CLIENT'S SATISFACTION WITH SOFTWARE DEVELOPMENT QUALITY IN SMALL AND MEDIUM COMPANIES (PYMES) IN BAJA CALIFORNIA, MEXICO

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ABSTRACT

A descriptive study was carried out, analyzing development, client's satisfaction and software quality of Pymes in the state of Baja California, and the purpose was to characterize development, client's satisfaction, and quality of small and medium companies (PYMES) dedicated to offer software services and products in the cities of Ensenada, Mexicali, and Tijuana in the state of Baja California. Likewise, results obtained correspond to 52 Pymes, which contributed in finding the existent relation between development, client's satisfaction, and quality, and how they influence and contribute to the continuous improvement of this industry, since Pymes activities involved in this research are aimed to client's satisfaction and involve many external elements that invites to participate in innovation, as well as the importance of anticipating to potential and future needs of clients, where processes quality plays an important role in this area.

KEYWORDS*: Pyme, TIC, and Quality*

INTRODUCTION

Nowadays, we live a phase in which technology and, specifically, software have developed to an unthinkable extent, where organizations dedicated to software development have evolved, with the objective of competing, where part of this competitiveness takes place through sustaining development, use, and quality of software as a main part of their corporate strategy. It is evident that, as a society, we are witness of how technology has evolved, a society where software and information are really relevant in decision making. On the other hand, having an organizational structure is important for the organization, since in it, hierarchies, authority, command chains, organization chart, among others, are defined. Having a clear structure that allows the organization to adopt their functions, seeking to produce quality software products is important in order to achieve goals and objectives set by the high directives, where organizational structure is the assembly of a construction, a relatively lasting order of the parts of a whole and their relations among themselves (Quiroga, 2002; Hernández, *et al*., 2006).

The organizational structure is the pattern to organize the design of a company, with the objective of concluding goals and objectives set. Considering the aforementioned, it is important for organizations to have a clear organizational structure in which not only would the objectives set are achievable, but also the products and services would have the quality that clients require in an organization (Chiavenato, 2004). In this sense, talking about quality in a product or service may be approached from the qualities of a thing, since the initial quality, meaning, such as product attributes, to the present, where the clients demand quality in a service or products they acquire (Torres and Vásquez, 2008). When speaking

about quality in a product or a service in a company, we speak of the needed tools and techniques for better implementation of quality in the process of a company, seeking to satisfy a client's need and expectative. As time goes by, companies have also evolved in the use of mechanisms to manage quality of products or services in their production systems, initially verified in final product, and, afterwards, in the process of product elaboration, with which such evolution in production systems has benefited companies that now seek to guarantee quality in their fabrication processes, through techniques used to verify requirements relative to quality of products or services (Climent, 2003). Pymes seek to survive in the future, by being productive, accomplishing their mission, and achieving their objectives, developing their human potential, keeping on growing and developing, accepting new challenges (where information technologies play an important role in the economy of countries all around the world and help companies reduce operation costs), and by including them in the company's strategies, which is the case of the European Union, and, specifically, Spain, where the tendency in services related to software engineering projects, databases use, as well as business intelligence, seeks to contribute in the achievement of objectives through strategies set by the company (Piedra, González, and Rainer, 2014). In this sense, Pymes dedicated to software development are not the exception; there have been changes in work systems through the increasing introduction of Information and Communication Technologies (TIC), making it obvious that, as a society, we are witnesses of how we have evolved, a society where quality is relevant in all the economic environment (Gómez *et al.,* 2014). For software companies, a crucial factor in the development project are the methods used in such process, aimed to improving software quality, where a deficient estimate in the project's length and process can cause loss of competitiveness and incompliance in product delivery. This is why it is essential to keep track of the product during its execution, improving the efficacy of elements during the production process, and contributing to the product quality, where many countries such as Malaysia, the Philippines, Thailand, and some countries in eastern Europe such as Poland, Czech Republic, Hungary, and Ireland are developing high quality software, determining in their processes an added value for their clients, achieving a clear leadership in the software world industry (López, Niembro andRamos, 2013). In this context, Latin-America has also begun to participate in this global dynamic, and many countries in this region are entering this dynamic, especially Argentina, which has a favorable tendency to the software production area, where, through the Center (Anacleto, *et al.,* 2014).

Inside the software industry, Pymes dedicated to this area recognize the importance of delivering a quality software product to their clients, since it is an important part in the development process, since this market demands high quality products that satisfy their needs (Piattini *et al.,* 2014), where software engineering plays a main role in the development process, since it assumes that "the quality in a product depends, in a great extent, on process quality" (García, Dávila and Pessoa, 2014).

Considering the aforementioned, some authors (Rogers, 2005; McCallhan, 1977) have tried to determine, which factors affect quality in a software, agreeing that this through a combination of factors; seeking to guarantee software quality, it is required to measure attributes that affect said quality, and such attributes can be measured during the development process, which leads the company, and specifically the person in charge of the process, to have a real-time approach to analysis, design, and codification efficacy, as well as the quality of the software developed. Nowadays, the development of quality software is a necessity for companies, be them small, medium, or large, since there is a high competition with industries in other countries, such as India, China, and the United States, for these countries have quality and processes improvement certificates, where competitiveness in a company is achieved by improving their production

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processes and granting value to their clients, which is why the companies that belong to the software industry aim for continuous improvement, through the implementation of a quality model or standard (León, et al., 2014).

In this sense, in PYMES dedicated to this area, there are processes that adapt to the current dynamic environment; among these strategic programs the incorporation of quality systems that guarantee excellence levels in organizations stands out. Software services, according to (Baeza*et al.,*1995; Kim, Westin y Nikhilesh, 1989), are an important part of a country's economic development, increasing the citizens life quality and competitiveness in organizations, where, for more than a decade, the software industry generates competitive advantages to underdeveloped countries, such as Mexico, where, with the growth of telecommunications, many benefits for companies have risen, since TI have a great impact in the result of activities in the company, and in its business processes. Furthermore, according to (Tahuiton, 2011), he mentions that a software system is a group of decisions around design, which seeks to satisfy the client needs; such decisions are made for a system's development, where the company carries out a decision-making process, selecting a decision centered around the client, who is an important part in software development, where a proposition of value that constitutes a series of advantages that the company can offer to clients can increase their satisfaction and seeks for the client to decide for one company or another (Osterwalder, 2011).

In Baja California, between 2000 and 2001, a group of businessmen representing firms related to the development of software products and services made the decision of creating a formal organization or cluster, as they call it, having as main objective to make the most of California's demand for software services, the objective of making business with the State of California resides in taking advantage of the border between both countries, being this crucial in the creation of the cluster, which can be understood as a group of interrelated companies that work in a same industrial area and collaborate strategically in order to obtain common benefits. On February 20th, 2004, such integrating efforts were consolidated when the National Chamber of Electronic, Telecommunications, and Informatics Industries (CANIETI) and the Association of Information Technologies Suppliers in Baja California (APTI) publicly announced the signing of an accord for the constitution of the 'Clúster de Tecnologías de Información y Software de Baja California, A.C.' (CANIETI, 2004), with 26 founding companies affiliated.

In this sense, the Ministry of State Development of Baja California includes the existence of fifteen Clusters in the state of Baja California, software among them, adding the state to a conceptualization of adopting a Cluster as the base of its industrial politic (Hualde y Gomis, 2006). Based on the aforementioned, a study in the State of Baja California was carried out with a population of 82 Pymes, which sample was of 52 in the cities of Ensenada, Mexicali, and Tijuana, with the objective of analyzing the development, client's satisfaction, and quality of Pymes dedicated to software development in such cities.

METHOD

A descriptive study was made, analyzing Pymes in the software development area in Baja California, for which a 36-question survey divided into four sections: the first one consisted of 8 questions regarding a company's general information, the second section was of 8 questions regarding software development, the third was of 11 questions regarding client's satisfaction, and the last one consisted of 9 questions regarding software quality, where a classification of Likert was used, which purpose was to characterize the development, client's satisfaction, and quality in small and medium companies (Pymes) dedicated to offering software products and services in the cities of Ensenada, Mexicali, and Tijuana in the state of Baja California. Likewise, the results obtained correspond to 52 Pymes dedicated to software development,

which allowed the identification of the existing relation between development, client's satisfaction, and quality, and how these affect the results in this industry, seeking to contribute to the continuous improvement of software (Hernández*et al*., 2006).

RESULTS

For this research, we studied 52 Pymes dedicated to software development, applying a survey to Pymes, which are located in three municipalities in Baja California, distributed in this manner; Mexicali (22), Tijuana (20), and Ensenada (10), which results are described next.

Table 1: Number of Employees in the Company

Classification N Percentage		
Micro (0-10)	31	59.6
Small (11-50)	18	34.6
Medium (51-250)	2	3.8
Large (251 and more)	1	1.9
Total	**52**	**100**

The information presented in table 1 indicates the classification according to the number of employees in the company; the majority is Micro (0-10) with 59.6%, followed by 34.6% that reported they are a Small company (11-50), and with a lower percentage of 3.8% are the ones that informed they are a Medium company; the remaining is just one with 1.9% classified as Large (251 or more).

Table 2: Techniques to Obtain the Clients' Opinion Regarding the Interface in the Development Process

Used Techniques	N	Percentage
Paper drafts	5	9.6
Software prototype	31	59.6
Software prototype, Paper drafts	9	17.3
Software prototype, Paper drafts, Storyboard (images showed in sequence)	1	1.9
Software prototype, Structured modular design	1	1.9
Software prototype, It shows every change and advancement in the system	1	1.9
Software prototype, Wizard of Oz technique (prototypes for simulating human-machine interaction)	2	3.8
Desktop tests with final users	1	1.9
Wizard of Oz technique (prototypes for simulating human-machine interaction)	1	1.9
Total	**52**	**100**

The results regarding software quality are presented in table 2; the percentages that stand out above techniques used by companies to obtain the clients' opinion, such as Software prototype with 59.6%, corresponding to 31 positions surveyed; likewise, with 17.3% are the ones that reported they used Software prototype and Paper drafts. Others informed they only use paper drafts (9.6%); Software prototype and Wizard of Oz technique (prototypes for simulating human-machine interaction) with 3.8%, and 1.9% for the remaining that use Software prototype, Paper drafts, and Storyboard; Prototype software and Structured modular design; Software prototype, it shows every change and advancement in the system; Desktop tests with final users and the Wizard of Oz technique, this last one considered as a prototype to simulate human-machine interaction.

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Table 3: Development Phase in which Clients Participate

Phases	N	Percentage
Analysis	2	3.8
Implementation	2	3.8
Requirements	3	5.8
Requirements, Analysis	4	7.7
Requirements, Analysis, Design	4	7.7
Requirements, Analysis, Design, Implementation	27	51.9
Requirements, Analysis, Implementation	6	11.5
Requirements, Design	2	3.8
Requirements, Implementation	2	3.8
Total	**52**	**100**

Regarding the data presented in table 3 linked to the development phase in which the company's clients participate, 51.9% corresponds to 27 surveyed people, who said there were four phases in the software development process; Requirements, Analysis, Design, Implementation, followed by 11.5% that said they only participated in three; Requirements, Analysis, Implementation. Others informed, with 7.7%, that there were only two phases; Requirements, Analysis, and one more in the phase of Design, and the remaining that corresponds to 3.8% of each mentioned in table 3.

In table 4, the methodologies or certifications of the company are shown, where the person surveyed works, in order to improve software processes. 71.2% said they do not use any methodology, 17.3% confirmed they use only CMMI, followed by 1.9% for CMMI and MOPROSOF; ISO 9001:2015; MOPROSOF and Quality; MOPROSOF and ISO 20000; SCRUM MASTER; and TSP, respectively for each. The aforementioned data indicate that this company dedicated to software development in Baja California with 71.2% does not have a method or certification in their processes in order to develop software that guarantees a high quality product, considering clients' demand products that satisfy their needs.

Table 4: Methodologies or Certifications for the Improvement of Software Processes

Methodologies Orcertifications	N	Percentage
Integrated Model of Capacities Maturity (CMMI)	9	17.3
Model of Software Processes (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 Frames of Software Development (SCRUM)	1	1.9
Software Processes Equipment (TSP)	1	1.9
No methodology	37	71.2
Total	**52**	**100**

Regarding the results in table 5, there is a concentrated level of opinions about what surveyed people said regarding whether the company use techniques to obtain the clients' opinions about the interface in the development process, such as Paper drafts, Software prototype, Paper drafts, Storyboard, Software prototype, Structured modular design, Software prototype, It shows every change and advancement made to the system, Software prototype, Wizard of Oz technique (prototypes for simulating human-machine interaction), Desktop tests with final users, and the Wizard of Oz technique (prototypes for simulating human-machine interaction).

Table 5: Agreeing Level about Techniques to Obtain the Opinion of Clients in the Interface Phase

Values Scale Importance of the Developers Ability and Communication with the User	Agreeing Level with the Performance Evaluation of a Software Product Developed by the Company											
	Totally Agrees		Agrees		Neutral		Disagrees		Totally Disagrees		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Totally agrees	19	73.1	6	23.1	1	3.8	0	0	0	0	26	100
Agrees	12	60	6	30	2	10	0	0	0	0	20	100
Neutral	2	40	3	60	0	0	0	0	0	0	5	100
Disagrees	1	100	0	0	0	0	0	0	0	0	1	100
Totally disagrees	0	0	0	0	0	0	0	0	0	0	0	0
Total	**34**	**65.4**	**15**	**28.8**	**3**	**5.8**	**0**	**0**	**0**	**0**	**52**	**100**

CONCLUSIONS

The results allow to demonstrate that surveyed people in different positions regarding software development state that most of these companies work with own resources, do not require external resources of social, public or private sectors, meaning they are auto-financeable for offering software development services that clients request.

Among the activities carried out by the companies involved in this research and aimed to client's satisfaction, the companies involve many external elements that invite to participate in improvement and innovation activities developed in the company, therefore, the importance of anticipating to the potential and future needs of the client, involving them in activities within the company, which also has as purpose to compile needed information about the client's perceptions and people that request the services offered by the company, achieving their satisfaction. We also detected that it is important for the companies to offer their services with an added value (100%) because they are completely sure that this will allow them to be more competitive and to adjust to the requirements and needs of every client. Since the added value demands the review of existing models and the thinking of doing different, better, and higher quality things, more focused in the needs of the client, and that will help them as a company in order to set a difference between the others. Regarding quality in software development processes in Pymes, the people surveyed informed that the companies where they work using different communication media with clients for which the software development is aimed, with the main purpose of getting information through meetings with clients, the use of social networks (Facebook and Twitter), as well as e-mail, satisfaction surveys, and phone calls. These companies, mainly use these techniques of Software prototype and paper drafts, in order to obtain the client's opinion regarding the interface in the software development process. Even though, nowadays, the software industry in Baja California has grown and has had a significant impact in the state, we can observe there are still opportunity areas in this sector.

RECOMMENDATIONS

Even though Pymes surveyed to make a document report and keep track of preemptive and corrective actions, during the development process, it is recommended to continue doing analysis in different indicators associated with software development, considering it as an improvement and competitiveness area of the organization. It is relevant to consider that, in order to continue in a competitive and dynamic market, Pymes need to apply control of aspects related to software development, in order to offer a product with the highest quality standards, where such product is in accordance to the needs and client's total satisfaction.

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