

BUSINESS DEVELOPMENT OF SME DEDICATED TO SOFTWARE

DEVELOPMENT IN BAJA CALIFORNIA, MEXICO

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ABSTRACT

This work was made in small and medium sized companies (SME), dedicated to software development in the State of Baja California; with the purpose of generating information about three key points in this industry: the development, client's satisfaction, and software quality, considered important factors in the software industry in this region. SME that shape the sample of this work are organizations that have a number of employees between 5 and 250, and that are growing. During the analysis, we made surveys via e-mail to managers in SME, as well as personal interviews. The information, analysis showed that each of every dimension mentioned impacts directly in the process of software development, as well as information received from the client regarding satisfaction and quality with which software products offered by these companies are made. In addition, results obtained belong to 52 SME dedicated to software development, which allowed to identify the link between development, client's satisfaction, and quality, and how they influence results in this industry, looking to contribute to the continuous enhancement of the software, since SME activities related to this work are focused on satisfying clients and involve many external factors that invite them to participate in the continuous enhancement and innovation activities.

KEYWORDS: Organizational Structure, Software, Development, SME & Client's Satisfaction and Quality

INTRODUCTION

Nowadays, technological tools, especially software, used by companies around the world as support when doing their economic activities, by using programs that range from the most basic, like spreadsheets, to the most advanced ones that help to efficiently manage the company, where company management software like ERP (Enterprise Resource Planning) helps analyze and process information, in order to be analyzed and to make decisions. It has been an object of analysis and reflection as to how the software industry and other services technologically advanced have been evolving, where India is one of the main countries in software development, and its research of the evolution of such industry on an international environment parts of information management firms. According to O'Riain (2004), the importance of research about software industry especially in Ireland, where he mentions how the industry has evolved, doing a general analysis of economic and social development of that country, or Spain, where companies dedicated to this line of business called software development have a number of employees between 50 and 100, working to cover needs in specific areas such as public sector, bank sector, or others, where each of these SME face different types of problems when trying to satisfy such need of product on the client's side.

In some Latin-American countries like Chile, Colombia, and Argentina, the development and technology innovation strategies and politics look to strengthen their position in this area of software development, which has been advancing in some of these countries through the construction of their scientific-technological capabilities. Regardless, this region still shows some backwardness in this matter, especially in comparison with developed countries and other growing countries. According to (Rivas and Rovira, 2014) the experience in designing and executing innovation, politics in Latin-America where companies in the software industry, parting from innovation, politics in each country of the American continent in the 50's, the scientific research councils were born in many Latin-American countries; in example, in Brazil, on 1951, the National Council of Scientific and Technology Development was created. This is also the case of Argentina, where, on 1958, the National Council of Scientific Research and Techniques (CONICET), while, on 1967, the National Committee of Scientific and Technological Research (CONICYT) was created in Chile. These councils, among their main goals, had as goal the creation of research institutes, as well as the promotion and sustain of research projects. On this matter, in Argentina, specifically in Buenos Aires, the growth that has been observed in small and medium companies in the software and informatics services sector (López and Ramos, 2008), in which there is a stage where growth opportunities are increasingly better, considering factors like human resource, socioeconomic environment, as well as company growth in the region. Regarding this, Argentina has a dynamic software sector in the local market, as well as the international market, where it makes the best out of the capacity and creativity of human resource, a main competitive advantage in this area. In addition, software in Colombia is of great importance in organizations for controlling their processes, and a main factor for competitiveness (Vega and Ospina, 2014), where company restructuration is made through companies that are acquiring versions of company software adjusted to the needs of big software companies; most of the companies in the software industry are considered either micro, medium, or small, where 96% of Colombian companies are SME and generate 76% of Colombia employment. Likewise, the software industry in Colombia is made up by micro and small companies by a 92%, 7% by medium companies, and 1% of big companies (Fonseca, 2013). On this matter, through strategic alliances and attempts to make groups of software technology, many new companies have been formed in the software development area, especially in universities and businessmen, since there is a company interest in the participation of innovation systems that lead to a national competition. Companies dedicated to software development consider it as the combination of instructions made by a programmer or many programmers in order for a computer to do one or many actions, and to process, store, and communicate informative content (Mochi, 2006). These companies were approved as SME in Mexico in 2002, where the Ministry of Economy recognized that the adoption of models and standards is expensive, which is imperative in order to comply with that stipulated in the Regulations for Contracting, Procurement, and Services of the Public Sector; they must be accessibly enough in terms of cost, in order to avoid an entry barrier for small and medium companies, whose classification is published in the official journal of the federation of 2002 (González, 2006), where the classification is described: a small company has from 1 to 100 employees, medium from 101 to 500; small from 11 to 50, and medium from 51 to 250.

Software, telecommunications, and informatics constitute the pillars of the new industry, since they provide to other companies, as well as many others searching for goods and services, and this new industry is increased or developed continuously with information technologies (Hualde and Aleman, 2008). In Mexico, the size of the Information and Communication Technologies (ICT) went from 18 billion dollars in 2001 to 33 billion dollars in 2008, a little less than half of Brazil's and India's. The main part of costs in ICT belongs to communications (63%), followed by computer hardware (21%), and software (3%) (Witza, 2008). The size of the market puts Mexico on a very far position, not only from lead

nations, such as the United States (150 billion dollars), Japan (22 billion dollars), and Germany (30 billion dollars), but also from nations of high growth in this area: Brazil (4 billion dollars) and India (5 billion dollars). A software market that represents 1% to 1.5% of the gross domestic product (GDP) is considered of high development, and one from 0.4% to 0.5% of growing dynamism (India, Brazil, Taiwan, Singapore, Finland). Mexico is located on 0.1%, under Argentina, with 0.5%. (Dabat and Ordoñez, 2009).

In Mexico, the software industry, specifically in Mexico City and Guadalajara, where software service has had a considerable development, taking into account that this industry is continuously growing, constituting a series of activities from this sector, being a highly intellectual and productive activity with high intensity in the knowledge work. There are other cities like Mexicali and Tijuana, the latter being the second city with the highest gathering of textile factories, some of which are related to the United States market. (Rivera and Bátiz, 2010). Due to the aforementioned, the SME have been evolving, looking to adapt to a dynamic and competitive environment, where said competitiveness in the industry can come to place through sustaining three dimensions: software development, client's satisfaction, and quality, as one of the main strategies of management.

In addition, it is clear that software has had a constant development, and organizations dedicated to software development look to align their goals in order to compete, since society is witness of technology evolution where information is important in decision making (Quiroga, 2002). On the other hand, is important for the organization to have an organizational structure where hierarchies, authority, and a chain command is defined, as well as an organization chart among other factors, so the organization can be allowed to adopt its functions, looking to produce quality software products, reaching goals and objectives set by the management (Hernández, et al., 2006).

The small and medium company is an industry that has a great importance in the region's economy, representing companies by their number of employees: Micro (0-10) with a 59.6%, followed by 34.6% that said they were a Small company (11-50), and with less percentage, 3.8% of the ones that informed they were Medium sized, and the rest, which is only one, SCT software with 1.9% classified as Big (251 and more). Es decir, el 94.2 % de PYMES en Baja California dedicadas al desarrollo de software son pequeñas y medianas empresas (Gómez, 2014). De ahí la importancia que tiene esta industria en el desarrollo económico de este estado. No obstante, estas PYMES pueden verse afectadas por una serie de problemas como los son los recursos asignados para proyectos, el tiempo de entrega de los productos software, así como la calidad del software, factores a considerar en la competitividad global que esta industria actualmente tiene. A company's organizational structure plays an important role in achieving goals and objectives (Chiavenato, 2004). Likewise, it is important to consider a clear organizational structure where hierarchies are defined, as well as activities and roles to develop, achieving with this not only the planned objectives, but also making the products or services with the quality that clients demand. Regarding quality of a service or product, it can be approached through the quality of things, from its meaning of the product's attributes, where the client demands quality in the service or product he acquires. When talking about quality, companies consider tool and techniques in order to implement quality in their processes, taking into account the clients' satisfaction regarding their needs and expectance (Baeza et al., 1995). SME immersed in a technological dynamism seek to guarantee quality of products and services offered through a fabrication process where techniques are applied in order to verify requirements relative to the product or service quality.

Companies seek to compete by applying models, standards, and methods in their productive processes that allow

them to keep competing in a dynamic and ever defiant market, considering that, due to each organization's characteristics, such as size, economic resources, specialized human capital, as well as adequate infrastructure in order to make an efficient software development process, where the incorporation of quality systems to the process guarantees excellence levels in organizations (Kim, 1989). SME dedicated to software development seek to survive through achieving their objectives and mission, being productive and generating value-added products, and assuming new strategies in a competitive and dynamic industry. On this matter, software services are an important part of a country's economic development, increasing the citizens' life quality and organization's competitiveness, where, formore than a decade, the software industry generates competitive advantages to underdeveloped countries (Climent, 2003).

In years 2000 and 2001, with the objective of creating a cluster (companies that work in the same industry and collaborate strategically to obtain common benefits), a group of businessmen gathered and made decisions to develop software products and services in the state of Baja California, seeking to make the best out of the existent software services demand in the state of California, as well as to generate businesses in the border between both countries, this being an important part when creating a cluster; these businessmen's efforts concentrated on February 20th, 2004, when the Association of Information Technologies Providers of Baja California (APTI) and the Nation Chamber for the Electronic, Telecommunications, and Informatic Industry (CANIETI) publicly announced the signing of a treaty for the constitution of *Information Technologies and Software Cluster, A.C.*, with 26 founding companies affiliated (CANIETI, 2004).

The Ministry of Development of the state of Baja California includes the existence of fifteen clusters in the state of Baja California, such as the software cluster, adding the state to a conceptualization of Cluster adoption as a base for its industrial policy (Hualde, 2006). In addition, CANIETI, while trying to develop the cluster, provided support to companies dedicated to developing software in a direct way through fomenting businessmen software networks of different regions in the country and north of the border, through the making of an event called Ti@mericas that has as main goal the relation of companies dedicated to developing software. Contributing to the development of the software industry in the state of Baja California, three key points were considered while making this work: development, client's satisfaction, and software quality, considered as an important part in order to do an analysis of this industry in the region.

Table 1: Agreement Level Regarding the Use of a Quality Model and the Offer of Value-Added Services to Clients.

Value Scale Using a Quality Model	Agreement Level Regarding the Use of a Quality Model and the Offer of Value-Added Services to Clients											
	Totally Agreed		Agreed		Neutral		Disagreed		Totally Disagreeing		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Totally Agreed	14	93.3	1	6.7	0	0	0	0	0	0	15	100
Agreed	16	69.6	7	30.4	0	0	0	0	0	0	23	100
Neutral	9	69.2	4	30.8	0	0	0	0	0	0	13	100
Disagreed	1	100	0	0	0	0	0	0	0	0	1	100
Totally Disagreed	0	0	0	0	0	0	0	0	0	0	0	0
Total	40	76.9	12	23.1	0	0	0	0	0	0	52	100

Table 1 shows the results of percentages obtained regarding the opinion of survey respondents, concentrating the data that cover all methodologies informed by them during the report, with the exception that the company also uses a specific quality model for the software quality requirements. High percentages resulted when agreeing in that, due to the elevated sector's competitiveness, it is necessary to offer value-added services to clients that make them different from the competition, where 100% agrees to it, thinking that having a quality model takes them to the need to offer value-added

services to the company's clients.

METHOD

A descriptive work was made, analyzing SME in the software development sector in the state of Baja California, for which a 36-questions survey was applied and divided into four sections: the first one had 8 questions regarding the company's general data, the second one had also 8 questions regarding software development, the third one had 11 questions regarding client's satisfaction, and the fourth one had 9 questions regarding software quality, where we used a Likert-type classification scale, which purpose was to characterize development, client's satisfaction, and software quality of small and medium companies, dedicated to offer software services and products in the cities of Ensenada, Mexicali, and Tijuana in the state of Baja California. Likewise, the results obtained belong to 52 SME dedicated to software development, which allowed to identify the relation between development, client's satisfaction, and quality, and how they affect the results in the industry, seeking to contribute to the continuous improvement of software (Hernández, et al., 2006).

RESULTS

In this research work, we studied 52 surveys that were made to people with a job in software development in the 52 SME dedicated to this industry, where surveyed people said that most of their clients belong to three municipalities in the state of Baja California distributed in the following way: 22 surveys in Mexicali, 20 in Tijuana, and only 10 in Ensenada.

Table 2: External Resources the Company Receives for Software Development

Resources for Software Development of Social, Public, or Private Sectors of an Organization	Level of Agreement with the Need to offer Value-Added Services to Customers											
	Totally Agreed		Agreed		Neutral		Disagreed		Totally Disagreeing		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Civil Association and CONACYT	1	100	0	0	0	0	0	0	0	0	1	100
Conacyt	2	100	0	0	0	0	0	0	0	0	2	100
Federal Treasury	1	100	0	0	0	0	0	0	0	0	1	100
Prosoft Funds	2	50	2	50	0	0	0	0	0	0	4	100
Prosoft Funds,SME Funds	0	0	1	100	0	0	0	0	0	0	1	100
Prosoft Funds,SME Funds, CONACYT	1	100	0	0	0	0	0	0	0	0	1	100
SME Funds	7	87.5	1	12.5	0	0	0	0	0	0	8	100
Private Resources	1	100	0	0	0	0	0	0	0	0	1	100
Own Resources	13	68.4	6	31.6	0	0	0	0	0	0	19	100
None	12	85.7	2	14.3	0	0	0	0	0	0	14	100
Total	40	76.9	12	23.1	0	0	0	0	0	0	52	100

As the results of table 2 suggest, regarding resources, received by the company in social, public, or private sectors of any organization, in order to make their operations, most of the surveyed people said they received none or operated with their own resources.

With an excellent 100% level of agreement, the surveyed people informed that they received funds from one or more institutions such as SME funds, National Committee of Science and Technology (CONACYT) and Funds for the development program for software industry (Prosoft), as well as others like Civil Association, Private resources, where

table 2 refers to the number of surveyed people that said they received funds.

Table 3: Agreement Level Regarding Whether the Company has Quality Measures or Indicators and the Need to be Certified in Some Regulation.

Value Scale	Level of Agreement with the Need to be Certified in Some Regulation											
	Totally Agreed		Agreed		Neutral		Disagreed		Totally Disagreeing		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Totally agreed	7	50	4	28.6	2	14.3	1	7.1	0	0	14	100
Agreed	6	26.1	14	60.9	3	13	0	0	0	0	23	100
Neutral	1	7.1	9	64.3	3	21.4	1	7.1	0	0	14	100
Disagreed	0	0	0	0	1	100	0	0	0	0	1	100
Totally disagreed	0	0	0	0	0	0	0	0	0	0	0	0
Total	14	26.9	27	51.9	9	17.3	2	3.8	0	0	52	100

The results of table 3 regard the opinion of surveyed people about whether the company has quality measures or indicators of the software development process. A total of 41 surveyed positions informed, with high levels (78.8%), that they agree with the need of being certified in some regulation referring to software quality in order to successfully carry out the compliance to indicators and to achieve the client’s complete satisfaction.

Table 4: Level of Agreement Regarding the Client’s Participation in the Interface Designing Phase

Value Scale Interface Phase	Level of Agreement with which the Requirements Analysis is Applied to Company’s Procedures and Techniques											
	Totally Agreed		Agreed		Neutral		Disagreed		Totally Disagreed		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Always	13	52	10	40	1	4	1	4	0	0	25	100
Almost always	5	33.3	7	46.7	2	13.3	1	6.7	0	0	15	100
Neutral	5	45.5	3	27.3	3	27.3	0	0	0	0	11	100
Almost never	0	0	0	0	0	0	0	0	0	0	0	0
Never	1	100	0	0	0	0	0	0	0	0	1	100
Total	24	46.2	20	38.5	6	11.5	2	3.8	0	0	52	100

Table 4 shows percentages in relation to the perception level that surveyed people have about their company, regarding the specification of requirements and software performance with the client’s participation rate in the interface design phase, where most of the people surveyed in companies dedicated to software development informed, on percentages in ‘always’ and ‘almost always’ scales up to 84.7%, that their companies apply techniques and procedures during their requirements analysis, which allows them to know the system needed elements to define the software to be done, considering that the requirements’ main objective is to comprehend what clients and users expect the software to do. On the other hand, procedures and techniques are carried out, which allow them to know the needed elements to define the software project; 11.5% showed a neutral position, and the rest, just a very low 3.8%, just maintained their disagreement opinion.

Table 5: Methodologies or Certifications for Software Processes Improvement

Methodologies or Certifications	N	Percentage
Integrated Capacity Maturity Model (CMMI)	9	17.3
Software Processes Model (MOPROSOF)	1	1.9
Quality Management System (ISO 9001:2015)	1	1.9
MOPROSOF, Quality	1	1.9
MOPROSOF, ISO 20000	1	1.9
Agile Software Development Frames (SCRUM)	1	1.9
Software Processes, Equipment (TSP)	1	1.9
No methodology	37	71.2
Total	52	100

The results of software quality dimensions are presented in table 5: percentages that stand out among the techniques used by companies to obtain the client's opinion, where we can find the Software prototype percentage of 59.6% equivalent to 31 positions surveyed, as well as the 17.3 % who informed that they used Software prototype and Paper drafts. Others informed that they only use paper drafts (9.6%), software prototype, and the wizard of Oz technique, which is a prototype to simulate human-machine interaction with 3.8%, and the rest with 1.9% for those who use software prototype, paper drafts, and Storyboard; prototype software show every change and improvement made to the system and can do desktop tests with final users, while the wizard of Oz technique is a prototype that simulates human-machine interaction.

CONCLUSIONS

Among the activities carried out by companies involved in this research, aimed to client's satisfaction, companies involve many external factors that invite them to participate in innovation and improvement activities that are carried out in the company; therefore, the importance of anticipating to potential and future client's needs, incorporating them in the company's activities, which also has as main purpose to compile needed and valuable information about the client's perception, who request the services that the company provides, achieving he's satisfaction. Also, derived from the analysis, it was detected that it is important for companies to provide their value-added services (100%) because they are completely sure that this will allow them to be more competitive and to adequate to the requirements and needs of each of their clients.

Even though the SME do documental reports and keep track to preemptive and corrective actions during the development process, it is recommended to continue doing analysis in the different indicators associated to software development, considering it as an improvement and competitiveness area for the organization. It is pertinent to consider that, in order to be in a dynamic a competitive market, SME should apply controls in aspects related to software development process, in order to provide a product with the highest quality standards, where such product complies with the needs and total satisfaction of the clients. Nowadays, the quality of a software product has key importance, since the client's need evolves to a global value concept, where, if the companies want to improve in terms of international competitiveness, it is important to use appropriate models that help us have a better control of the software development process.

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