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Knowledge Management and Collaboration Strategies for Technology-Based Firms in Baja California

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***Abstract*— Knowledge Management (KM) and Collaboration are viewed as a key strategy for achieving competitive advantage in companies around the world. Knowledge by itself is considered one of the most valuable assets owned by an organization. In technology-based firms, it is perceived as being of the upmost value. In Baja California, Mexico, several companies exist which develop products and services using knowledge creation as a core value. In this paper, we summarize the results of 14 interviews with general managers and directors of knowledge-oriented firms to further understand which KM strategies are employed in seeking to gain competitive advantage. Results indicate that all firms adopt different approaches to KM. A common opinion amongst those interviewed was that knowledge provides greater value to businesses, improving corporate performance. All confirmed a significant relationship exists between KM, collaboration and competitive advantage.**

Keywords—Knowledge Management; Collaboration; Business Strategy; Knowledge Intensive Firms

I. Introduction

Competitiveness in technology-based companies around the world is a trend that is not going to change. As a matter of fact, every day it grows exponentially. In emerging economies, such as Mexico, the use of knowledge for enhanced product development and services is a well-known strategy to improve social and economic growth; this is an agenda that industry is seeking to promote by encouraging actions and the generation of public policy aimed at creating a better environment for improved competitiveness. In this context, it is necessary to conduct management research in firms that try to create value using knowledge as a tool; this research emphasis has been the subject of several recent studies, including those which have explored the use of ICT to collect, classify, store and distribute codified knowledge within organizations.

In this paper, we aim to determine the relationship between actions and tactics used in order to embed KM processes into organizations and to identify the existence of properly defined strategies used to compete in the technology marketplace. The importance of this approach increases when we can consider that knowledge is a critical asset for organizations seeking to build competitive advantage.

In recent approaches, economic growth has been oriented to analyze the role that human capital has on the growth of Gross Domestic Product (GDP) and on the economic development of developing countries; a key factor in this process is education which is derived from the desire to achieve an improvement in knowledge production. In various forums we can find that economic growth is not possible without the social development of a company's workforce and the ability to adapt to change. KM strategies must be driven by a firm's competitive strategy. Organizations in the technology sector should look toward product innovation strategies to provide highly customized offerings to each client. One of the challenges to be addressed is the need to store information relating to individual issues encountered during the product development process so that, when another similar issue emerges, the firm is able to take advantage of that stored knowledge.

II. Regional Context

In Mexico, both public and private sectors have sought to promote academic and industry partnerships to define and implement measures to support emerging industries and to consolidate the processes of economic development. An example of this can be seen in Mexico's software industry which, in recent studies [1], has demonstrated interventions to facilitate the creation of appropriate environments. Human capital, funding means and regulatory frameworks are factors of interest to the Mexican government which is aiming to trigger growth throughout its industries.

Processes highlight the need for public policies in education, communication and the development of strategies to encourage a corporate culture towards self-learning and to support the establishment of new companies that ultimately increase the competitive factor in the sector. Education is also seen as a crucial axis in the structural change of a social group and should be part of long-term strategic plans [2].

Baja California is one of the most dynamic states in Mexico due to its strong economic activity, which is driven by close interaction with the rest of the world, especially with its northern neighbour: The United States. This activity is influenced by the influx in migratory flows from the South of Mexico, that arrive in the North seeking to take advantage of opportunities presented by the border region, including better opportunities for employment and higher salaries; these features are key to the economy of Baja California [3].

III. Literature Review

A. Competitiveness

Competitiveness exists when an organization is able to produce quality goods and/or services to serve an active marketplace. This approach suggests that the ability to produce valuable knowledge can become a key factor for innovation and consolidation of an organization [4]. Competitiveness is seen as an attribute or quality of a company. It is determined by four fundamental attributes: factor conditions; demand conditions; related and supporting industries; and strategy, structure and rivalry of companies. Such attributes of a firm and their interaction explain why some firms remain competitive in certain regions [5].

In order to establish a competitive business strategy, an understanding of competitive advantage is required. Competitive advantage is the superiority that distinguishes an organization; i.e. its distinctive value. This advantage comes from the core capabilities of the organization and may take the form of the skills embedded into an organization's workforce; this provides something that competitors cannot do or do better than others. Also, those core capabilities that lead to competitive advantage come from the assets or resources of the organization which it possesses and which competition lacks.

B. Knowledge

One factor that has recently acquired a strategic value in organizations is knowledge. Knowledge generation is seen to be directly related to the economic, social, cultural and educational growth of a company, which explains the need to verify and validate the consistency of KM with the ability of companies to create competitive advantages. Knowledge emerges when an entity develops their experience and capacity through the interpretation of information received at a certain time [6]. The main studies on KM and their respective classifications are shown in Table 1.

TABLE I. Knowledge Classification

Knowledge Type.	***Studies***
Tacit and Explicit	Nonaka and Takeuchi [7]
Individual and Collective	Spencer and Grant [8]
External and Internal	Andreu and Sieber [9]
Know-how, What & Why	Garud [10]

1) Knowledge Economy

The term 'Knowledge Economy' refers to those organisations whose operations are based on the production, distribution and use of knowledge and information. This knowledge and information directly influences processes and the use and creation of knowledge can increase the capacity of traditional production factors (labor, capital and raw materials, *inter alia*) and can even turn them into new products and processes [10].

In an economy that is not knowledge focused, there comes a time when increased investment is needed in capital, labor and raw materials, resulting in reduced profits for each new investment made. In this regard, knowledge-based enterprises are seen to be an opposite: with increasing investment, knowledge gains do not decline, instead benefits increase with each new investment using, adapting or generating knowledge. This allows the business to learn from new knowledge, increase the demand for higher skilled employees, adopt new technologies and gradually generate new knowledge that is likely to be incorporated into the production process.

2) Knowledge Management

It is in this new sub-field of the knowledge economy where the value of intangibles become the center of actions and business strategies. KM has established itself as one of the main research interests for managers and one paradigm for excellence in the field of organizational development.

The growing importance of knowledge as a production factor makes the development of technologies, methodologies, innovation and strategies for its measurement, creation and diffusion a top priority. However, it may also be considered that it was the development of these elements that have become indispensable for economic and social development.

From a KM perspective, the concept of business intelligence is named after the set of strategies, actions and tools focused on the creation and management of knowledge by analyzing existing data in an organization [11]. In Table 2, a description of the KM instruments and strategies applied most commonly to firms is given.

TABLE II. KM Instruments and Strategies

Coding strategies	***Personalization strategies***
Decision Support Systems	Spontaneous Knowledge Transfer
Groupware	Mentoring
Repositories	Equipment/Communities of Practice
Maps	Groupware
Workflows	Video Conference
Diagrams	Discussion Forums
Shared Databases	

It is during KM activities where these strategies follow a set of actions which intelligent companies can undertake and these give them an advantage over their competitors [12]. This is mainly because value added services or products that result from these actions develop efficiency in production and performance, which cannot be replicated by those entities that do not have these defined processes or strategies.

Literature also identifies human resources as an important asset for improved performance. Today, every employee is required to learn throughout their work life, to acquire new knowledge, process it and disseminate their expertise amongst colleagues. KM has also influenced companies that use ICT in order to obtain competitive advantage. ICT can be a key factor in a company's development to build its competitive advantage in domestic or international markets. Transformation has

occurred from an era of information scarcity to information surplus, so the key global pressures on management are now knowledge identification, creation and dissemination [13].

The transient nature of project teams and the competitive environment in which organizations operate require an effective mechanism to manage and reuse knowledge created during projects without straining resources. The choice of a specific knowledge management strategy may result in the need for change in an organization, particularly with regard to information systems, internal communication and human resource management. Table 3 identifies the key factors to the success and failure of knowledge management initiatives.

TABLE III. KEY FACTORS TO KM IMPLEMENTATION

Output	***Perceived Factor***
Failure	• Absence of goals • Inadequate organizational culture • Diffuse responsibility • Lack of planning • Construct confusions • Context
Success	• Knowledge orientated culture • Institutional and technical infrastructure • Management support • Economic and market value • Process oriented • Well defined goals • Motivation and knowledge structure • Several knowledge transfer channels

Figure 1 illustrates how knowledge emerges in a firm. The steps in organizational development that are required to achieve competitive advantage are defined by the knowledge itself. An IT firm must find means to include the value of knowledge into the processes needed to develop new products and services.

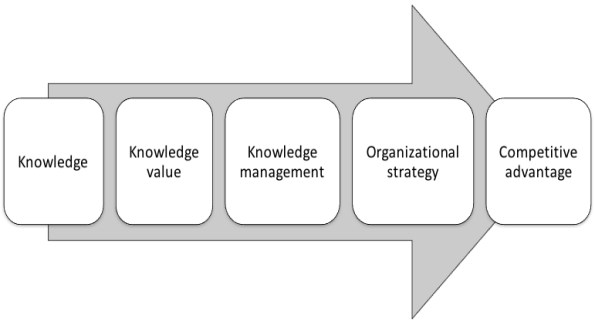

Fig. 1. Knowledge Steps to Competitive Advantage

IV. METHODOLOGY

Semi-structured interviews following a series of 8 open-ended questions were used to capture the views of managers and directors employed in 14 technology-based companies in the Baja California region of Mexico. Each interview was audio recorded and lasted between 50 to 120 minutes in length. Face to face interviews were chosen due to their ability to solicit greater understanding of dynamics present within individual scenarios and discover new relationships and concepts in collaborating companies.

The questions asked to interviewees are listed here.

1. What is the product that gives greatest value to your company?
2. What activities do you currently do or would like to do regarding knowledge management, collaboration, strategy definition, scientific productivity, innovation, technological developments and to improve links between institutions, businesses and government?
3. Are you satisfied with the results of your employees and with your business goals? If not, how do you think they could be improved?
4. How do you view the knowledge management strategies of other IT companies in their business development?
5. What do you think the government could do in order to help your business develop in terms of knowledge management strategy?
6. If you had the opportunity to give advice or recommendations to the person in charge of promoting competitiveness in companies in your sector, what would you say?
7. Is there an area of opportunity you can improve in your company to have better scientific and/or technological results that will help improve productivity and business competitiveness?
8. Is there anything else you would like to add?

Questions posed related to the current practices in the collaborating company in relation to innovation and technological development and if they were seen as highly competitive in their sectors. The common denominator of the 14 organizations interviewed was recognition of research, technological development and innovation, which means all demand highly qualified staff and processes are of high added value which, according to theory, applies plausibly to the approach necessary for successful knowledge management.

V. RESULTS

Table 4 shows the results of our investigation. In the left hand column, an overview of the collaborating company is provided. In the middle column, key findings of the investigation are given. Finally, in the right hand column, conclusions drawn at the end of each interview are provided.

TABLE IV. INTERVIEW RESULTS

Company	*Key Findings*	*Final Conclusions*
Company A Company A is an international company dedicated to developing video games for mobile devices. The company has operated in Mexicali for over a decade.	• Develops games for mobile phone and portable devices. • International target market: the internet. • Differentiation strategy in software products. • Requires qualified employees. • Solves problem skills in selection process. • Permanent change and innovation in products. • Cheap labor competitors in China. • Competitors in Europe, US and Canada. • Use of knowledge management systems.	The company makes constant innovations in their products in order to continue competing in the market place. Company A has resisted several crises thanks to its innovations in the field of video games for mobile devices and their approach to the international market. With specialists in the area of software development, the company takes university graduates and develops in them the ability to become specialists in their field, as the company is betting on internal promotion as a management tool.
Company B Company B is an American multinational corporation that produces a variety of consumer products, engineering services and aerospace systems for a wide variety of customers, from private to major corporations.	• In-house lab for testing electronic systems. • Design activities transfer to regional context. • Openly shares intellectual property. • Specialization for human resources. • Joint activities with universities in the region. • Joint creation of Postgraduate degree program in aerospace industry. • Knowledge management oriented.	Company B is one of the companies that has been conducting research, innovation and technological development in Baja California. The company is one in the region that supports the transition from the marketing campaign: "Made in Mexico" to "Created in Mexico", giving its intellectual property and offering its infrastructure and research centres to research and development engineers and technologists from the region.
Company C Company C is a creative centre in Mexico with offices across Latin America. Their services focus on training staff in creativity and problem-solving techniques.	• Trains staff in problem solving. • Strong organizational culture. • Importance of research and development. • Creativity in the mind-set of employees. • Patent oriented activities. • Innovation culture. • Knowledge management used for creativity.	Company C is a centre for applied innovation and is interested in promoting entrepreneurship. Promoters consider the need for technology transfer and promote creativity. However, much remains to do to boost regional competitiveness. This includes improved communication with psychological blocks and education oriented innovation.
Company D Company D provides computer Networking solutions to Mexican organisations.	• In-house software development team. • Importance of research and development • Innovation and quality systems present. • Knowledge management seen as key.	Company D aims to develop a technical school specializing in software solutions development. The company identifies opportunities at regional level in the field of Information Technology Clusters. A rethinking of the purpose of the cluster could be an alternative.
Company E Company E manufactures integrated circuits. It invests heavily in research and development in technology, facilities and sophisticated and innovative wireless communications equipment.	• Investment in hardware equipment. • High quality standards. • Automated manufacturing process. • Importance of research and development • Innovation and quality systems present. • High Knowledge management standards.	Company E is one of the most important companies at regional level, given its technological and knowledge capabilities. With a great approach to human capital, the company seeks to improve and develop each member of staff. With cutting-edge infrastructure and the latest technology in its facilities, the company demands highly qualified personnel to meet the needs and standards of product quality. Such staff are facilitated in part by regional institutions, which work in tandem with the company, generating highly qualified human capital through the interaction of teaching by the institutional part and practice by the company.
Company F Company F is located in Mexicali.	• High quality standards – Six Sigma. • State of the art equipment. • Importance of research and development. • Innovation and quality systems present. • High knowledge management standards.	Company F is a leader in the automotive industry. The company has a broad vision towards innovation, as in the case of its proposed trucks, which have been well received by state and federal government as well as public and customers in general.
Company G Company G is a family-run business that has been operating for 30 years in the Tecate region. They produce and supply electronic and plastic prototypes, focusing on prototype design silicone.	• Family-run business. • Strong Mexican investment. • Innovation and quality systems present. • High Knowledge management standards. • Patents present. • High importance on intellectual property.	Company G is a successful local company showing a lot of growth, commitment to expand production and unexplored markets clearly under the automotive, aerospace and electronics industries. The manager interviewed believes that the State of Baja California has a lot of potential to attract investment in higher value-added processes and not just as a cost centre. If the supply of professionals with profile industrial design does not meet the expectations of the company, it has been responsible for training and moulding profiles of existing human capital in the region to adapt to the requirements of this industry and as an added value enriches the knowledge of regional intellectual capital.

Company	*Key Findings*	*Final Conclusions*
Company H Company H specializes in biotechnology. The company manufactures antibodies and develops detector toxins and hormones.	• Innovation and quality systems present. • High knowledge management standards. • Patents present. • High importance on intellectual property.	Company H is emerging as a driving biotechnology company in the region and shows good growth potential. The company oversees all parts of corporate research and development. The company opens its doors to institutions that want to get involved in research in order to produce better professionals in the field of biotechnology.
Company I Company I is engaged in applied research in the Mexicana region.	• Innovation and quality systems present. • High knowledge management standards. • Patents present. • High importance on intellectual property.	The experience of the manager is rich in themes of entrepreneurship and its links with research centres to identify innovative products and launch them as businesses into the market. The company aims to innovate and transfer technology. Gaps and challenges that exist in terms of the overall business vision and knowledge of the legal aspect to these cases are barriers which the company struggle to overcome.
Company J Company J provides IT solutions and processes focused on meeting development, implementation and support needs of client companies.	• Innovation and quality systems present. • High knowledge management standards. • Patents present. • High importance on intellectual property.	Company J has been very helpful for quality training of students of information technology in Ensenada. This experience should be extended in other undergraduate programs to qualify the region. Undoubtedly, a student trained by a global company will have more chances to compete in global markets and a greater vision to join the labor market or start their own business.
Company K Company K is a biopharmaceutical company producing new drugs to fight against mycobacterium tuberculosis.	• Innovation and quality systems present. • High knowledge management standards. • Patents present. • High importance on intellectual property.	Company K's experience helps to understand the linkage from the perspective of business to be done with private companies. In order to develop innovative projects, it requires increased budget, improvements in legal aspects of technology transfer and patents. Personnel in this company consider that to grow and position an innovative product, it is important to partner with global companies and identify the product to market the name of the producer body, thus serving as a trigger for other scientists to join the research with practical applications.
Company L Company L seeks to develop human capital in the region. The company receives researchers and scientists from enterprises and manufacturers of high-tech products. The company offers its facilities in order to promote knowledge and its transfer to the company.	• Innovation and quality systems present. • High knowledge management standards. • Importance in developing human resources. • High importance on intellectual property. • Viewed as a technology transfer centre.	Company L is seen as a company in the region which wants to innovate and go beyond the manufacturing world. With a cutting-edge infrastructure, the company plays the role of a technology transfer centre, offering both services and facilities for the development of better trained professionals and, if possible, specialized certification in the engineering industry. Currently linked with universities, the company seeks to develop better regional intellectual capital and likewise, improve internal processes for this, establishing its position as a competitive advantage.
Company M Company M is dedicated to the collection and marketing of waste.	• Innovation and quality systems present. • High knowledge management standards. • Importance in developing human resources. • High importance on intellectual property. • Viewed as a technology transfer centre.	Company M is socially responsible and an example for many companies operating in Baja California. Although considered a recycling centre, the company leads to new standards. With an innovation philosophy which states that it begins "from below", the company lets their employees participate in process improvement and new ideas for improving their infrastructure and equipment.
Company N Company N is a local company based in Tijuana. It is a molecular biology laboratory and has seven highly qualified employees.	• Innovation and quality systems present. • High knowledge management standards. • Importance in developing human resources. • High importance on intellectual property. • Viewed as a technology transfer centre.	As a successful example of the link between government, business and institution, the company has open doors for research to institutions. Currently they are working on joint projects with Universities in the region.

VI. CONCLUSIONS

In this paper, we share the findings of 14 interviews conducted with managers of technology-based firms operating in the region of Baja California in Mexico. Our analysis enables a diagnosis of the views of entrepreneurs who work in these companies regarding themes relating to science and technology, innovation and intellectual Capital inter alia.

The study indicates that humans are key sources of knowledge for the organizations. Intellectual property and technology transfer for innovation and research and development are seen as being of great importance in terms of intangible assets which grow technology-based companies in the Baja California region. The importance of information technology and collaboration was observed and reaffirms that the sector in Mexico is updating and increasing in value, innovation processes and specialized human elements. People and processes are seen as fundamental to corporate activities, meaning that many of the productive activities revolve around the value of knowledge and how this manifests itself in the possibility of business for the organization.

The study identifies that the business environment in the region is a joint effort between business and local government, but it is the responsibility of the latter to provide the necessary conditions for companies to realize and obtain more projects.

The possibility of doing business and increasing competitiveness of the companies is an axis that is not entirely dependent on the organization. This is important to the existence of strategies to facilitate access to national and international markets, but also to ensure the existence of a socio-political and economic stable environment for the region receiving investment returns in the field of research and development of new products. Hence the importance to generate KM strategies in order to take advantage of every market opportunity that could arise.

Finally, KM, collaboration strategies and innovation tools for research and development purposes are essential for business activities. Innovation is considered one of the aspects that help the learning of the companies and the strengthening market of information technologies. For their business strategies to succeed, there must be highly skilled, trained and qualified employees. Organizational culture, public policies and links with the education sector are the main reasons for success or failure. For this reason, it is necessary to encourage cultural change with a greater focus on collaboration, sustainable development, quality and protection of intellectual property, all of which are foundations of an environment for innovation and research and development. These will provide an edge to both economic growth and the development of systemic competitiveness in the technology sector.

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