IMPLEMENTATION OF A BUSINESS PLAN FOR A SMALL SOFTWARE DEVELOPER ENTERPRISE USING DISCRETE EVENTS SIMULATION

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ABSTRACT
Nowadays, Mexican small enterprises whose activity is the development of software and related services, face the problem of having a life expectancy of less than two years, mainly due to the lack of a business plan. The objective of this study is to design and implement a business plan for small software developer enterprises that let to improve the economic and operational indicators. In the literature review, several business plans have been formulated from the last ten years, however the problem of implementation persists. In this study, during one year and a half, we worked together with the human resources of a small enterprise for the implementation of the business plan. Additionally, a simulation model based on discrete events simulation methodology was also implemented for the analysis of internal process in terms total costs. We consider that this study and the simulation model implemented could support the decision making process of small enterprises whose main activity are services.

Keywords: business plan, simulation of business process, small enterprises, software developers

1. INTRODUCTION
In Mexico there are around 5 million economic units that generate 29 million jobs, according to INEGI (2015) (National Institute of Statistics and Geography). The economic units are classified into six main activities: manufacturing, commerce, private non-financial services, other economic activities, religious activities and public services. Following INEGI (2015), the 99.8% of the Mexican economy is based on micro, small and medium enterprises (MSME). The life expectancy of MSME in the sector of professional technical and scientific services is approximately two years (see Fig. 1). This situation is unsustainable for the Mexican economy. The solution for this problem has been approached from different perspectives, for instance, through the analysis of financing, which allows a direct confrontation to organizational difficulties for entrepreneurship. However, this approach is mainly economic and elements that have tested to be essential to the viability of firms are usually neglected. Economic resources are provided, however, not only the viability is not guaranteed, but also the internal shortcomings of the company will compromise it. On the other hand, entrepreneurs see as a possibility, to pursue personal advice to improve their managerial and leadership skills, which allows them to visualize in a comprehensive way aspects that should be taken into account when undertaking a venture. However, it is very common for the entrepreneurs to be obligated to understand and intervene in all the areas that make up the company. Despite these solutions, enterprises in this sector continue to disappear affecting the national economy in Mexico. The objective of this study is to design and implement a business plan for a small software developer enterprise that let to improve the economic and operational indicators. The implementation is carried out both in the reality and based on a discrete-event simulation model.

This paper is prepared as follows: the literature review of business plans for technology-based enterprises is presented in Section 2. A business plan for small software developer enterprises is proposed in Section 3. A simulation model for the analysis of internal process and key performance indicators is implemented using Anylogic™ software and validated via face validation technique in Section 4. Concluding remarks are drawn in Section 5.

![Figure 1: Life expectancy for enterprises in Mexico.](image-url)
2. LITERATURE REVIEW OF BUSINESS PLANS FOR TECHNOLOGY – BASED ENTERPRISES

As Salazar (2000) explains: a business plan is a document that in an orderly and systematic way details the operational and financial aspects of a company. It is the anticipated and written description, which allows determining where you want to go, where you are and how far to reach the goal set. It is a document that can take different forms depending on each situation. The business plan is based on the idea that all the information necessary to evaluate an investment alternative can be presented in a standardized and systematic way. There are three fundamental concepts that must be contained in the business plan (Salazar, 2000):

1. Business definition. You must understand the clear idea of the product and the business.
2. The environment. It includes market analysis, competition and general context conditions.
3. Financial factors. They are the financial elements that describe the financial conditions of the business.

On the other hand, Diaz et al. (2007) point out that the business plan is a document that identifies, describes and analyzes the business opportunity and, in turn, contains an analysis of economic, market, organizational and economic viability. In order to develop a good business plan, it is necessary to collect a large amount of information and the appropriate sequence of steps, that is, you cannot know the economic viability without knowing the market or the strategies.

The Incubator Program for the Creation of Companies PICE (2016) of INNOVAUNAM, is an environment conducive to the creation of new companies from the early stages. It is an internal organization that offers a range of business development services as well as a space in flexible terms to meet the needs of start-up companies. From the canvas business model of Alexander Osterwalder, the elements that are fundamental to the creation of the organization are identified, starting from the Business Model, the value for an organization, and a guide to generate the business plan. In this case, the business model is defined as a promising idea based on the business plan, which shows that the business idea really constitutes a good investment alternative.

A business plan must contain:

1. Executive Summary
2. Value Proposition: Obtained from identifying a solution to a real need, based on some elements such as: innovation.
3. Market Research: Discover, acknowledge and meet the needs of customers.
4. Technical study: It demonstrates the viability of the project, justifying that it has selected the best alternative to supply the market, in accordance with the constraints of location resources and affordable technologies. It encompasses the means of production, as well as the organization of productive activity.


3. A BUSINESS PLAN FOR SMALL SOFTWARE DEVELOPERS ENTERPRISES

The proposal of the plan is based on the structure proposed by Diaz et al. (2010) including in the section of definition of the company the business model and the proposal that generates value for the small company defined by Osterwalder & Pigneur (2010). This proposal is defined in this way due to the needs of the company and the sector to which it is already directed.

3.1. Executive summary

It must capture the attention and facilitate the understanding of the information. It includes some factors such as:

- Business presentation.
- The product or service.
- The value to the customer.
- The potential market.
- Conformation of team.
- Operations

3.2. Enterprise definition

It must show from the business model all the functional activities of the company. What it must contain is:

- Mission, vision and values.
- Business model.

3.3. Potential market

This element defines whether if the product or service being offered in the market meets the needs of the market. Considering the macro-environment that contemplates the socio-economic context, the legislation and the tendencies; On the other hand, the microenvironment in which the activity is carried out, the clients, the suppliers, the competences and the possible collaborators must be defined.

3.4. Marketing

Once the market and the situation of the sector are known, the strategies to reach the client are defined.

3.5. Internal organization

It should detail the production process or service provision, identify the processes and of these are key, to detail the equipment needs and the quality policy. In this way the functions within the organization chart are identified, the profiles necessary to carry out each activity and create the work team. The financial analysis shows if the company is profitable and can be funded.
The elements that must contain a financial analysis are:
- Cash flow.
- Balance sheet of financial needs.

4. THE BUSINESS PLAN IMPLEMENTATION

Due to confidentiality issues we will name as ENTERPRISE the small software developer enterprise whose data are used in this study.

4.1. Executive summary

- Business presentation. The ENTERPRISE offers customized software development and consulting services based on knowledge of the Brokerage Firms operating processes in the markets operated in Mexico, as well as the regulations of the financial entities and all solutions of information and accompaniment to the user, oriented to support the business processes of the companies that provide financial services, to small, medium and large Brokerage houses. The ENTERPRISE has the mission of providing comprehensive custom software solutions and providing consulting services in information technology for the financial sector. It complements the offer with the specialized consultancy service of the sector. The strategic objectives of the company are mainly positioning to achieve the visibility of being the leading Mexican company in development and software implementation to the extent that it allows the automation of processes. As well as sales and profitability with the marketing plan to get more clients.

- The services. The services offered by ENTERPRISE are based on the own technologies developed internally, a system for automating the operational processes of a brokerage house, which is supported by a proprietary database search, registration and administration technology, security, reliability and traceability of information. The characteristics of this service are installation, configuration and optimization of its developments, execution in update, migration and configuration of new modules.

- The potential market. As Guel and Araiza (2015) states, in the last decade the sector of product development and software services has become a key driver of ma s increasingly growing information economy. Following Guel and Araiza (2015) the software development is capable of generating the most qualified jobs and obtaining foreign exchange for the exports of products and services generated at a distance, such opportunities are possible from the technological advances in the areas of communication, information, architecture and industry. The Mexican financial system is made up of several sectors, most of which operate under the supervision of the National Banking and Securities Commission (CNBV). The market of the financial sector that requires the automation of market operating processes, can be identified that the segment for the product and service we offer represents 5% of the market, in this segment are the Multiple Banking Institutions, Societies Cooperatives of Savings and Loans and the Stockbrokers.

- Conformation of team. In the organization chart, there is a general manager to which are integrated the coordination of design, planning and management of projects and in the third level the directions of the main activities. In addition to managing, there is an outsourcing area for activities that are not carry out by the personal of the ENTERPRISE.

- Operations. The operation of the company is based on the management of key operational processes of said processes are: processes of new developments, maintenance processes and service process.

4.2. Enterprise definition

- Mission. "We are a Mexican company dedicated to providing comprehensive custom software solutions. We develop, implement and provide consulting services in information technology for the financial sector. To adapt the system to the operations of our customers. We serve for our customers to serve”.

- Vision. "To be the Mexican company leader in the development and implementation of software made to measure, that allows to automate the critical processes of our clients in the world. To be the main technological partner for the automation of processes and information management in the sectors in which we develop, optimizing our communication in the commercial area and after-sales service”.

- Values. Reliability, integrity, service, collaboration, innovation, robustness, honesty, transparency, quality, human capital, and teamwork.

- Business model. In key activities, the management, attention and follow-up to clients is lacking and marketing is scarce. Therefore, in key resources there is no manager, with customer service staff and a salesperson. The clients currently targeted are the financial sector specifically Brokerage Houses, however, the proposed model can be adapted
with its elements to any industry that requires the automation of its processes.

4.3. Potential market
Nowadays, in Mexico 47 banks are in operation. It was identified that the market of the financial sector that requires the automation of processes of operation of the market, it can be identified that the segment for the product and service offered by the ENTERPRISE represents 5% of this market. In this segment are the Multiple Banking Institutions, Cooperative Societies of Savings and Loans and Brokerage Houses.

4.4. Marketing
Digital marketing and social networks. The places to present the ENTERPRISE are congresses, breakfasts and meetings. By the characteristics of the product and services the channel that is handled is direct sale.

4.5. Internal organization
Customer service is provided via telephone and e-mail. The business of the company focuses on three activities that generate value that are the New Development process, customer service process, and maintenance process. The implementation of the new developments process was done based on a simulation model. The development of the simulation model follows the Discrete-events simulation methodology (Banks 1998).

4.6. The conceptual model
Figure 2 shows the flow chart of the activities that are carry out in the New Development process.

4.7. The simulation model
The objective of the simulation model is to measure the total process time and to estimate the resources needed to carry out the New Development process. Data available for each activity were provided by the company's operational staff based on their experience in an approximate way (see Table 1). To verify the data, the company was visited for a week. The human resources for this process are: 2 assistant, 3 programmers and 1 analyst, the working day schedule, and the meal times of each one. We implemented the simulation model using AnyLogic™ software release 7.0.2. We used the Process Modeling Library whose blocks allow users to use combinations of resources and processes to create process-centric models of real world systems (Grigoryev 2015). The simulation model was implemented with three interfaces for users: animation, logic diagram and graphics. In the animation interface, the areas of the company were located as well as the activities carried out (see Fig. 3).

Table 1: Duration for the main activities of the New Development process

<table>
<thead>
<tr>
<th>Activities duration</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>-</td>
<td>4 months</td>
<td>-</td>
</tr>
<tr>
<td>Direct sales</td>
<td>-</td>
<td>2 years</td>
<td>-</td>
</tr>
<tr>
<td>Customer service call</td>
<td>1 minute</td>
<td>5 minutes</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Sales time</td>
<td>1 hour</td>
<td>1.5 hours</td>
<td>2 hours</td>
</tr>
<tr>
<td>Analysis of the new development</td>
<td>1 hour</td>
<td>5 hours</td>
<td>8 hours</td>
</tr>
<tr>
<td>New development</td>
<td>1 hour</td>
<td>20 hours</td>
<td>35 hours</td>
</tr>
<tr>
<td>Test</td>
<td>0.5 hour</td>
<td>2 hours</td>
<td>3 hours</td>
</tr>
</tbody>
</table>
4.8. The validation of simulation model

As Banks (1998) explains: the validation of simulation model is the determination of whether the conceptual model can be substituted for the real system for the purposes of experimentation. For the validation of the simulation model implemented we used one of the validation techniques proposed by Banks (1998) called face validation. This technique consists on the validation by the user area. The simulation model was presented in a meeting to the team of the ENTERPRISE, and the workers said that the simulation model reflected the behavior of the real system. Therefore, the simulation model of the New Developments process of the ENTERPRISE was validated.

4.9. The verification of simulation model

Following Banks (1998), the verification of simulation model is the determination of whether the computer implementation of the conceptual model is correct. In order to verify the simulation model implemented, the model errors were checked using the compiler included in the simulation software AnyLogic™. One the compilation process was error free, the simulation model was considered verified.

4.10. Simulation experiments design

The design of experiments has been a very powerful tool in the study of complex systems. On the one hand, it has improved the efficiency and economy of the experimental processes. On the other hand, the use of statistical methods in the analysis of the results obtained has given the scientific objectivity to the derived conclusions (Montgomery & Runger 2003). The deterministic simulation experiments (Kleijnen 2008b) have been applied mainly in the area of engineering and chemistry, in the simulation of airplanes, automobiles and chemical processes. In the case of deterministic simulation experiments, the same simulation model response is always obtained at a given input value. Contrary to what happens in random simulation experiments (Kleijnen 2008a), in which the inputs vary according to a random number generator, thus obtaining an output value of the different simulation model with each value of an input. We conducted simulation experiments considering three factors with two extreme values (see Table 2). The key performance indicator that was analyzed was the internal total time of the New Development process (see Fig. 3) the impact of the three factors on it.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Management activities time</td>
<td>31 minutes</td>
<td>90 minutes</td>
</tr>
<tr>
<td>B: Consulting activities time</td>
<td>90 minutes</td>
<td>480 minutes</td>
</tr>
<tr>
<td>C: Production time</td>
<td>180 minutes</td>
<td>2940 minutes</td>
</tr>
</tbody>
</table>

4.11. Service quality analysis

Service quality is measured by the number of complaints, response times, server failures and the number of fines for non-compliance. This is a relevant issue, because it indicates the functionality and compliance of the system. One simulation scenario was proposed to analyze the service quality, in terms of requests no developed. In the scenario analyzed, we considered the number of customer calls and the number of employees as variables. Table 3 shows the results of the simulated scenario.
Table 2: Factors for the simulation experiments design

<table>
<thead>
<tr>
<th>Simulation experiments</th>
<th>Customer calls</th>
<th>Employees</th>
<th>Requests no developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.2</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>0.2</td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>18</td>
<td>7</td>
</tr>
</tbody>
</table>

5. CONCLUSIONS
During the development of this investigation, we were able to conclude that the simulation allowed the partners and collaborators of the ENTERPRISE to recognize the importance of the New Developments process for the improvement of the ENTERPRISE. Likewise, the partners were able to recognize that a further analysis of resources and costs associated to the process can be carried out using the simulation model implemented. Furthermore, we conclude that the simulation of the business plans is a useful tool for micro, small and medium enterprises in Mexico to define, analyze and make decisions regarding the business in their hands. From the statement of different scenarios, beneficial results can be obtained for the problems presented by several enterprises, such as a lack of general vision of the business, with the simulation of the business plan, entrepreneurs can obtain a vision of the enterprise, generating strategies and testing in the model before carrying them out, consequently helping the decision making that allows the survival for more than two years.

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