Time Spent Participating in Communities of Practice



Those respondents from Brazil spend more time per week participating in the communities than members from other regions. (See Fig.5.13, 5.14 and 5.15).

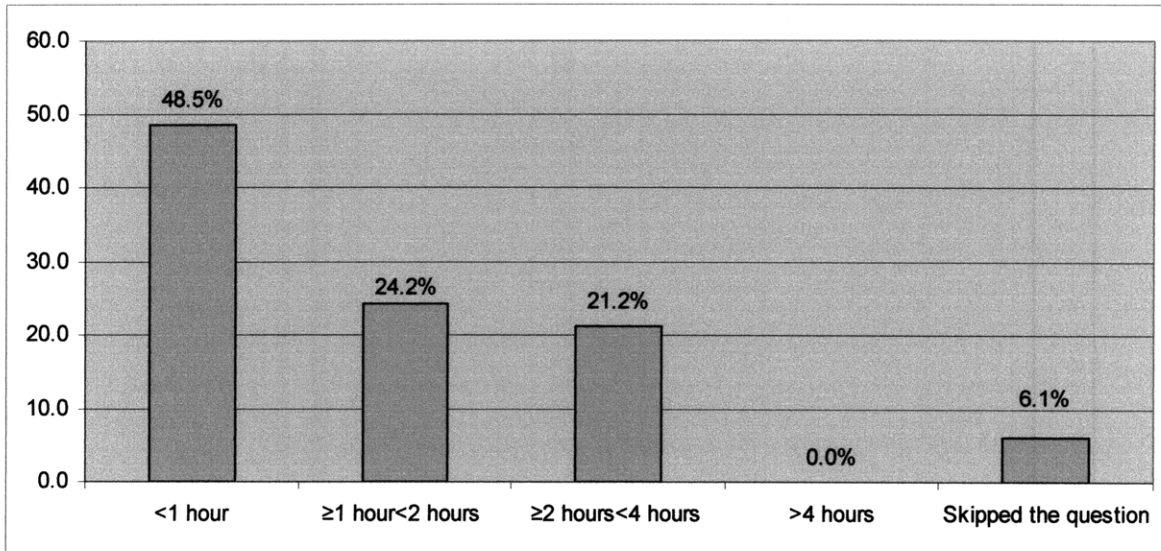


Fig. 5.13 – Weekly Period of Participation - Brazil

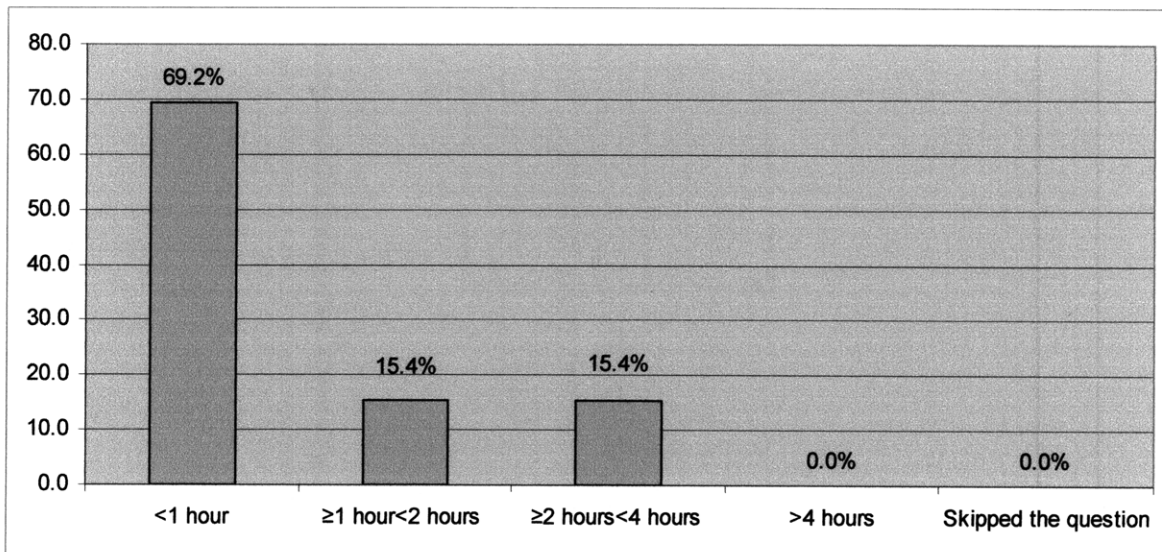


Fig. 5.14 - Weekly Period of Participation - South America

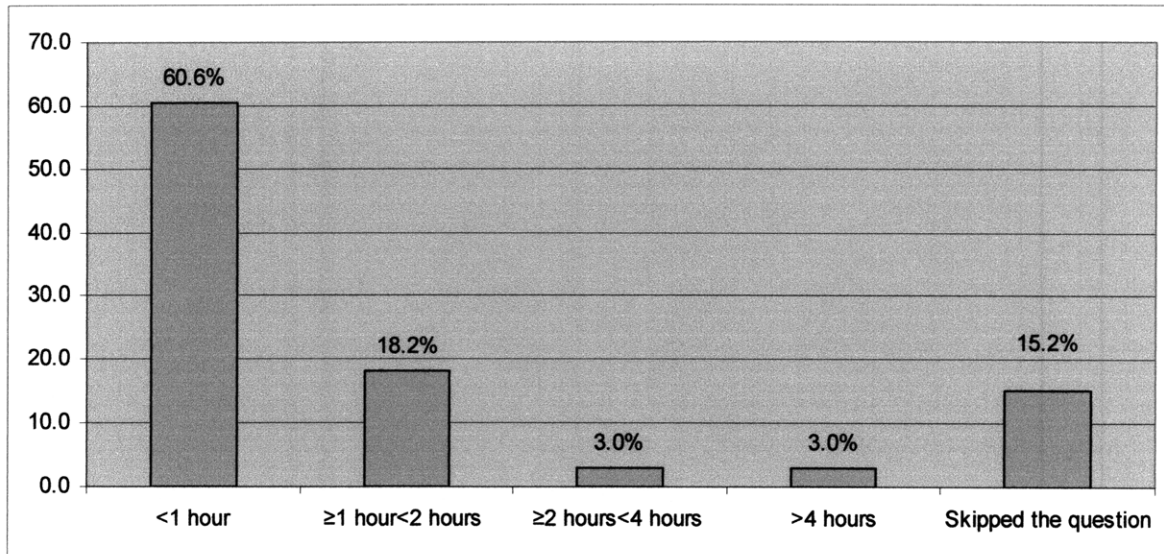


Fig. 5.15 - Weekly Period of Participation - North America

Members of communities related to the Melt Shop process such as: Scrap, Secondary Metallurgy, Refractories, and Casting are those who participate more time per week. From 50% to 66.7% of these communities' members say they spend more than 2 hours a week participating in the communities. (See Fig. 5.16)

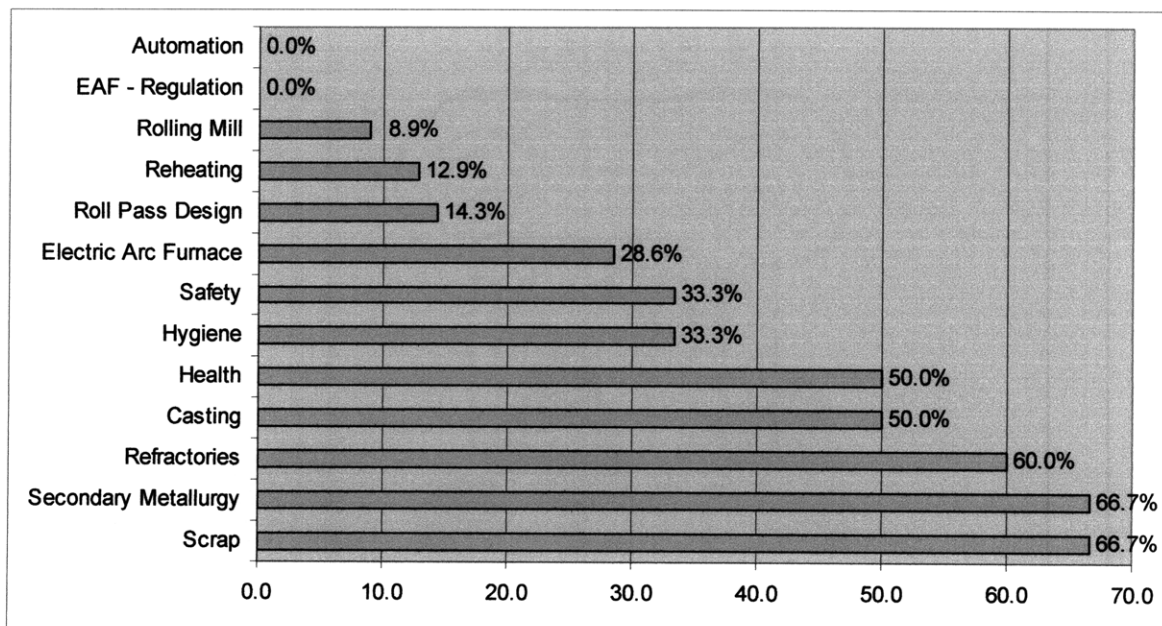


Fig. 5.16 – Weekly Respondents' Participation by Community – More than 2 hours

The results also show that members of communities related to the Rolling Mill process such as: Rolling Mill, Reheating and Roll Pass Design are those who engage in less participation time per week. From 61.3% to 68.9% of these communities' members say they spend less than 1 hour a week participating in the communities. (See Fig.5.17)

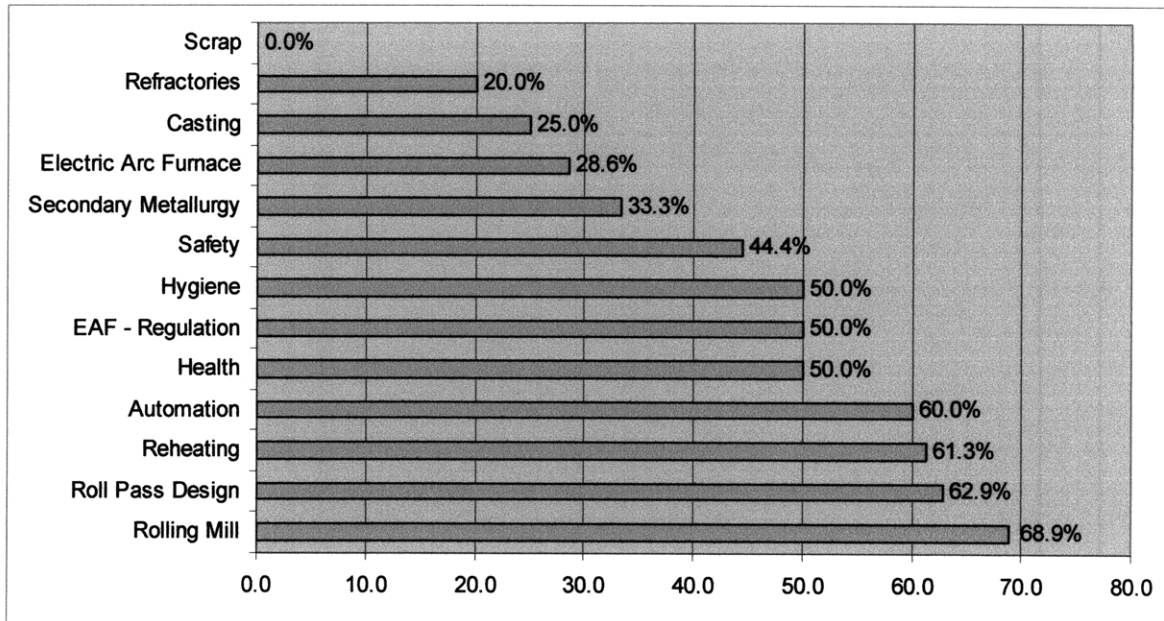


Fig. 5.17 – Weekly Respondents' Participation by Community – Less than 1 hour

#### Question 8 – How do you usually participate?

Fig. 5.18 shows how the respondents usually participate in their respective communities. The most common method is "reading articles." 62% of the members express their interest in the communities but did not really contribute. Almost half of respondents, however, said they use the knowledge system to ask and answer questions meaning that the "Q & A" method is the most used to share knowledge. Just 21.5% of the respondents say they "post work". This practice must be encouraged by the moderators to increase the quality of materials in the communities. Just 24.1% of the respondents consult the yellow pages. Members must be trained to understand and take more

advantage of this tool. 7.6% of the respondents say they participate through “other ways”. These “other ways” represent administrative tasks such as “to approve new membership”.

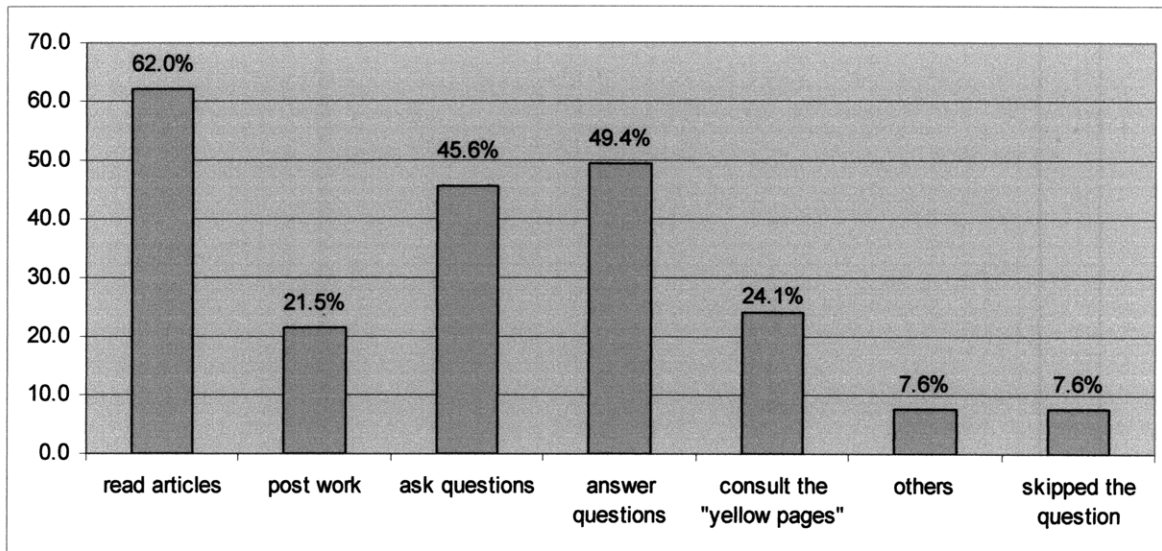


Fig. 5.18 – Participation Modes - Overview

Considering those who “post work” or “answer questions” as “active members”, the collected data show that respondents from Brazil and other countries of South America are more active participants than those from North America. (See Fig.5.19, 5.20 and 5.21).

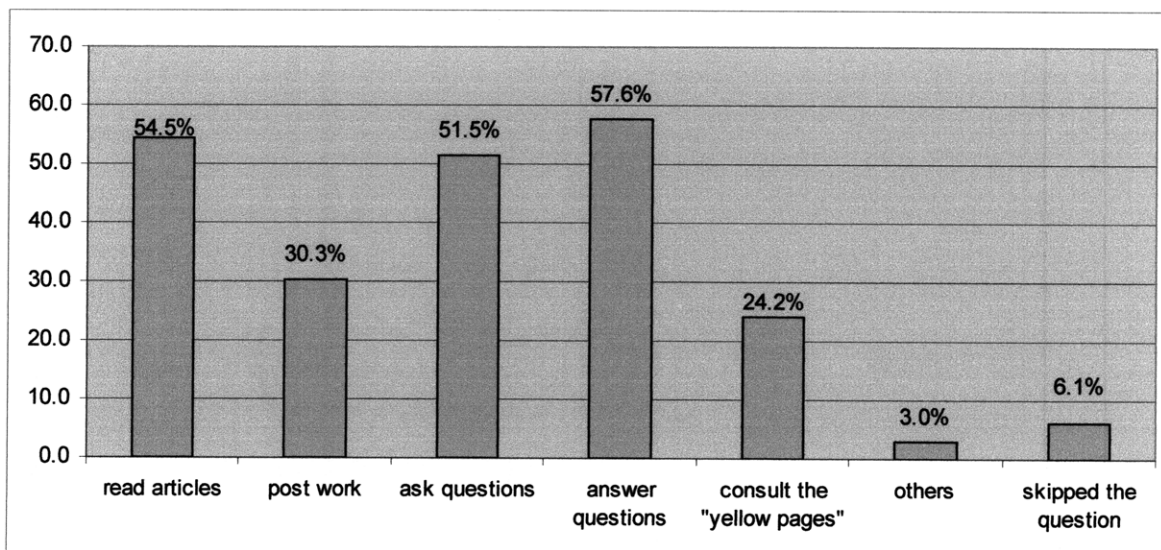


Fig. 5.19 – Participation Modes – Brazil

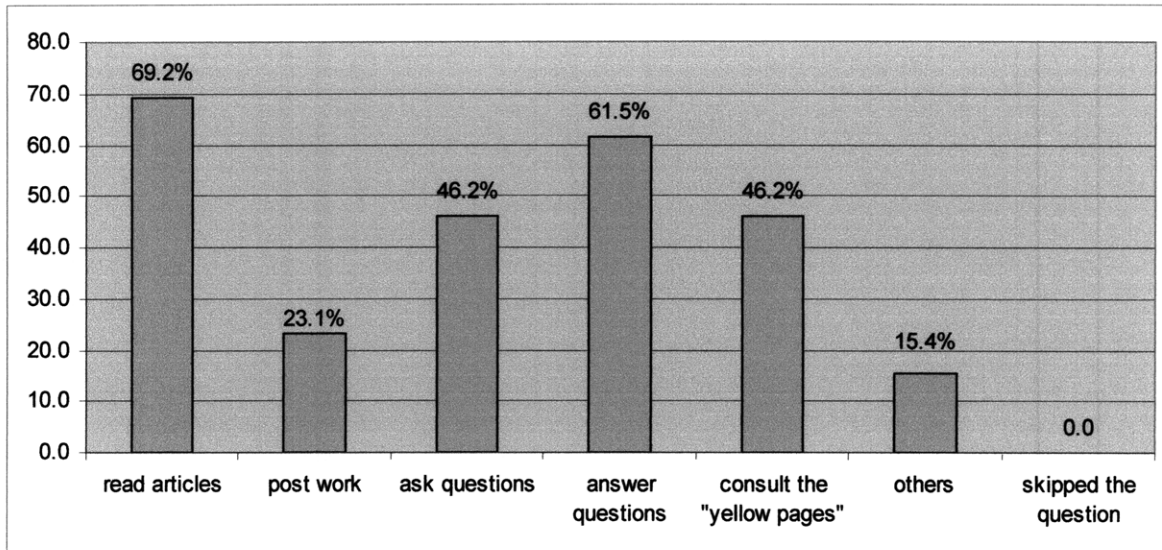


Fig. 5.20 – Participation Modes – South America

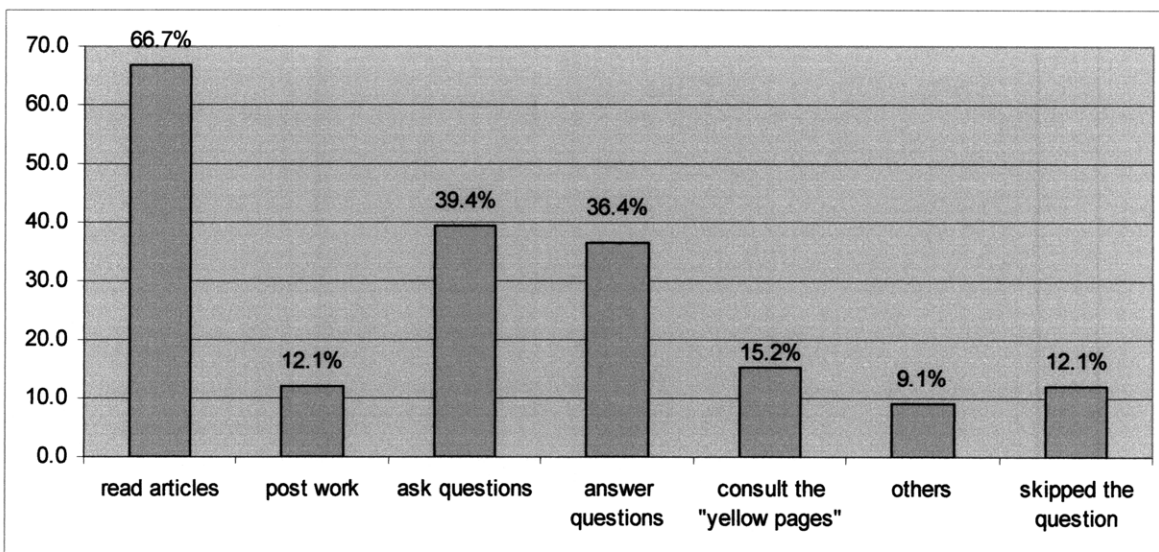


Fig. 5.21 – Participation Mode – North America

The answers to question 8 were crossed with the answers of question 6 to see if there is a correlation between those who report being “active users” and those who say they usually participate in blogs, forums or other kind of digital collaboration outside of the company. No correlation was found. Fig.5.22. shows the results.



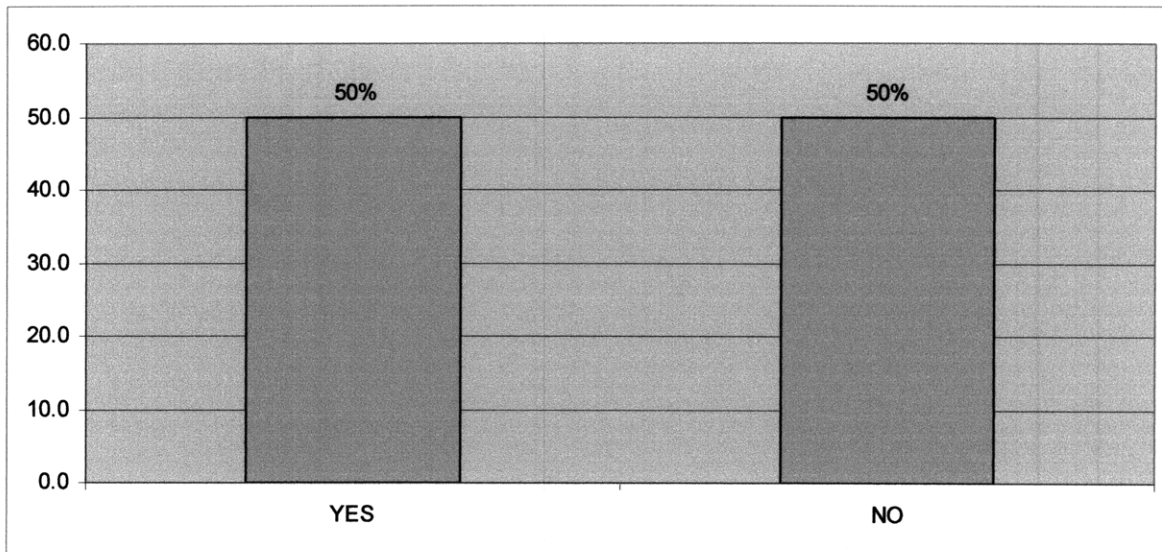


Fig. 5.22 – Active users x Use of Similar Tool Outside of the Company

#### Question 9 – Which reasons limit your participation?

The majority of respondents (58.2%) indicated that “lack of time” is the main limit to their participation (see Fig.5.23). “Lack of time” is a common problem and occurs in similar proportions in all regions.

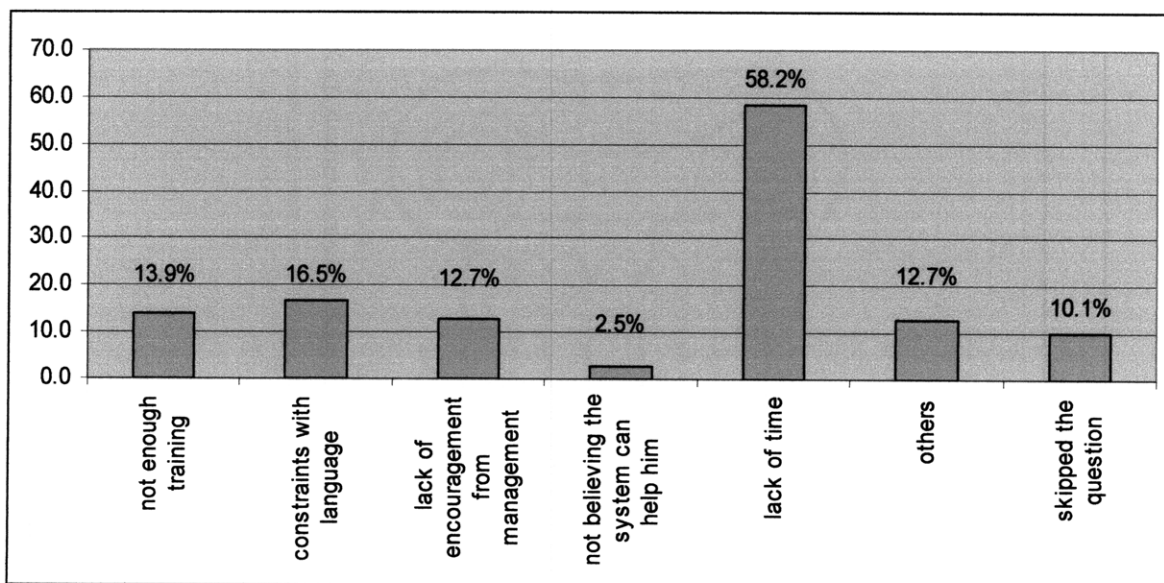


Fig. 5.23 – Limits on Participation

Those who reported having language problems are concentrated in North America.

(See Fig.5.24)

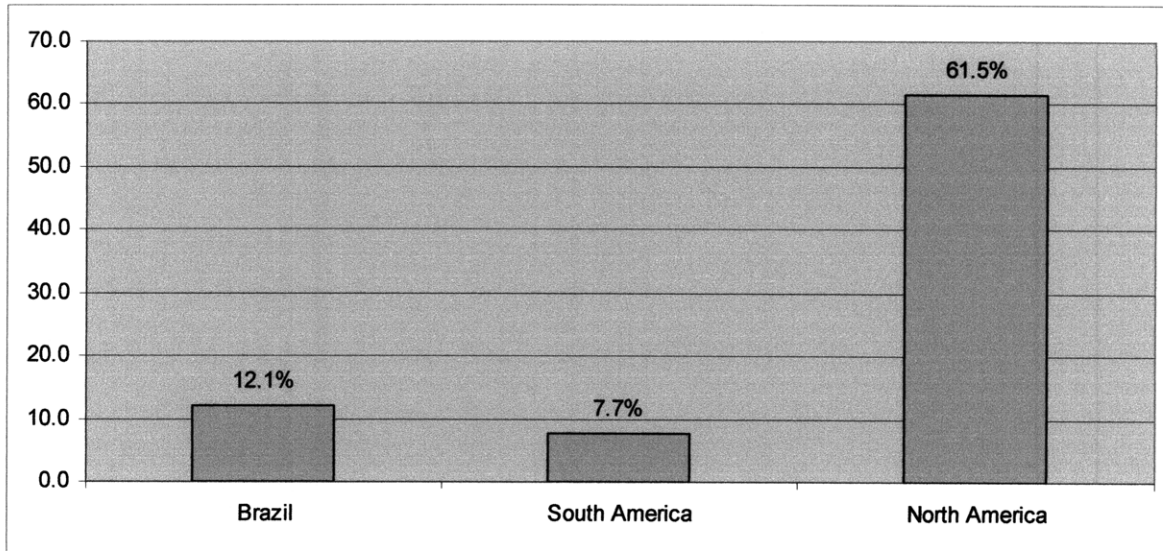


Fig.5.24 – Language Limitations by Region

The answers of those who reported that constraints with language limit their participation were crossed with the answers to question 2. The data show that in North America, the younger members reported more difficult with language than older members, but the problem is common to all generations. (See Fig.5.25)

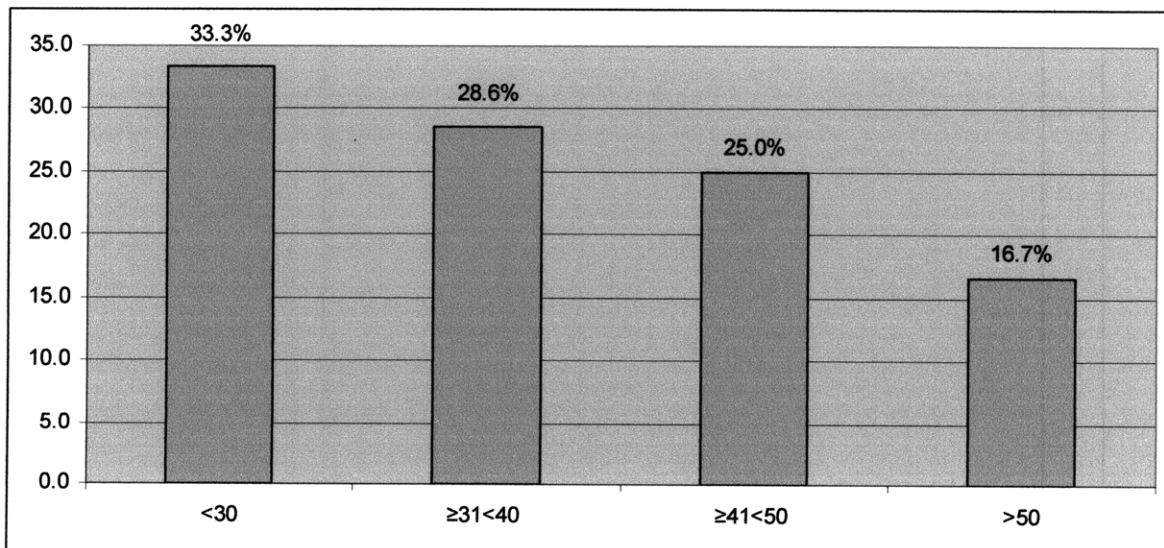


Fig. 5.25 – Language Limitation in North America by Age

The data show that in Brazil, language limitation is concentrated in only one age range (41 to 50 years old). (See Fig.5.26)

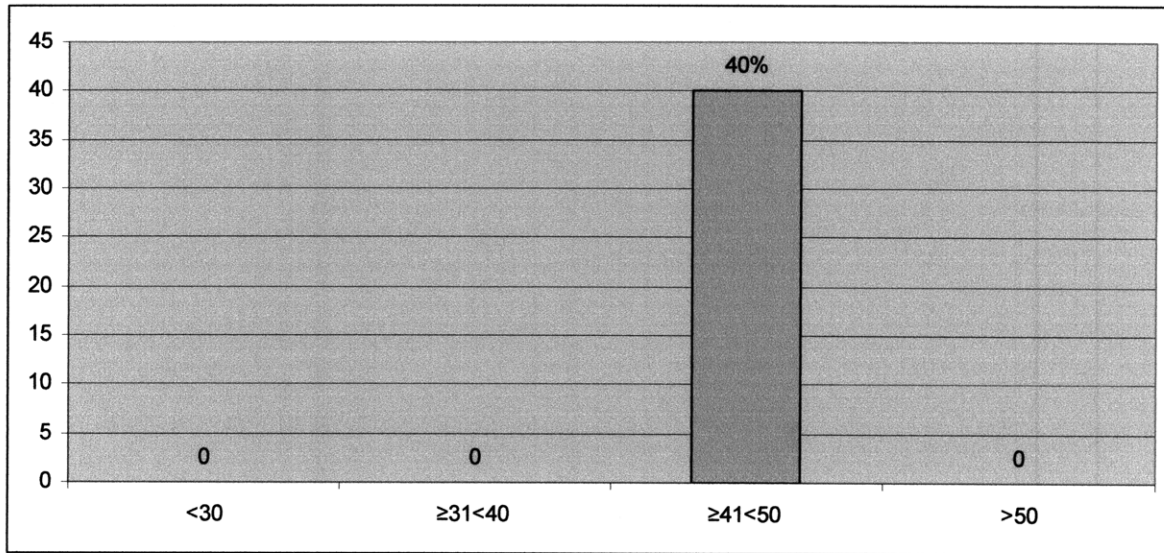


Fig.5.26 - Language Limitation in Brazil by Age

The majority of those who want more training are located in South America. (See Fig.5.27)

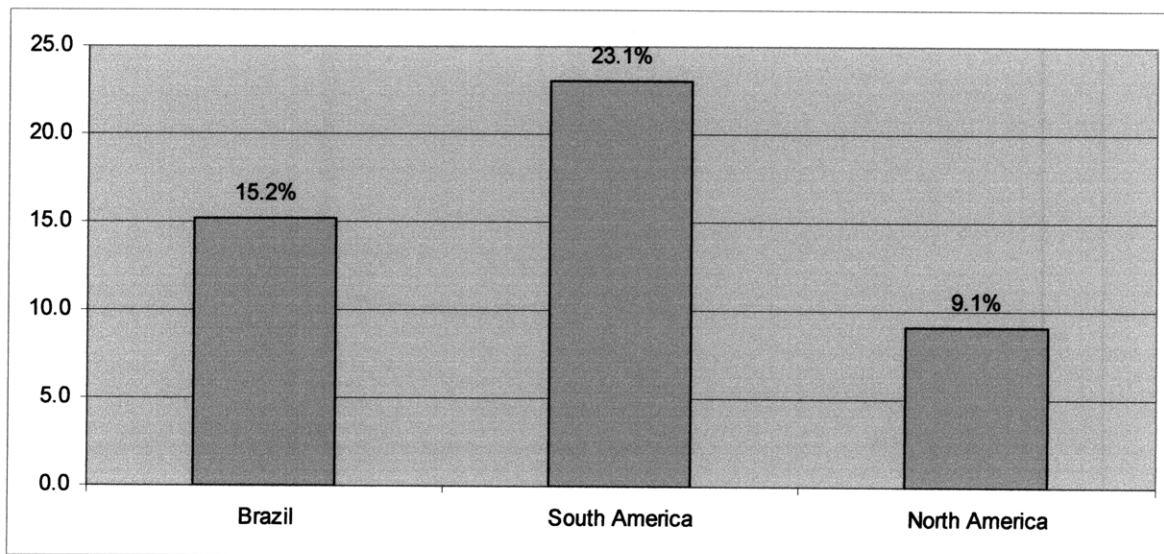


Fig.5.27 - Training Needs by Region



Question 10 – Have you ever applied any knowledge obtained from communities of practice?

40.5% of the interviewed members say they have already applied knowledge obtained from the communities of practice. (See Fig.5.28).

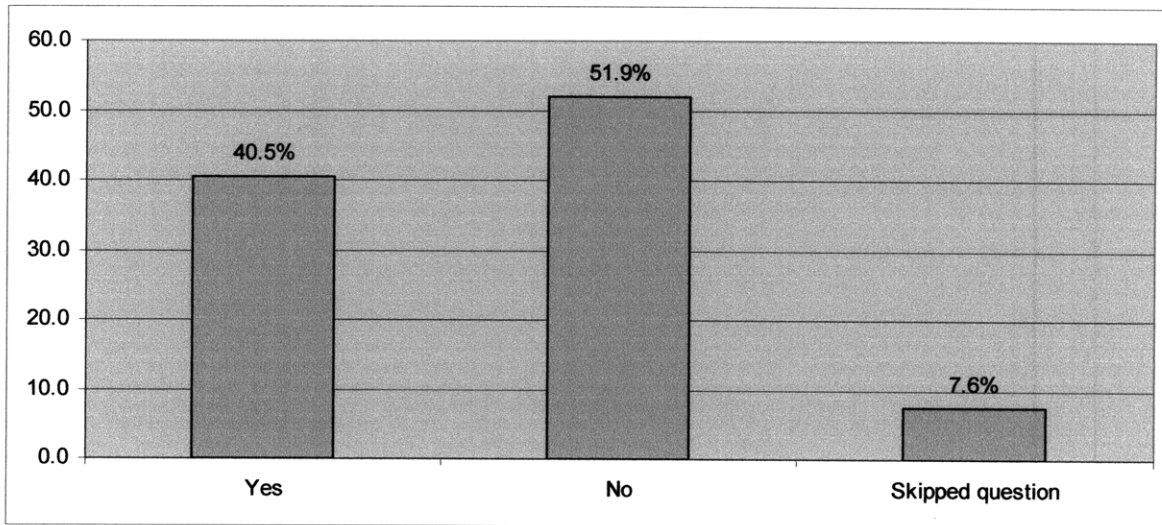


Fig. 5.28 – Application of Knowledge

Application is more concentrated in Brazil and South America compared with plants located in North America. (See Fig. 5.29).<sup>8</sup>

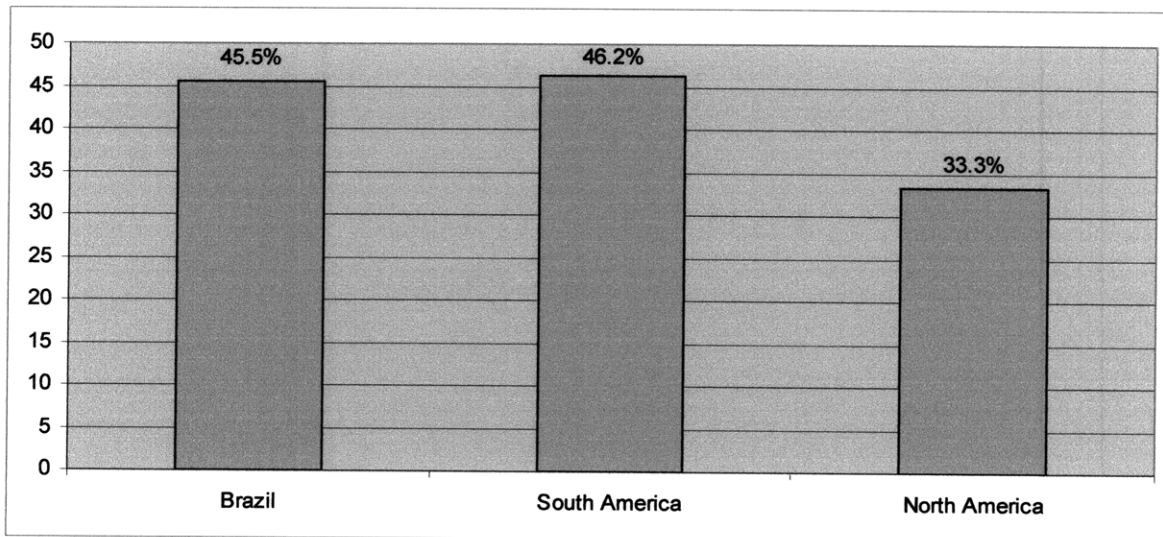


Fig. 5.29 – Solutions Application by Region

<sup>8</sup> Examples of knowledge applications are not presented in this thesis because most of them are written in Portuguese. They are available on request from the author.

The answers to question 10 were crossed with those to question 4. The results show that members of the communities of Health, Hygiene and Safety have applied more knowledge shared through the communities than others. (See Fig.5.30)

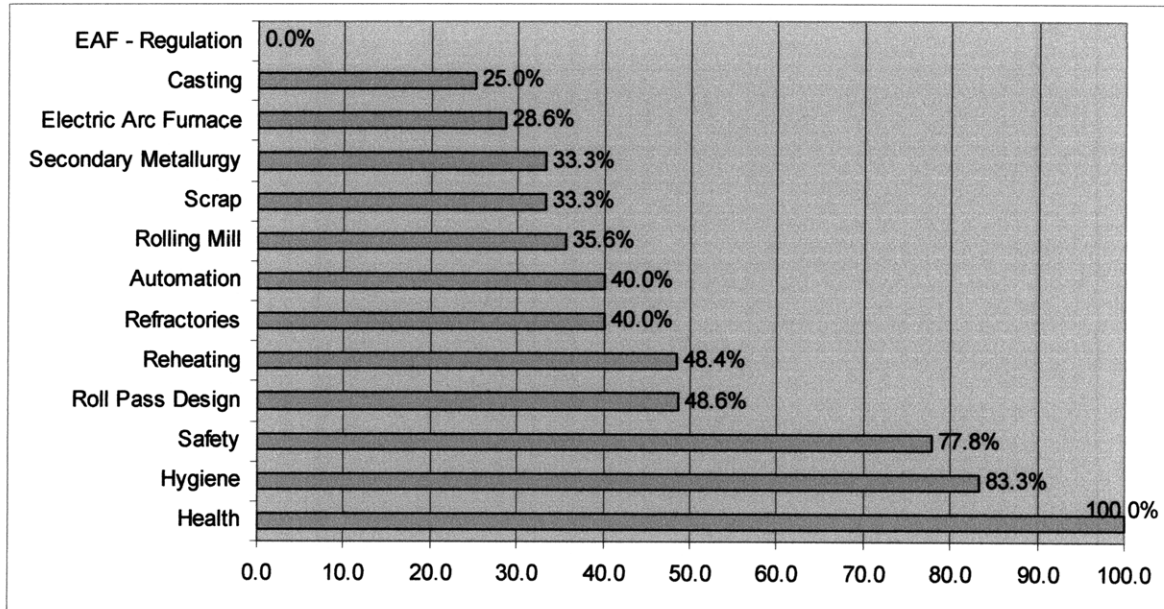


Fig. 5.30 – Knowledge Application by Community

Question 11 – At your unit / plant, is the environment open to innovating processes, applying solutions coming from other companies, and changing manuals and patterns?

The vast majority of respondents (83.5%) say that their work environment is open to innovation. (See Fig.5.31).

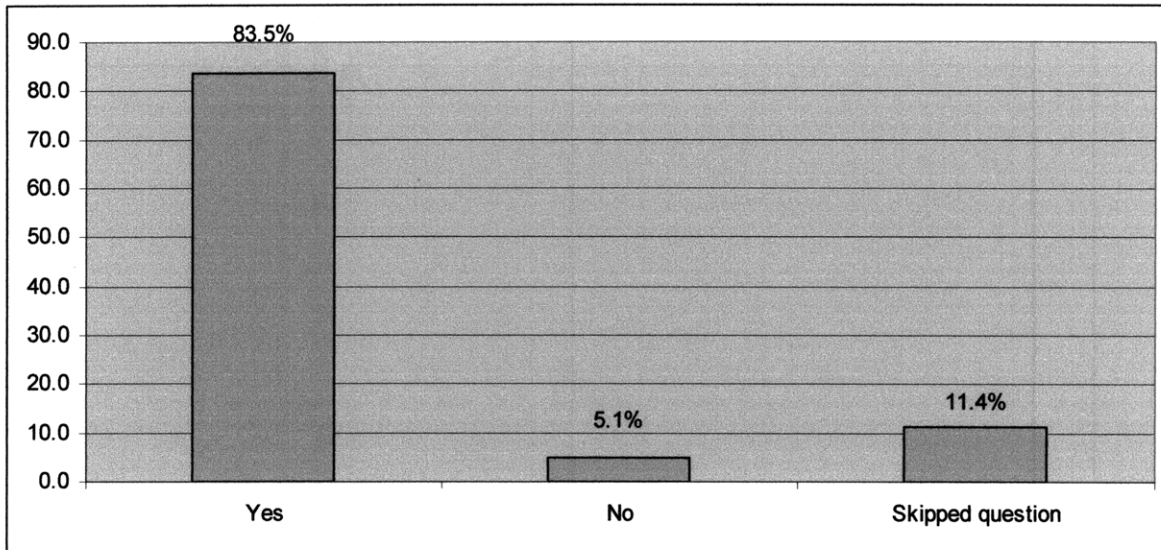


Fig. 5.31 – Environment Open to Innovation

Question 12 – Do you feel any barrier to implement the solutions you find in the communities?

Most respondents (68.4%) say they do not face barriers to implement solutions obtained from their communities. (See Fig.5.32).

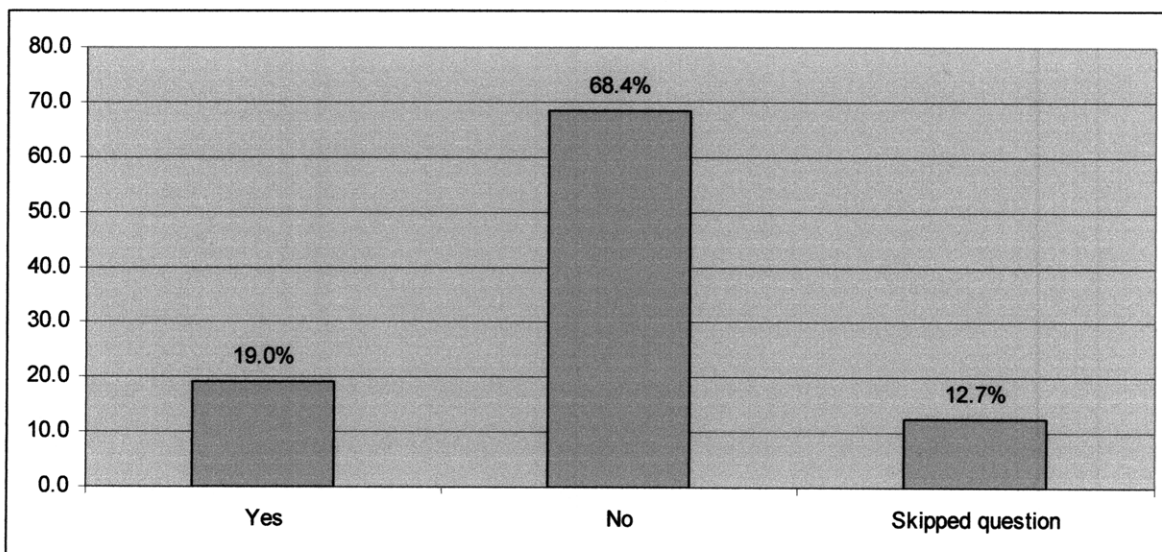


Fig. 5.32 – Barriers to Implementation

Members from plants located in South America reported that there are more barriers to implement solutions obtained in the communities of practice than members from elsewhere. (See Fig.5.33).

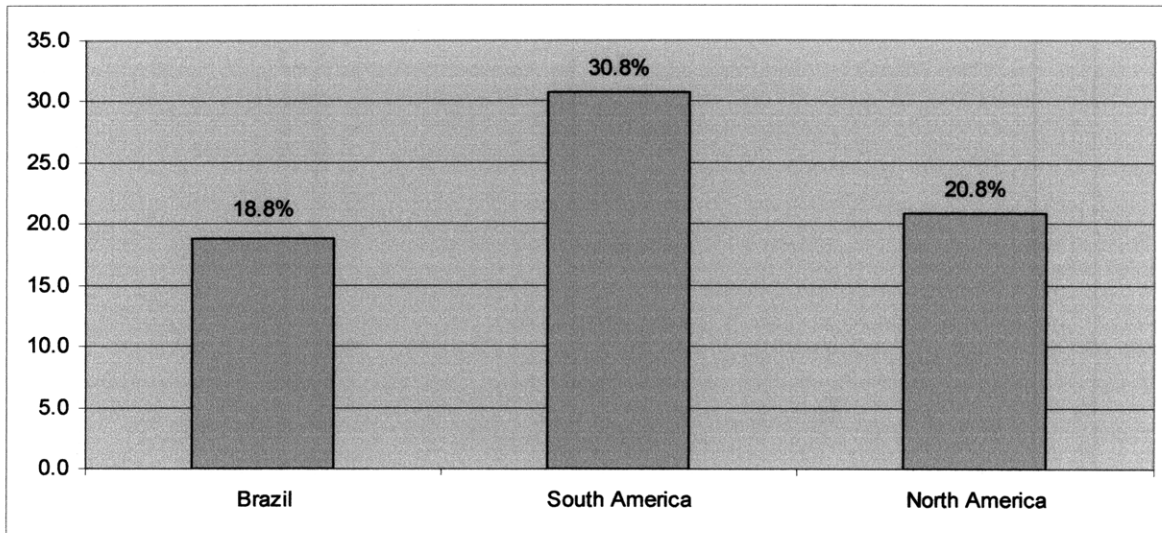


Fig. 5.33 – Barriers to Implementation (by Region)

The barriers reported by members to implement the solutions are listed below. They are listed from the most to the least frequent, but even the most frequent did not exceed four mentions.

- Budget limitations,
- The existence of differences in the processes among plants. Not every project can be replicated,
- People's resistance to change despite alleged intention of seeking improvement,
- Lack of human resources.

### Part 3 – Evaluating the Incentives to Participate

Question 13 – What kind of benefits, either personal or professional, do you get from participating in communities of practice?

The responses show that members recognize several benefits from participating in their communities of practice. The benefits I judge most important are listed below. The order is from the most to the least frequent, but even the most did not exceed 8 mentions.

- To improve technical knowledge;
- To reduce time in implementing a solution;
- To make possible the sharing of knowledge, experiences and best practices among plants;
- To enlarge the network;
- To increase members' exposure within the company;
- To expand the knowledge base;
- To create easy access to technical materials;
- To reduce cost and time spent on travel to other plants looking for solutions;
- To make possible implementing tested solutions;
- To speed up new professionals' learning ;
- To take advantage of other people's experiences;
- To be recognized due to his / her expertise;
- To minimize problems without having to "recreate the wheel".

#### Part 4 – Evaluating Comfort with the System

Question 14 – Are the people you usually ask for help when you have a problem in your job members of your community of practice?

65.8% of the respondents stated that the people they usually turn for help when faced with a problem in their jobs are members of their own communities (See Fig.5.34).

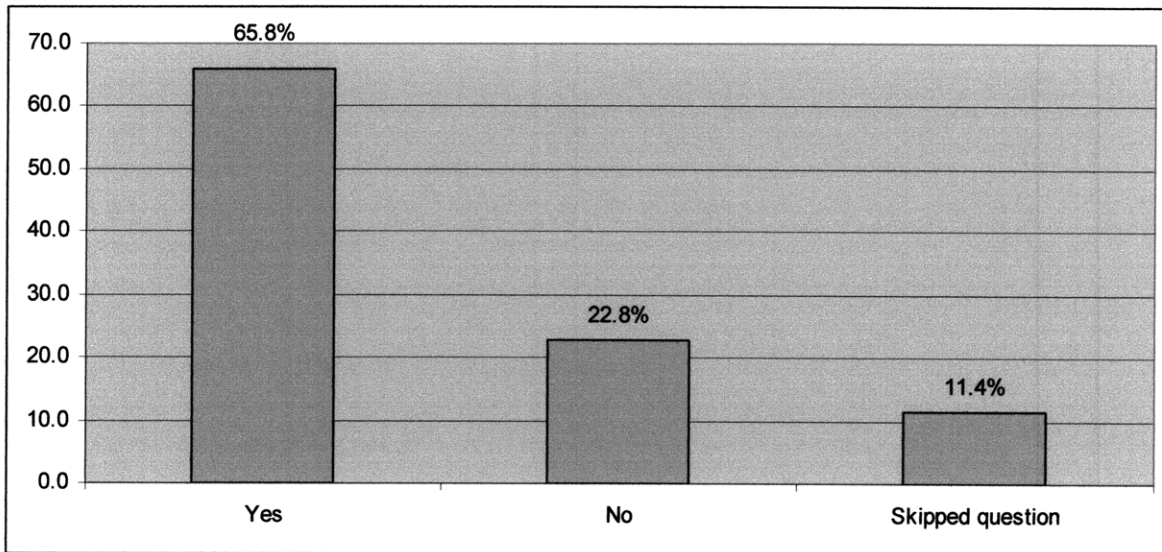


Fig. 5.34 – Respondents Ask for Help x Their Community Members

Question 15 – Do you feel comfortable receiving contributions from people who, though working for the same company, you have never met?

Respondents feel comfortable sharing knowledge without previous face-to-face contact (See Fig. 5.35).

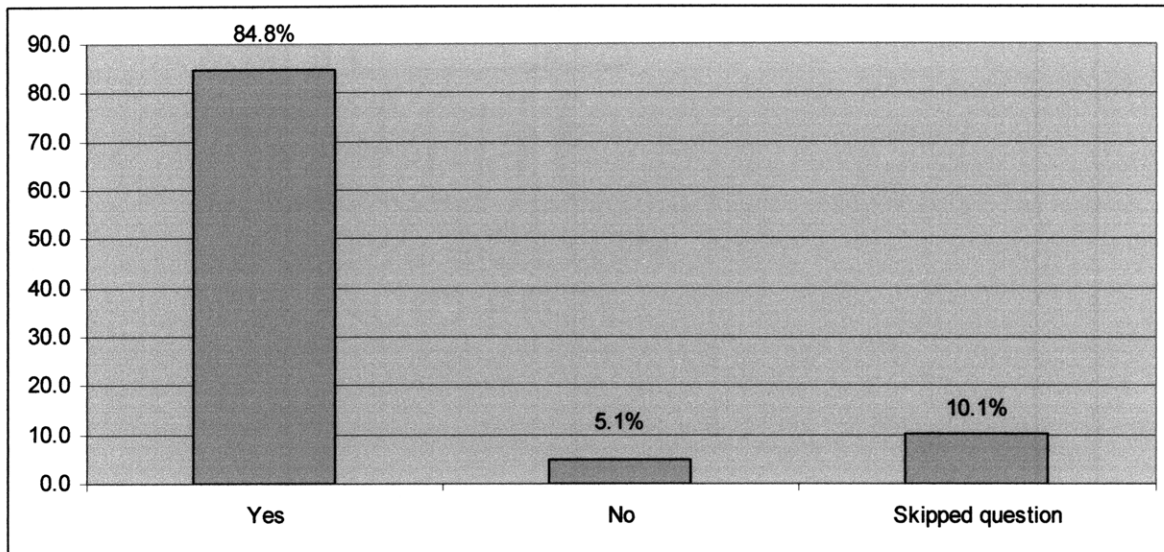


Fig. 5.35 – Respondents' Comfort in Sharing Knowledge with others they do not know

Question 16 – Would you prefer to participate in communities of practice without a formal identification, for example, by using a nickname?

84.8% of the respondents prefer to be identified by their real names rather than by a nickname (see Fig.5.36).

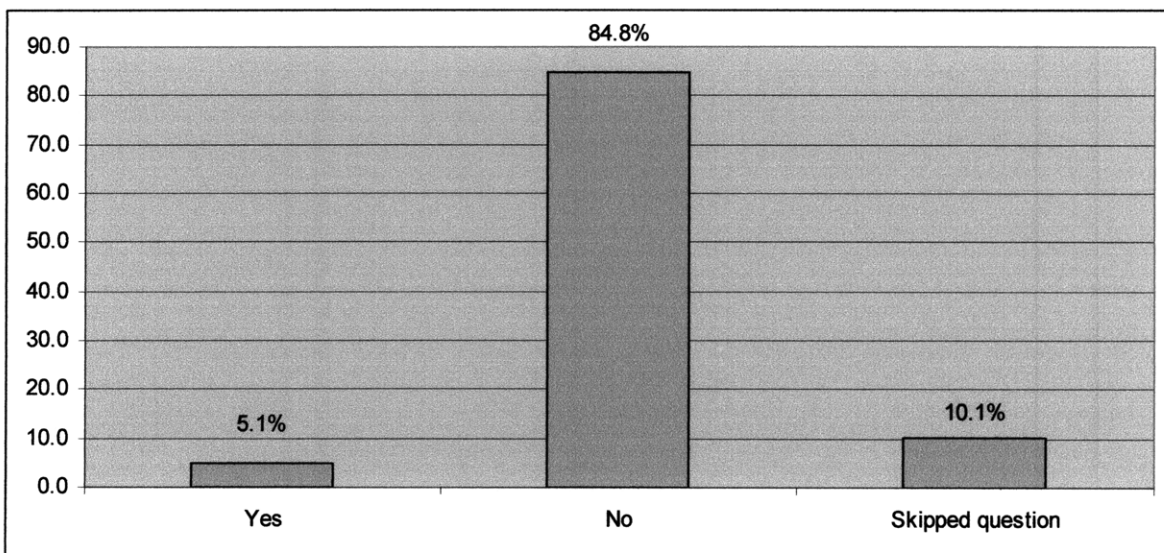


Fig. 5.36 – Prefer Nickname



## Part 5 – Identifying Potential Improvements

Question 17 – What could be changed in communities of practice to attract you more and enhance your participation in them?

Several good suggestions were collected in order to make the system more attractive for users. Those I judged the most important are presented below. The order is from the most to the least frequent, but even the most did not exceed 7 mentions.

- To standardize the language or to provide a tool to translate the three different languages easily;
- To allow identification of online users, enabling direct conversations among them through a chat. These conversations should be registered, allowing other members to consult them later according to their interests;
- To provide more training about the system;
- To eliminate the necessity of logging in the Knowledge Management System if the user is already logged in Gerdau System, i.e. using the email;
- To send email alerts to members in case of posting of new information or questions;
- To promote more forums and meetings among members;
- To expand file size limit in the website in order to allow the posting of videos (nowadays the limit is 4Mb);
- To create sub-sections in each community for group related information;
- To better recognize members who are active participants;
- To establish face-to-face annual meetings;
- To publish examples of consolidated solutions obtained from the communities;
- To create a Training Manual and make training mandatory to the whole Gerdau executive team;



- To train and to invite more professionals to participate;
- To better divulge the name of specialists and moderators of each community;
- To schedule conference calls among members with a common expertise.

#### **5.4. Survey Conclusions**

The results of the survey show that the Knowledge Management System at the Gerdau Group is being used to capture and disseminate knowledge among members of its plants but still needs improvement. The Knowledge Management System is working better in Brazil than in other countries. Brazilian members spend more time participating in their communities and are also more “active users.” They are responsible for the majority of the content posted in most communities. The lack of a standard language for communication among members or an easy way to translate the content from Portuguese into English avoids members from North America participating fully. Members from other countries of South America say they are not constrained by language (perhaps because of the similarity between Portuguese and Spanish). However, they also request more training.

The data collected also show that members from communities related to Health, Hygiene and Safety say they have applied the knowledge gained from their communities more than members of other communities. The reason for this may be that projects in these communities are normally simpler and require smaller financial resources than those from communities related to production sectors, such as the Melt Shop and the Rolling Mill.

Respondents’ report that the environment at most Gerdau plants is open to innovation and there are few barriers to implement solutions that arise from the communities of practice. This may be why the Knowledge Management System is sustained by Gerdau culture, which favors the accomplishment of collective goals rather than individual ones.

Members recognize several benefits from participating in the communities of practice. “Individual recognition,” “possibility to implement tested solutions with reduced time and cost,” “enlarging of network,” and “improvement of technical knowledge” were some of the more frequently stated reasons members give to explain their participation. These factors are aligned with the goals of the Knowledge System Project. Moreover, the vast majority of the members feel comfortable sharing their knowledge with colleagues from any plant and do not mind identifying themselves by name.

\* \* \* \* \*

Improvements, of course, must be considered. The next and final chapter is dedicated to present recommendations to improve the system, including those suggested by the respondents of the survey.

## **CHAPTER 6 – SUMMARY AND RECOMMENDATIONS**

A process of market consolidation has been occurring in the steel industry for the past two decades. Companies that failed to grow (organically or by acquisitions) have been left behind by their larger competitors. Gerdau has been growing. Through acquisitions, the firm expanded its operations across the globe and has become the world's 13<sup>th</sup> largest steelmaker.

Gerdau's top management has been aware that just raising the company's productive capacity is not enough to remain competitive in this industry. The company must increase the performance of all its operations to benchmarked levels. Senior managers believe this goal is possible by taking advantage of the diversity of knowledge that exists across plants. Until recently, however, the company was lacking a tool to do so. But, a Knowledge Management System was implemented one year ago. As has been shown in this thesis, results to date suggest the system is succeeding.

One of the main objectives of the Knowledge Management System is to connect those who are seeking knowledge, the "buyers", to those who are able to provide it, the "sellers". Gerdau's Knowledge Management System is effectively playing the role of a "broker" and connecting employees through communities of practice. These communities are based on a Social Network Analysis. Employees with similar interests were invited to become members of specific communities. Today the system links 590 people in 11 countries.

As noted in Chapter 4, several process improvements based on the knowledge shared by members of communities of practice have been implemented. These have resulted in cost reductions and performance enhancements in some sectors.

Benefits of participating in communities of practice, both personal and collective, have been identified by members. Recognition among peers, reduced cost and time to implement solutions, network expansion, and technical knowledge improvement are a few

of these benefits. Users rely on the system. They noted in the survey that they feel comfortable identifying themselves and are able to share their knowledge with colleagues from other plants through the system. The environment in most of Gerdau's plants seems to favor knowledge transfer. Most of users to date have not reported facing problems in implementing projects based on the knowledge shared by their respective communities of practice.

On the other hand, Gerdau's Knowledge Management System is not yet mature. The system needs improvement to fulfill its goals. These needed improvements are listed below.

1. A tool inside the system is required to make possible the translation of the content discussed in the communities to the three languages used in different plants: Portuguese, Spanish and English. Inability to understand materials posted by colleagues from countries with a different language significantly reduces participation and use of the system. The establishment of a standard language is not a solution. It is too costly and would take too long to teach a foreign language to all members of communities of practice.

2. A solution to the language problem would also enable the participation of more "blue collar workers" in the communities. Those who directly operate the machines have important practical experience and knowledge that is barely being captured and used. Training the workers will be needed as well. But, in the end, these workers can contribute as much, if not more, than their supervisors or managers. By such means, "tacit knowledge" can be transformed into "explicit knowledge".

3. Content overload in some communities creates difficulties for members. Sub-sections should be created within communities to make it easier to locate desired information. Sub-sections would be dedicated spaces for the discussion of specific subjects within communities. For instance, the Rolling mill community could have a sub-section related to guides, another one devoted to stands, a third one to rolls, and so forth.

4. Sometimes a practical activity is best expressed through images rather than words. Greater benefits from the system will result when the file size limit is expanded to allow the video sharing.

5. The identification of members that are online is a required improvement. Gerdau must undertake the effort to add this feature to the system. By knowing who is logged in the system at a particular moment will allow members to chat directly, thus obtaining quick answers to their questions and speeding up the exchange of knowledge.

6. The establishment of annual face-to-face meetings among members of the same community is critical and efforts should be made to sponsor such a meeting. These meetings would promote direct interactions among community members and thus strengthen and enhance the network.

7. Finally, in the long run, the expansion of the Knowledge Management System beyond the present communities of practice is desirable. The current system is based solely on sharing knowledge inside the communities. Broadening the reach of the system may lead to innovation and the wider circulation of “best practices” in the company. This expansion could be fostered through the creation of new practices. A “Happy Hour of Knowledge”, for example, could be established as an informal and spontaneous period of time focused towards tacit knowledge exchange. “Specialized Committees,” as well, could be organized by grouping experts on a specific subject. These groups could meet periodically with the intent to come up with new ideas based on knowledge sharing. In addition, “Merger Boards” could be created when a new acquisition occurs. These boards would be composed of specialists in different processes who would visit recently acquired companies in order to identify their best practices. These practices would then be compared with similar practices at Gerdau and, if considered superior, would become standard across the corporation.

As a final comment, I hope this thesis will help to improve the effectiveness of the Knowledge Management System at the Gerdau Group. Suggestions and ideas taken from members of communities of practice, as well as, from professionals with experience in the subject were considered, adding a great value to the work. If the recommendations presented here are taken seriously and implemented, I believe most of the current problems will be solved. The system will attract new users and the quality of the knowledge shared will be enhanced. Companies from all over the world have positioned themselves as leaders in several markets by taking advantage of their intellectual assets. It is a process that can be managed and managed well. I think the Gerdau Group will be able to do the same through its Knowledge Management System.

## APPENDIX A

**The biggest steel producers in the world, 2006-2007, in million metric tons  
crude steel output**

2007		2006		Company
Rank	mmt	Rank	mmt	
1	116.4	1	117.2	ArcelorMittal
2	35.7	2	34.7	Nippon Steel
3	34.0	3	32.0	JFE
4	31.1	4	30.1	POSCO
5	28.6	6	22.5	Baosteel
6	26.5	45	6.4	Tata Steel
7	23.6	5	22.6	Anshan-Benxi
8	22.9	17	14.6	Jiangsu Shagang
9	22.8	9	19.1	Tangshan
10	21.5	7	21.2	US Steel
11	20.2	16	15.1	Wuhan
12	20.0	8	20.3	Nucor
13	18.6	15	15.6	Gerdau Group
14	17.9	11	18.2	Riva
15	17.3	12	17.5	Severstal
16	17.0	13	16.8	ThyssenKrupp
17	16.2	14	16.1	Evrast
18	14.2	23	10.9	Maanshan
19	13.9	19	13.5	SAIL
20	13.8	18	13.6	Sumitomo

(Source: World Steel in Figures: 2008 Report, World Steel Association)

## **APPENDIX B**

### **Community of Practice Survey: Questions asked**

1. What unit / plant are you located in?

Several options were presented. These options include all the plants represented in the survey.

2. How old are you?

- a) Less than 30 years old,
- b) From 31 to 40 years old,
- c) From 41 to 50 years old,
- d) Older than 50 years old

3. What is your current position?

- a) Managerial
- b) Supervisory
- c) Hourly

4. Which communities of practice are you a member of?

- a) Automation
- b) Casting
- c) EAF – Water Cooling Systems
- d) EAF – Regulation
- e) Electric Arc Furnace
- f) Health
- g) Hydraulic Systems
- h) Hygiene
- i) Predictive Techniques
- j) Refractories
- k) Reheating
- l) Roll Pass Design
- m) Rolling Mill
- n) Safety
- o) Scrap
- p) Secondary Metallurgy



5. How long have you been participating in these communities?

- a) Less than 3 months
- b) From 3 to 6 months
- c) More than 6 months

6. Do you usually participate in blogs, forums, or other kinds of digital collaboration outside of the company?

- a) Yes
- b) No

7. How much time a week do you spend participating in communities of practice?

- a) Less than 1h
- b) Between 1h and 2h
- c) Between 2h and 4h
- d) More than 4h

8. How do you usually participate?

- a) Read the articles and what else has been discussed
- b) Post work
- c) Ask questions
- d) Answer questions
- e) Consult the "yellow pages"
- f) Others

If others, please specify.

9. Which reasons limit your participation?

- a) Not enough training
- b) Constraints with language (English, Spanish, Portuguese)
- c) Lack of encouragement from management
- d) Not believing the system can help him
- e) Lack of time
- f) Others

If others, please specify.

10. Have you ever applied any knowledge obtained from communities of practice?

a) Yes

b) No

If yes, please specify

11. At your unit / plant, is the environment open to innovating processes, applying solutions coming from other companies, and changing manuals and patterns?

a) Yes

b) No

12. Do you feel any barrier to implement the solutions you find in the communities?

a) Yes

b) No

If yes, please specify

13. What kind of benefits, either personal or professional, do you get from participating in communities of practice?

Open-ended question.

14. Are the people you usually ask for help when you have a problem in your job members of your community of practice?

a) Yes

b) No

15. Do you feel comfortable receiving contributions from people who, though working for the same company, you have never met?

a) Yes

b) No

16. Would you prefer to participate in communities of practice without a formal identification, for example, by using a nickname?

a) Yes

b) No

17. What could be changed in communities of practice to attract you more and enhance your participation in them?

Open-ended question.

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