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SUMARIO • SUMMARY • RESUMO

Editorial

The joint effort of our group of collaborators continues in this second issue of Project Design & Management, with the aim of consolidating the journal so that it may be a reference area for all researchers around the world. It may sound somewhat ambitious for such a young journal; however, it is of great importance that all of us who collaborate in it keep this final goal in mind.

Our fundamental interest in this new issue is to highlight innovation as a primary tool of scientific-technological development, pointing out its importance through creative, collaborative and comprehensive work to broaden the knowledge of mankind, culture and society in the design of new projects.

This new issue includes 6 articles with topics ranging from financial management, mobile operational systems, integral models for project management to methodologies for the supply of liquefied petroleum gas, which are all interesting due their wide variety.

It begins with an article that studies the financial management capabilities of industrial MSMEs in the city of Duitama, Colombia, analyzing the internal processes of such management, recognizing whether decisions are made based on knowledge, skills or culture. The work's conclusions determine the importance of training entrepreneurs in financial management for decision-making to help empower the administrative side of businesses and the adoption of an entrepreneurial culture.

The second article presents the topic on the concept of Social and Urban Sustainability (SUS) in which two theoretical models were correlated to identify the convergences and contributions of each in the construction of this new concept.

The results pointed to the understanding of both models through the use of meso-analytical rules for the interpretation of complex social variables where the reinforcement of each communities' singular, complex, dynamic and cyclical character of actions and norms serves as an improvement for the SUS concept.

The third article contributes toward the research on a sustainable solution for the Liquefied Petroleum Gas (LPG) supply problem in Peru, due to a lack of studies on its causes or the interrelation between the different factors that can affect the normal supply of said fuel; it follows the methodology of the dynamics of soft systems.

The results consider historical records that show the structure, processes, relevant events and interrelationships between all the elements involved in each phase of the LPG value chain, and which affect its supply by relating and interacting with it.

The fourth article in this issue addresses the importance of the construction sector within the global economy.

The study posits that the formulation of a model with clear principles, following international guidelines that meet the main objectives without casting aside socio-environmental variables, will be a powerful and solid tool for project management.

The penultimate article refers to the features of Android, Symbian, iPhone and Windows Phone operating systems. This work employs a methodology based on bibliographic references which concludes that not all types of computer viruses infect cell phones, since it will depend on the operating system's kernel.

Lastly, the sixth article addresses the importance of the migration to Digital Terrestrial Television or Open Digital Television under the ISDB-Tb standard, as a change that implies great investments in the transmission and content creation by television companies, as well as a change for the audience, who must adapt their television sets to have access to the new signal with improved audio and video quality. To this end, it is necessary to implement a methodological guide that studies these regulations and the essential requirements for good practice in project management.

We cannot end this editorial without thanking the entire team of both IT and technical collaborators, as well as the Iberoamerican University Foundation (FUNIBER) and those universities that provided support material so that this second issue could be carried out with the conviction that we are on the right path towards international recognition.

Dr. Luis A. Dzul López
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Gloria Nancy Duitama Castro
National Open and Distance University (UNAD*, Universidad Nacional Abierta y a Distancia*) (Colombia)
teriduitama@hotmail.com · https://orcid.org/0000-0001-9433-2337

THE FINANCIAL MANAGEMENT CAPACITY OF DUITAMA BUSINESS LEADERS

Abstract. This article arises as a result of the reflection of the research "Development of Financial Management of employers of industrial SMEs in the city of Duitama" developed by the Research Group - Ideas en Acción- which is part of the School of Administrative Accounting Sciences Economic and Business "ECACEN" of the UNAD, one of the questions that guided the present study is What financial management capabilities do entrepreneurs of industrial MSMEs in the city of Duitama have? Hypothesis H2 was raised- There are factors related to the capacities that influence a better financial management of the industrial MSMEs of the city of Duitama, the internal processes of the financial management of the companies studied are analyzed and it is recognized if these decisions are taken based on knowledge, skills or culture. The research is framed within a mixed approach, using the descriptive study as a research type. The quantitative survey is proposed as a data collection instrument to know the knowledge, attitudes and opinions of businessmen regarding financial management. In their companies, for the implementation, the Mipymes companies of the city of Duitama that are currently registered in the Chamber of Commerce were taken. In conclusion, entrepreneurs are trained in financial management for decision making that helps to empower companies from the administration and the adoption of a business culture.

Keywords: Financial capabilities, Enterprise, MSMEs.

CAPACIDAD DE GESTIÓN FINANCIERA DE LOS EMPRESARIOS DE DUITAMA

Resumen. Este articulo surge como resultado de la reflexión de la investigación "Desarrollo de la Gestión financiera de los empresarios de las Mipymes industriales de la ciudad de Duitama" que desarrolla el Grupo de investigación –Ideas en Acción- que hace parte la Escuela de Ciencias Administrativas Contables Económicas y Negocios "ECACEN" de la UNAD, una de las preguntas que orientó el presente estudio es ¿Qué capacidades de gestión financiera tienen los empresarios de las Mipymes industriales de la ciudad de Duitama? Se planteó la hipótesis H2-Existen factores relacionados con las capacidades que influyen en una mejor gestión financiera de las Mipymes industriales de la ciudad de Duitama, se analiza los procesos internos de la gestión financiera de las empresas estudiadas y se reconoce si estas decisiones se toman con base en conocimientos, capacidades o cultura. La investigación se enmarca dentro de un enfoque mixto, utiliza como tipo investigativo el estudio descriptivo, se propone como instrumento de recolección de datos la encuesta cuantitativa para conocer el conocimiento, las actitudes y las opiniones de los empresarios en torno a la gestión financiera que realizan en sus empresas, para la implementación se tomaron las empresas Mipymes de la ciudad de Duitama que están registradas actualmente en la Cámara de Comercio. En conclusión, se capacita a los empresarios en la gestión financiera para la toma de decisiones que ayuda a potenciar las empresas desde la administración y la adopción de una cultura empresarial.

Palabras claves: Capacidades financieras, empresa, Mipymes.

Introduction

Business leaders should be prepared to respond to the problems and opportunities in the financial management area due to globalization and transformation within the economy to define the financial capabilities of companies. "These refer to the behaviors, attitudes and knowledge of the economic process that companies implement regarding managing money, forecasting future needs, the selection and use of financial products, and information management".(Torres,2007,p.505), this component tells us the current and real situation of companies from Duitama. It's important that business leaders have knowledge, experience and practical abilities to make financial and functional analysis to ensure the present and future viability of their investments and changes in the production and marketing of their products. But despite having knowledge and attitudes a business culture evidencing integral and constant training is important for it to be a model of strength, responsibility, commitment and leadership.

Therefore, the research study begins with the question: What financial knowledge do Duitama entrepreneurs have to lead business management processes? The answer to this question is based on the hypothesis -there are factors related to the capacities that influence better financial management of industrial MSMEs in the city of Duitama- since the results shown by the economic indicators show a rise in the profits and stability of said companies. As for the Financial Capacities, there are several criteria that entrepreneurs must take into account when making decisions that affect their companies in different fields, because, as managers begin to empower themselves financially, their MSMEs will become increasingly competent in the productive sector to which they belong. Managers are required to begin to intervene in the investment capacity, indebtedness and possible actions taken in the face of financial crises in their companies.

The questionnaire designed is used as the basis for the analysis of financial capacities, taking into account the profiles, productive sector and economic projection of MSMEs. Based on this, we can conclude that financial capabilities are of great importance for MSMEs and the productive sectors of the city, while these are worked intuitively, there is some uncertainty that does not allow a functional economic progress that in turn drives the growth of managers as administrative professionals and companies as projects that significantly contribute to the economic development in the region.

After going through the background of studies on the financial capacity of Duitama's companies, we find the work titled "Financial Capabilities in Colombia: results on the national survey about behaviors, attitudes and financial knowledge" developed by the World Bank. Another work discovered that favors the research at the level of research categories is the "Social Responsibility Plan: a proposal for small and medium-sized enterprises in the province of Tundama" developed by Avila (2017) of the Free University which contributes to the findings discovered in the study of corporate social responsibility (CRS) of small and medium-sized enterprises in the province of Tundama. With this purpose in mind, the evolution of the different appraisals on CSR is taken into account; an initial approach to the CSR concept; the characterization of MSMEs; the proposal for a CSR plan and finally, the points of arrival. The development of a social responsibility structure can be conducted through internal programs for employees with the purpose of having elements that enable participation of different parties.

One characteristic of MSMEs is that owners have the combined role of senior manager and administrator, making the decisions, that in many occasions, are personal and influencing the selection of inefficient alternatives for the company's proper functioning. It is important to contribute to an entrepreneurial culture by means of constant training to the businessmen of Duitama. For that reason, the following objectives are proposed: Research on the financial capabilities of Duitama's companies, get to know the employers' profiles and then design training processes that support strengthening the business culture and hence financial capabilities in terms of knowledge and management.

In order to construct the theoretical framework, the categories of financial culture were taken into account, which is defined from the cultural value that permeate the administrative processes to the extent that the company is developed as a value of the environment, this having an impact on the development of people, as stated by Ramírez, Sánchez & Quintero (2005). "Financial culture certainly involves the values and beliefs that members of a company have in common, but it is also how a person identifies them self in thought, feeling and reaction that guide decision making" (p 34). From this statement it can be said that financial culture must be part of the same business culture that each member must adopt. The strategic decisions that the entrepreneur can make at any given time to define the direction of the company depends on the financial culture. Its suitability depends on the manager's capacity and autonomy, and their training and openness to administrative cultural changes in recent decades. This research, therefore, emphasizes the importance of the adoption of financial culture and development of capabilities involved in MSMEs in Duitama. We have Velaez (1999) to substantiate what is previously mentioned

> Culture is what shapes an organization's decision-making models, guides its actions and drives the individual behavior of its members. It's the way things are done on a day-to-day basis. All companies have a culture more and less settled and more and less explicit which is sometimes fragmented and difficult to perceive from the outside (p.7).

It is important to state that companies are involved in the cultural and economic change brought about by globalization, which is why another category of research is financial capacity, understood by Medina, Acolt, & de León, (2013) as:

> Those possibilities that a company has to make investments or payments in a certain time whether in the short, medium and long term in order to achieve its growth and development objectives, seeking to make profits in their day-to-day operations (p.201).

As such, it's important to define certain competences that a company's manager should be prepared to develop in order to compete with the other companies that are part of the productive sector to which they belong to. The sum of the development of the financial culture and the development of the financial capacity must result in the improvement of the business processes that in turn will allow the integral training in financial matters of those managers from MSMEs.

The scale of the microentrepreneurial sector in the country, and the exhibition of the economic and social environment in the city of Duitama, has become more and more complex, with more difficulties such as: the ability of microenterprises to capture information, evaluate the corresponding production relationships, interpret the available information and anticipate events is becoming increasingly insufficient, as these facts increase the uncertainty and difficulties in making strategic planning. For Quintero (2005)

> Despite the fact that microenterprises in the city of Duitama constitute the broadest sector of entrepreneurship, the Municipal Administration has not been willing to join in efforts with the Chamber of Commerce of Duitama, the SENA and other microenterprises and institutions of the local, departmental and national order to integrate these efforts and fulfill the functions that, by law, correspond to them in terms of fully complying with the principles of complementarity and subsidiarity to provide the city's entire business sector with a comprehensive policy to support solutions for its main difficulties, which in many occasions have led to the imminent death of its microenterprises that are ultimately regulated by the same national legislation, but which in reality are the ones with the fewest resources at all levels (p.65).

It would be interesting to be able to have updated data on MSMEs, since in some circumstances microenterprises appear to open their doors for business, but soon afterwards disappear, arriving as soon as they leave without a trace, with only the uncertainty of their owners who, these days, can only think about surviving without being indebted. This research is intended to serve as a basis for microenterprises to make decisions in support of the business sector, and for the microenterprise sector to take very seriously the fulfillment of their functions by supporting the business development of the city of Duitama with sustainable programs.

Methodology

The present research is framed within a mixed approach, and by using descriptive study as a research type, the quantitative survey is proposed as a data collection instrument to know the knowledge, attitudes and opinions of entrepreneurs about the financial management carried out in their companies, to implement were taken the MSMEs of the city of Duitama that are currently registered in the Chamber of Commerce. An Inductive-Deductive analysis is carried out, taking as a starting point the observation of the problematic situation around specific situations that affect businessmen in making financial decisions, which is subsequently analyzed in light of a general theoretical framework, by means of an induction process. The deduction starts from situations that are explained in the theoretical framework and are applied specifically to the population under study.

Considering that, of the 1090 selected companies, micro, small and medium enterprises will be studied, a distribution is carried out using stratified sampling. In this type of sampling the population is divided into subgroups called strata and a sample is randomly selected from each stratum. The distribution of the sample according to the different strata is called allocation. The proportional allocation is used for this research, since each stratum is represented in the sample in exact proportion to the size of the total population. Georeference was designed through ONA.IO, a phone application that allowed real and immediate access to the data. Data was collected from this that allowed the analysis of the research variables, as well as others common to the entrepreneurs of the city. It was also found that the financial culture of the companies is very similar due to the characterization of its managers and the productive sectors to which they belong to.

The following figure presents the research phases:

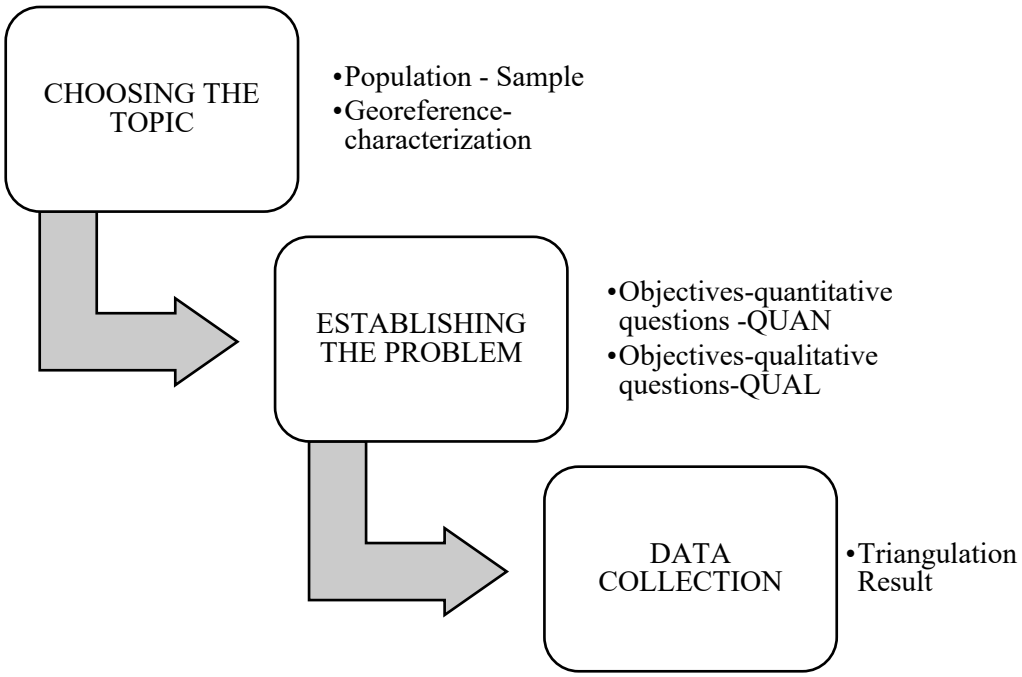

Figure 1. Research Phases.

Note: Source. Author's own creation

The financial management topic is chosen as it is important for companies to make an analysis of their internal processes and how they intrinsically and extrinsically affect it. Financial management allows companies to be a whole and not a series of disjointed processes. According to Padilla, (2011) "this is understood as the management of moving funds. It's the quantification of the strategic planning of a business." (p.37). We can affirm that once managers appropriate the processes involved in financial management, they can develop empathy skills that allow employees to interact in the appropriation of a financial culture that allows MSMEs to evolve and contribute to the productive development of the region.

Bearing in mind that in the city of Duitama no studies have been carried out on the financial capacities of companies, nor on the financial knowledge that owners, managers and administrators possess, the DELPHI METHOD is designed using the selection of a group of professionals and academics to whom we ask for their opinion regarding the aspects established in the questionnaire, their wording and the degree of understanding of the established items. Some consensus was reached with this method and some questions were adjusted which, according to the opinion of the experts consulted, required modifications. This allowed for a broader approach than that of the researchers and generated a greater level of coherence in the instrument.

A pilot test is then carried out to be applied to business leaders in the sample. This test allows adjustments to be made around the meaning of some questions and answers, as some of the items were not entirely clear to the respondents. With the pilot test, modifications were made to the wording and options of the questionnaire. This test revealed

the understanding, the duration of the questionnaire and, in general, the possible difficulties that could be generated in the process of applying the instrument.

The initial stage started with the characterization of the business leaders, the financial skills and the financial capacity of the companies. This was done through a questionnaire of 44 questions in which the previously mentioned items were related. In this questionnaire, the research variables were related to the profiles of the managers, in order to build a model that allows managers to reveal shortcomings, strengths and develop financial skills that help them to be competitive at an organizational level.

The collection and processing of data took place through an application that allowed quick and easy access to information. It also takes advantage of the evolution of this type of tools that favors the interaction and location of entrepreneurs in real time. The automatic Georeferencing was made from the received information. The advantage that this application has is that the information can be edited if necessary, which contributed to the interaction from mobile devices. The following table summarizes the variables and categories that are analyzed for the development of the research.

Table 1
Variables and Categories

RESEARCH TOPIC	**DEPENDENT RESEARCH VARIABLES**	**RESEARCH CATEGORIES**	**RESEARCH ITEMS**	**INDICATORS**
INTERNAL MANAGEMENT FINANCIAL MANAGEMENT OF INDUSTRIAL BUSINESS LEADERS ATTACHED TO THE CHAMBER OF COMMERCE OF DUITAMA	CHARACTERISATION	COOPERATIVE GOVERNANCE	Ownership relationship Responsibility Size Financial expertise	Owner Administrator Manager Another one
		TYPE OF ENTERPRISE		Private, public, mixed, other. Ltda. SAS, shares, S.A. Supportive, another one Micro, small, medium, large enterprise In a period of time
	KNOWLEDGE	FINANCIAL EDUCATION	Educational level	Percentage of business leaders with an education in high, medium, low finance. (Empirical,

		APTITUDE	Characteristics for each management level	basic, professional) Planning (debts, expenses, income, savings) Diagnosis Goals Objectives Policies Strategic actions Organization (accounting records, books, financial statements, financial indicators) Management Against the standards Deviations Corrective adjustments
	Capacities	Attitude	Financial management Practices	Financial statements Credit access
		BEHAVIOR	Future planning	Uses of financial services Use of financial products Use of insurance
	CULTURE	VALUES	Honesty Transparency in information Discipline	Compliance with regulatory parameters (DIAN, Treasury, etc.),
		ETHIC	Social responsibility for financial decisions	With the shareholders With the workers With the state With the

			suppliers
	ORGANIZATIONAL CULTURE	identification of financial problems	
		Analysis of alternatives	Risk awareness
		Criteria for selecting a suitable alternative	Cautiousness in analysis
			Informed decisions

Note: Source. Author's own creation

When developing the study, this is done through the analysis of three variables of knowledge, skills and culture. A theoretical approach is first made followed by the instrument design which is assessed by academic peers, and through the Delphi methodology which performs a statistical analysis to check the reliability and validity of the data collected, the instrument is then applied to business leaders in the city of Duitama, through an application from the Smartphones performing georeferencing of the population under study. This application enabled the surveys to be delivered in real time, even adapting to areas without Internet access, recording the survey to be sent via Wi-Fi.

The survey is applied to 206 companies registered with the Chamber of Commerce of the city of Duitama. The information is displayed and analyzed when introduced into the cloud, then shows the map of Duitama with the companies surveyed.

Figure 2. Map of Surveyed Enterprises.

Note: Source. Program used for data treatment (ONA).

The initial part of the questionnaire includes characterization questions that include information on the economic sector, the organizational structure of the company, operating time, assets and liabilities. The other questions are aimed at determining the three variables studied.

The questions of the variables of knowledge, capacities and culture were asked by means of multiple-choice questions, where the respondent had the possibility of choosing one or more options from the list of answers given. In order to carry out an orderly data management process in the SPSS and in the georeferencing application, a codebook is made, which clarifies scores with respect to the analysis items, with a score of True = 1 (option chosen), False = 0 (option not chosen) and Does Not Know does not respond = 2. The Likert scale was used, also called the summative grading scale, for the other questions. It is one of the most used techniques of attitude scaling and is useful because it allows subjects to express the intensity of their opinions. In developing this type of scale, the researcher tries to generate statements related to the topic or object in question.

In the case of the underlying variables (such as attitudes[1], motivations) and complex variables, the researcher must provide the operational definitions of such variables.[2] For Likert scale questions, the more favorable the respondent is inclined towards the question, the higher the score. The following procedure is used to tabulate the surveys:

- Each response category is assigned a value between 1 and 5.
- The values of the responses of each interviewee are summed separately, using the numerical values assigned to each response category.
- They are ordered according to the scores obtained by each of them, this process is carried out by means of the statistical package SPSS.

The table indicates the scoring scale used for the proposed questionnaire:

[1] By attitude we mean a state of psychological disposition, acquired and organized through one's own experience that incites us to react in a characteristic way due to certain stimuli.

[2] Ibíd., pag. 26

Table 2

Scoring Scale

VARIABLE	QUESTIONS	ANSWER OPTIONS	SCORING SCALE-CODE BOOK
Capacities	23 to 38	Multiple choice questions with multiple answers (23 to 38)	True =1 (option selected), False = 0 (option not selected) and Does Not Know does not respond =2

Note: Source. Author's own creation

In order to write this article, we take up questions 24, 25, 26 and 27, which correspond to financial capacities.

Results

Profile of Business Leaders (financial culture).

Boyacá business leaders make investments taking into account the financial situation of the company, i.e. consult the financial indicators. In the case of the investment

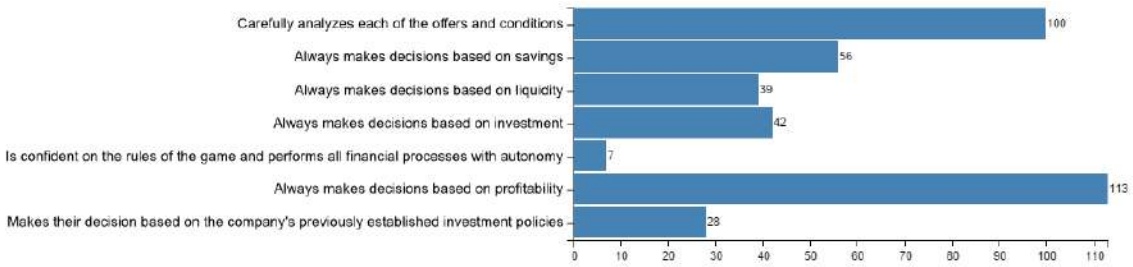

Figure 3. Financial Situation Regarding Investment

The business leaders are based or have the financial capacity of the company based on the mission, vision and objectives in its greatest proportion

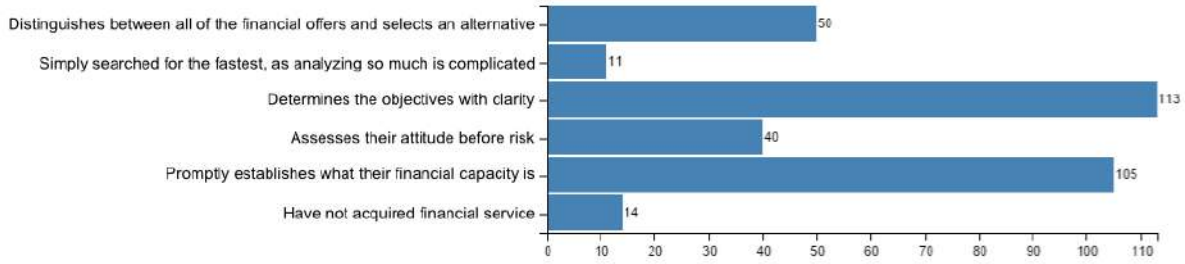

Figure 4. Mission, Vision and Objectives

In times of crisis, when companies are at financial risk, desperate measures are taken and loans are used at high interest rates, and in many cases the Company's objectives are not rethought in order to seek more efficient measures to overcome the crisis or get out of it

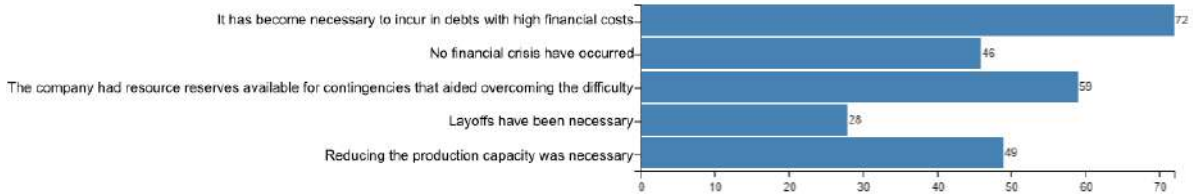

Figure 5. Mission, Vision and Objectives

Business leaders conduct ongoing assessments to determine whether the objectives were met through investment

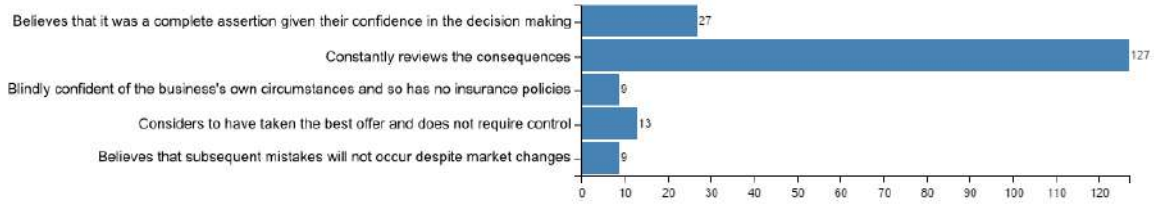

Figure 6. Goal Fulfillment

The analysis of these questions confirms that the corporate financial culture of managers sometimes leads them to take measures that are often transitory and these only allow them to carry out emergency plans that do not contribute in the long term. In addition, anxiety, insecurity and poor financial knowledge lead to companies not investing on a continuous basis given the fluctuation of the market and the poor knowledge of financial services currently offered to these types of companies.

The results of the survey have also shown us that even though managers are mostly empirical, they see the importance of their role in the company. Many of them consider that the management involved needs to be redesigned because they are acting in a disorganized

way and this does not allow the processes to be as successful as they should be, resulting in uncertainty, mistrust and slow updating processes in the business culture.

Likewise, if we look at the results of questions 24 to 27, it is evident that managers are focused on the analysis of the consequences of their decisions rather than on the projection of the different functional areas of their company. At the same time, we perceive that business leaders are cautious and do not trust that investments and loans are a tool, but use them as a measure to solve financial crises momentarily. This circumstance evidences that there is still resistance towards the market of financial products.

Finally, it is stated that the development and appropriation of a financial management culture is essential, given the new market conditions, globalization and the evident economic development of the city of Duitama. The appropriation of financial culture also becomes urgent because companies and business has changed. Duitamese companies have a great responsibility in the city's development, in the creation of new economies and the opening of markets.

Financial management in companies is a tool that enables the development of managerial capacities, the appropriation of financial culture, and the development of different ethical, labor and business values, says Rodríguez and Bustamante

> Managerial ethics is conceived with the intention that managers approach their work in a critical and proactive manner, with a training approach that allows them, on the one hand, to get closer to the knowledge and implications that make up their profession and, on the other, to get used to practices that demonstrate their responsibilities and impacts in a context such as the one in Colombia (p.27).

This has the added value that the entities involved feel they are an essential part of it. This is translated into the channeling of efforts that allow companies to evolve, propose and innovate not only on the financial aspect but also within the productive sector, since a company that is well focused financially can be confident that its capital will be productive in the future.

It is crucial for the business leader to know the structure of the financial information since the results of a certain period are a starting point for the efficient decision making of MSMEs. Emphasis is placed on making financial information as consistent as possible with reality. It is often found in the culture that financial information is manufactured by complying with the reports of the control entities and the DIAN for the payment of taxes, i.e., as commonly said, "information is masked", and this is a worrying situation because such information does not express the company's reality, with it being directly tied to the honesty of business leaders. Therefore, it is important that these values are developed from the mission, vision and goals but applied at a general level, states Saavedra (2011)

> The company's main responsibility is related to the economic results it expects to achieve when carrying out its productive activity. If it does not obtain benefits at least equal to its total costs, it is socially irresponsible, as it squanders resources. For this reason, we deduce that economic performance is fundamental for it to be a good employer and generate wealth in its environment (p.27).

In the era of globalization, companies are required to meet international standards and international accounting, where the reflected financial information must be standardized by the country or any other place in the world where transparency reflects the business culture of Colombia.

The businessmen participating in the training agree that business in Colombia is difficult because of political obstacle. But it is a known fact that in Colombia there is no political will and much less an anti-corruption culture that helps MSMEs with state resources, and sometimes the high cost of production leads many of them to bankruptcy or temporary closures.

Another drawback is the high tax burden that the employer faces with major difficulties, and despite generating employment, the State does not provide tax payment relief.

It is for this reason that, at this moment, companies must direct their investments to social and environmental problems that allow them to reach their sustainable development in the future. It is essential to raise awareness among business leaders to identify options by taking into account production cost savings, improved ability to implement businesses, reduction of emissions, waste and tributaries since this can encourage them to channel themselves in the path of environmental management and to modify the environmental perception in general.

Conclusions

As a result of the research, it became evident that the business leaders of the city of Duitama execute internal financial management processes that often disrupt the functional areas of the company and affect its evolution. One of the characteristics of MSMEs is that they have arisen from individual or family capacities to manufacture a product and has grown due to the demand generated for it over time, by which financial or organizational capacities have not been intrinsic within the company, but rather have arisen as a need for marketing. We can say that the creation of a MSMEs has developed as the formalization of an activity.

Because of this, it is evident that the knowledge that business leaders of the city of Duitama have are basic, and they have acquired them through their activity, where the person who launches the business idea is the one who finishes becoming the manager, without giving much importance to the financial information. In addition, they are subject to the development of the market for each product, do not diversify, do not innovate but are carried away by the economy in such a way that there are companies that do not develop their activity during a fiscal period, but interrupt work for certain periods.

The characterization of managers showed that most of them have little education in financial management, because the processes are done empirically and intuitively.

A relationship between the form of financial management and the lifespan of the companies is observed, where companies that have lasted more than 5 years still appear in the Chamber of Commerce and with the report of a suitable financial management that

determines the responsibility with the control entities. The business leader, despite being empirical, displays business ethics.

As far as investment is concerned, managers give priority to its profitability, that is to say, they focus on the supervision of profit and not on the alliances or future usufruct they may bring to their companies. This means that the confidence in investment and its projections are affected. This brings in turn a retraction of the economic progress of the productive sectors.

When analyzing financial capacity and its relationship with the mission and vision of companies, business leaders have them as the reference to defining it. They focus on the financial conditions and what they allow in the real context; they are in charge of analyzing in depth the different aspects that affect the financial capacity of their companies.

In relation to financial capacities and the skills that must be developed through them, it is evident that companies resort to credits in times of crisis, even though these have a high interest cost. There are very few managers and companies that have or keep reserves for these events. This confirms the low importance that many managers attach to training in financial skills and management of the same.

In order to determine the consequences of business decisions such as investments, loans or capital injections, managers make high use of the review and evaluation of investments and their outcome, keeping them constantly under control. Very few trust the markets or believe that their decision do not require immediate oversight.

The research determines that the managers in the city of Duitama, although they have some knowledge, require training in financial management to determine actions that fix the continuous growth of the productive sectors.

In designing the training for MSMEs business leaders, the main deficiencies in terms of knowledge, skills and culture were taken into account; workshops were scheduled on strategic planning, human talent, financial management and how to study the business environment. The evaluation of these workshops takes into account the meaning and sense of the business leaders regarding what they have learned, in terms of the control that should be exerted on suppliers, customers and the financial area. Planning for business problems or emergencies, as well as focusing on financial reports and interpreting them in the decision making of MSMEs.

Among the events in which there was an opportunity of participating as speakers in the Congreso Internacional Prospecta2016 (2016 Prospecta International Congress), Ponencia de Semilleros 2016 (2016 Conference on Seedbeds) and in the Congreso Prospecta 2017 (2017 Prospecta Congress), Duitama obtained the award for best research conference. Moreover, the UNAM from Mexico funded by UNAD participates at the international level.

In 2017, the Alternative Seminar on Public and Private Financing was held. Simultaneous activities were proposed such as conferences focused on financial management, a banking fair with 12 entities participating as exhibitors, training in financial literacy and in 2018 the Presentation of the Research Poster at the 1st Meeting on Research,

Innovation and Business Leadership, Alianza Universidad Empresa Estado CUEE "El empresario CUEEnta”

Figure 7. Poster presenting the meeting

One participates in the Program "con Olor a Región" (*With the Smell of the Region*) in the topic “MSMEs in Boyacá of the UNAD”, where research is considered as a collaboration so that the business leader of the city of Duitama reflects on their own role in the economy of the Region.

Figure 8. Presentation of the “con Olor a Región” Program

Note: Source: https://www.youtube.com/watch?v=wgnwmaCw2lw&feature=youtu.be

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THE CONTRIBUTIONS AND CORRELATIONS OF TWO THEORETICAL MODELS FOR THE CONCEPT OF SOCIAL AND URBAN SUSTAINABILITY: RIO (2015) AND RIO AND AMORIM (2017)

Diego Felipe Borges de Amorim
Fundação Gaúcha do Trabalho e Ação Social (FGTAS)
diego-amorim@fgtas.rs.gov.br ·https://orcid.org/0000-0001-8259-5703
Javiera Andrea Rojas del Rio
Fundação Gaúcha do Trabalho e Ação Social (FGTAS)
javiera.andrea.rojas.del.rio@gmail.com

Abstract: The dialogical emergence of mesoanalytic rules as a potential guide to the interpretation of social phenomena, dynamic and complex in nature, is something new in the search for clues that help to polish the concept of sustainability, especially the Social and Urban Sustainability- SSU. In this sense, the present research sought to correlate two theoretical models of SSU, Rio (2015) and Rio and Amorim (2017), in order to identify the convergences and the contributions of each one to the construction of the SSU concept. In order to achieve this objective, a qualitative, exploratory and comparative study was proposed, in line with the Multivariable Analysis Theory and with the method known as Quantitative Propositional Analysis (APQ) for the transformation of qualitative and quantitative data. The results pointed to the convergence of the understanding of both on the structural bases of the SSU model through the use of mesoanalytic rules for the interpretation of complex social variables; Complexity Theory and Multilevel Analysis, the concepts of hospitality and hostility, and Learning Theories as fundamental tools for the search for a broader and deeper interpretive route of the complex social dynamics from which the SSU emerges. The conclusion indicated the reinforcement of the unique, complex, dynamic and cyclical character of the actions and norms of each community that one wishes to study, so that the conception of a theoretical model of SSU must be constantly tested, revised and developed, in line with reality of each community, in order to improve the emerging SSU concept.

Keywords: Mesoanalytic rules, social and urban sustainability, multilevel analysis, theory of complexity, theories of learning.

AS CONTRIBUIÇÕES E AS CORRELAÇÕES DE DOIS MODELOS TEÓRICOS PARA O CONCEITO DE SÓCIO SUSTENTABILIDADE URBANA: RIO (2015) E RIO E AMORIM (2017)

Resumo: A emergência dialógica de regras mesoanalíticas como guia potencial para a interpretação de fenômenos sociais, dinâmicos e complexos por natureza, é algo novo na busca por indícios que ajudem a polir o conceito de sustentabilidade, em especial, a Sócio Sustentabilidade Urbana - SSU. Nesse sentido, a presente pesquisa buscou correlacionar dois modelo teóricos de SSU, Rio (2015) e Rio e Amorim (2017), de modo a identificar as convergências e as contribuições de cada um na construção do conceito de SSU. De forma a alcançar este objetivo, foi proposta uma pesquisa qualitativa, exploratória e de estudo comparativo, alinhada à Teoria de Análise Multínivel e com o método conhecido como Análise Proposicional Quantitativa (APQ) para a transformação de dados qualitativos em quantitativos. Os resultados apontaram para a convergência do entendimento de ambos sobre as bases estruturais do modelo de SSU através do uso de regras mesoanalíticas para a interpretação de variáveis sociais complexas; da Teoria da Complexidade e da Análise Multinível, dos conceitos de hospitalidade e hostilidade, e das Teorias de Aprendizagem como instrumentos fundamentais para à busca de uma rota interpretativa mais abrangente e profunda da dinâmica social complexa de onde emerge a SSU. A conclusão indicou o reforço do caráter singular, complexo, dinâmico e cíclico das ações e das normas de cada comunidade que se queira estudar, de modo que a concepção de um modelo teórico de SSU deve ser constantemente testado, revisado e desenvolvido, alinhado à realidade de cada comunidade, de forma a aprimorar o emergente conceito de SSU.

Palavras-chave: Regras mesoanalíticas, sócio sustentabilidade urbana, análise multinível, teoria da complexidade, teorias da aprendizagem.

LAS CONTRIBUCIONES Y LAS CORRELACIONES DE DOS MODELOS TEÓRICOS PARA EL CONCEPTO DE SOCIO SUSTENTABILIDAD URBANA: RIO (2015) Y RIO Y AMORIM (2017)

Resumen: La emergencia dialógica de reglas mesoanalíticas como guía potencial para la interpretación de fenómenos sociales, dinámicos y complejos por naturaleza, es algo nuevo en la búsqueda de indicios que ayuden a pulir el concepto de sustentabilidad, en especial, a Socio Sustentabilidad Urbana - SSU. En este sentido, la presente investigación buscó correlacionar dos modelos teóricos de SSU, Rio (2015) y Rio y Amorim (2017), para identificar las convergencias y las contribuciones de cada uno en la construcción del concepto de SSU. Para alcanzar este objetivo, se propuso una investigación cualitativa, exploratoria y de estudio comparativo, alineada a la Teoría de Análisis Multínivel y con el método conocido como Análisis Proposicional Cuantitativo (APQ) para la transformación de datos cualitativos en cuantitativos. Los resultados apuntaron a la convergencia del entendimiento de ambos sobre las bases estructurales del modelo de SSU a través del uso de reglas mesoanalíticas para la interpretación de variables sociales complejas; de la Teoría de la Complejidad y del Análisis Multinivel, de los conceptos de hospitalidad y hostilidad, y de las Teorías del Aprendizagem como instrumentos fundamentales para la búsqueda de una ruta interpretativa más amplia y profunda de la dinámica social compleja de donde emerge la SSU. La conclusión indicó el refuerzo del carácter singular, complejo, dinámico y cíclico de las acciones y de las normas de cada comunidad que se quiera estudiar, de modo que la concepción de un modelo teórico de SSU debe ser constantemente probado, revisado y desarrollado, alineado a la realidad de cada comunidad, para mejorar el emergente concepto de SSU.

Palabras clave: Reglas mesoanalíticas, socio sustentabilidad urbana, análisis multinivel, teoría de la complejidad, teorías del aprendizaje

Intoduction

The search for a conceptual definition for the term "sustainability" and other analogies, such as the terms "sustainable" and even "sustainable development" is a topic that dates back to 1970 and, up until today, can't get an epistemological agreement (Lima, 2003; Mikhailova, 2004; Feil e Schreiber, 2017), and it's very likely that no other "concept has been quoted, argued and used so many times in so many researches." (Mikhailova, 2004). According to Lima (2003), "the birth of the sustainability discourse stems as the dominant expression in debates related to environmental issues and social development, in an open sense." The different research aspects that are present in the terminological race for the aforementioned concept, follow different paths according to the convenience of the chosen perspective in the way of one of the pillars in the triage of sustainability: economic, environmental and social. Therefore, according to Stepanyan, Littlejohn and Margaryan (2013) apud Feil and Schreiber (2017), "the meanings of this term varies in literature due to the quantity of perspectives and links with the context and area of action."

The birth of the discourse that involves sustainability covers complex elements that look for an explanation through Positivism, meaning that it's based on traditional science aligned with systemic theory, where we look for causal explanations of social, behavioral and physical phenomena. However, according to Dimitrov (2003), this supposition may be accepted for artificial things, something created by humans, but in nature and society, it doesn't work. This is due to the complexity that is present on the system, requiring a more holistic view and a deeper consideration to search for a real comprehension of the process as an interdependent whole. To get there, complexity is linked to the study of mesoanalytic rules, linked to the Learning Theories and Multilevel Analysis, understood as a main medium to interpreting the acts and rules that stem from social, interactive and dynamic environments naturally.

Due to this chaotic scenario, this research's goal is to relate the two Social and Urban Sustainability (SUS) models, presented in this the study as models for the correct interpretation of the mesoanalytic rules for the SUS concept, which will be seen as a growing and relevant aspect of discourse, implicating the "sustainability" term. Therefore, the following question is established: What are the contributions to the theoretical model of the Social and Urban Sustainability (SUS) of Rio (2015) and Rio and Amorim (2017) when developing the concept of SUS? Even so, is there any evidence of correlation between the previous theoretical frameworks?

Theoretical Framework

Urban hospitality and hostility

As a topic of academic research, hospitality is quite recent. Congress, seminars and conferences related to the topic did not discussed it until the mid-2000s. Also, the limited accessible material related to the topic of hospitality is generally developed within the reach of domestic or commercial hospitality, which means that it is only related to the relationships taking place within a private space. There are only a few academics dedicated to urban hospitality focusing on topics related to public space, exercise of citizenship and the manifestation of public life (Severini, 2013).

Considering the idea that new urban acts will appear due to globalization, it's possible to identify new behavior codes and rules to study. Nonetheless, the paths to take in urban planning appear as new contemporary behavior codes and rules that stem from new acts determined by many factors; among them, we may highlight some that are heavily related to the behavior of a global society in cities (in differentiation to the behavior that may be seen in rural areas, where codes and rules are based on new standards, for example.)

According to Grinover (2006), the rules for use should be observed and preserved through the principles of hospitality, like guaranteeing every citizen access to devices and services, public transport, work, etc. These rules, which are basically hospitality rules through the articulation between public and private, imply relationships between different social groups, generations, families and individuals. These rules also express the values in which social community and collective experience are based within each period of time.

Something that seems convergent between academics about the topic related to the concept of urban hospitality considers the factor of "welcome" as the main guide for this event. As Grinover (2006) explains: "Hospitality presupposes acceptance: is one of the superior laws of humanity, is a universal rule. Accepting is permitting the inclusion of others in your own space, under certain conditions." Hospitality, as Jacques Godbout (1997) apud Grinover (2006) explain, is the gift of space; space to be read, enabled, crossed or contemplated.

On the other hand, Rio (2015) highlights that hospitality should be considered a "necessity" in our behavior, prior to rules. Same as this, peace (hospitality) should be prior to the state of war (hostility). At the same time, literature considers hospitality the law that regulates us, like a specific law unto foreigners in every country, defining new behaviors in the new environment.

The growing concept of Social and Urban Sustainability

The concept of SUS, even though it's still growing and, in this sense, is a continuous "reconstruction" phase, includes the idea of "balance" between three dimensions of sustainable development (social, economic and environmental) according to the correlated topics by Colantonio (2009) apud Rio and Amorim (2017). Therefore, when thinking about the SUS concept, Rio and Amorim (2017) present the idea of a "system", something organized and interactive, that encourages thinking on urban communities as social and sustainable spaces, combined with urban planning and sustainability. The concept also brings the integration of the learning process as a "medium" for the immersion of new rules and urban acts that revolt and regenerate with time, shaping the SUS concept.

The concept of learning, depending on the studied aspect, is present in the studies of Kolb (1997, 2005), Argyris y Schön (1974, 1978, 1996), Senge (1990), Bandura (1997), Wenger (1998, 2000), Templeton, Lewis and Snyder (2002) and Blackmore (2007), apud Rio and Amorim (2017), and reveal all their complexity as a definition due to the smallness that shouldn't be twisted with other concepts. Therefore, this concept shouldn't be mistaken with the conception of SUS, since this last one is configured as a "process itself", which means, a whole, a unit. The first one is characterized as the "medium" of this process, which means, a channel that interacts with the study of behavior, rules and individual acts as a collective; it covers the path of assimilation, incorporation and action execution (rules, acts) in the functional process of this complex system (Rio y Amorim, 2017).

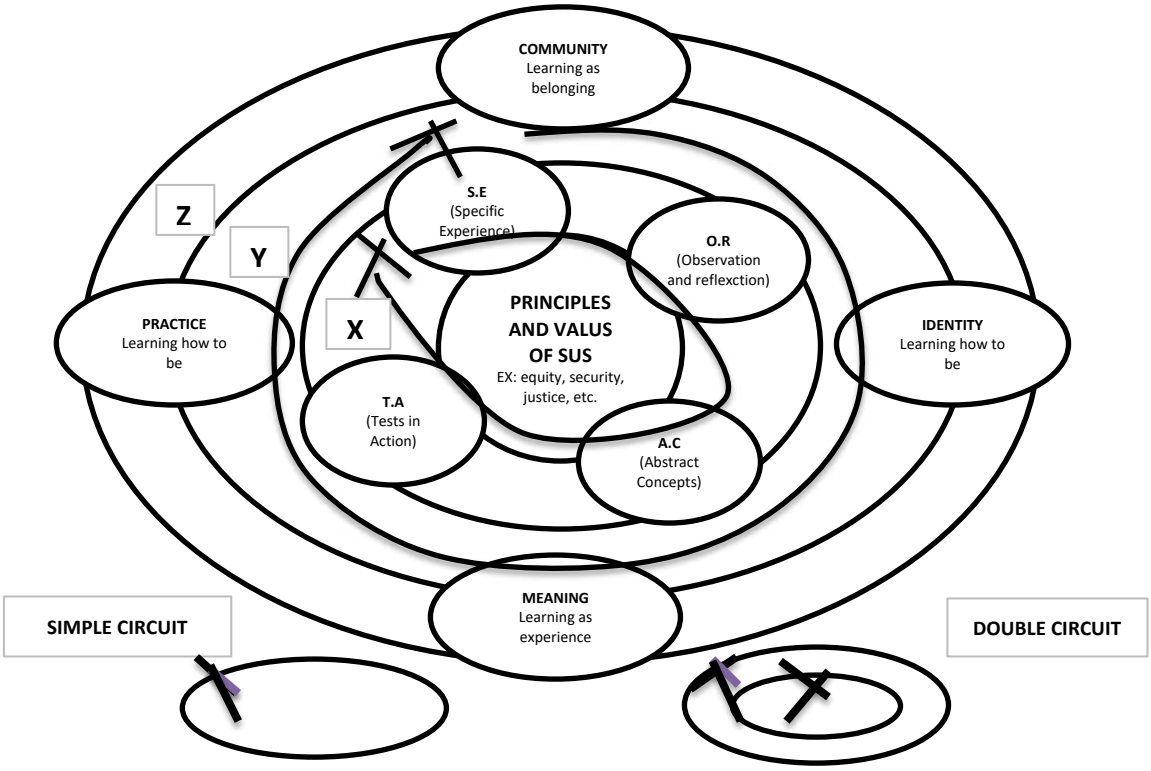

Figure 1. Theoretical model of Social and Urban Sustainability (SUS)

Note: Source: Rio and Amorim (2017).

In a recent work by the authors Rio and Amorim (2017) about the Social and Urban Sustainability (SUS) topic in which they proposed the construction of a theoretical model (figure 1) based on three Learning levels (individual, organizational and social), it was concluded that the "values and principles" of five SUS projects used in the preparation of this original study, all from Latin American communities, are included in the framework of practices adopted by the citizens of this societies.

In other study base, we find the social sustainability model created and implemented in Vancouver, Canada. In 2005, the municipal authorities of this city enacted a Social Development Plan; this was the first project of this kind that was implemented on an urban city level (Rio, Pedrozo and Turcato, 2014; Rio, 2015). The justification for using this model, according to the aforementioned authors, was: to get a sustainable society, the basic needs of the residents must be met, so it must have the ability to develop itself from its own resources, preventing and treating deviations sustainability, living on the present and guaranteeing the future.

The relevance of Vancouver's sustainable social plan is due, precisely, to a declaration of values or principles that shape the development of more specific questions. On the other hand, the limited access to traditional criteria may compromise the search for performance indicators aligned with temporal reality, that has a dynamic nature. Therefore, the possibility that there haven't been considerations about an important topic may undermine the legitimacy

of this model to be reproduced in other cities, even on the long run (Rio, Pedrozo and Turcato, 2014; Rio, 2015).

The paradigm of complexity

Complexity's paradigm focuses on the rich conceptual essence of non-linear science: science of turbulence and chaos, origins and fractals, auto-organization and critics, that impregnates traditional disciplines and counteracts the classic mechanism (Dimitrov, 2003; Kanso, 2015). This field of study covers numerous recent theories such as fractal theory, chaos theory, catastrophe theory and fuzzy logic, among others, come from exact sciences and approaches a vision that is closer to reality, without simplification nor reductions (Kanso, 2015; Torres, 2018).

The word "complexity", as Dimitrov (2003) shows, comes from the Latin word complexus which means "totality". In this way, the Science of Complexity focuses on the study of everything, in the completeness of dynamics: forces, energies, substances and shapes that are present in the whole universe ate part of a net system, integrated, dynamic and interactive. Also, according to the previously mentioned author, there's multiple and different scales of representations of this complex net, including, specially, on micro and macro levels, but also individually and socially. Even though it's complex, it presents characteristic levels of regularities and similarities, creating the paradigm's conceptual essence that births emergent phenomena (Dimitrov, 2003).

The study of the Complexity Theory, according to Kanso (2015), when used as a synonym for Complexity Epistemology, has gained popularity trough the pioneer study published by Edgar Morin, Isabelle Stengers and Ilya Prigogine, as well as the Computational Complexity Theory. From this point of view, according to Rio (2005), this study reveals the generic meaning in generalist logic from the concept of system, that allow us to highlight the influence that the parts (or individuals) have on the whole, due to their reflective enrichment. This can't be conceived trough Systemic Thinking, which is deeply organized, goal-centered and predictive (Dimitrov, 2003).

Morin's thinking, as Salles and Matos (2017) identify, contributes to the clarification and belonging to the Complexity Theory when sharing and articulating disciplinary knowledge, so they can contribute to understanding the whole starting from here. Complexity is by itself a hard critic to linear models of today's way of thinking; rigid, mechanical, pragmatic, dead. It claims that it develops critical, reflective, holistic and transdisciplinary thinking, able to pointing out at the issues of current models, allowing a transformation, which Edgar Morin baptizes as "thinking reform", something created to relieve the true comprehension of "real" (Silva, 2011). Morin (1992) apud Rio (2015) suggest that the new, contemporary advances in our knowledge about organizations demand a radical reorganization of our knowledge organization. Like this, a critical approach to reductionism spirit appears, dominant in the science field.

Multilevel Analysis model

Multilevel Analysis model, just like Structural equation modeling, according to Collares (2011), can be described trough many synonyms found in literature, just like the hierarchical linear modeling, the random ratio modeling, the varying components modeling, multilevel model, contextual analysis, linear mixed model; mixed effects model, random effects model and hierarchical regression (Laros and Marciano, 2008). According to Santos, Ferreira, Oliveira, Dourado and Barreto (2000), its use as tool to analyze complex data (mainly qualitative data and multiple empirical researches) dates back to the 70s, associated to the explosion of technological development that combined many publications about

generalized linear models (GLM), specially on the work of Wedderburn (1974), who proposed the use of more generic models with the inclusion of correlated data, that he named quasi-plausibility (Santos et al. Al, 2000).

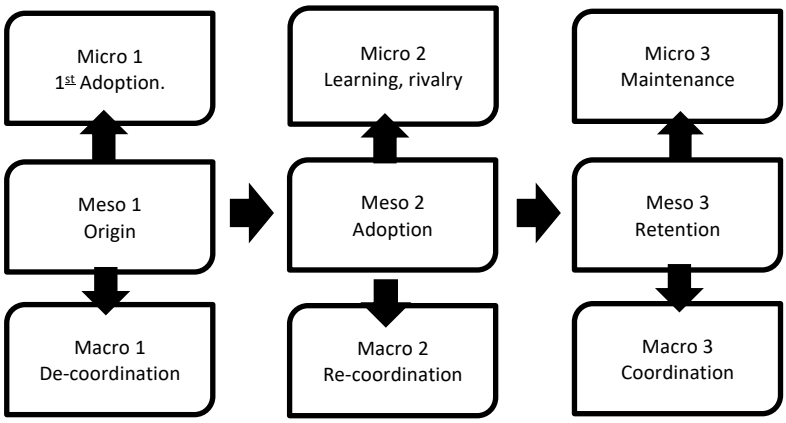

Figure 2. Analytical structure halfway in the journey

Note: Source: adapted from Dopfer, Foster and Potts (2004) apud Rio (2015)

Multilevel Analysis counts on the inclusion of local predictive variables on different levels (Santos et al, 2000; Laros and Marciano, 2008; Collares, 2011; Eto, 2013; Mendonça, Cunha and Nascimento, 2013; Rio, Pedrozo and Turcato, 2014; Rio, 2015; Rio and Amorim, 2017). Geels (2002; 2004; 2006) apud Mendonça, Cunha y Nascimento (2013), observe multilevel Analysis, emphasizing mainly the influence process in different directions from three dimensions: micro level, where radical innovations are formed, according to the literature quoted by Eto (2013). Level 1 (micro or niche) regards the explanatory variables from the lowest level, which is the level of the people that compound the study. The mesolevel, the one of socio-technical regimes is, according to Dopfer et al (2004) apud Rio (2015), derived from evolution economy and allows to associate the use of algebraic (or mathematical) study, passing through the knowledge-process idea, that differs from the engineering or control analysis, as well as a connection between micro and macro scales. Lastly, the macro level, is the level of scenarios and structural changes of society as a whole (Mendonça, Cunha and Nascimento, 2013).

On the horizontal line of figure 2, there's the middle point of the research's study, which is the mesolevel structure. This is where collective behavior defines the individual's functional patterns, let's say, how do they work as an organization, being the middle ground that connects individual levels (micro level - figure's top axis) with the dynamic of wider levels (macro level - figure's bottom axis). This is reinforced by Puente-Palacios and Laros (2009), who teach that, in general, levels could be described as social attachés, which are collectives with significant effect on its member's behavior. Therefore, individuals can constitute the lower level; the context of collectivity where they're inserted would be the top level (Puente-Palacios y Laros, 2009).

Material and Methods

The approach used in this research is qualitative and exploratory, with the proposal of a comparative analysis between the SUS model created by Rio and Amorim (2017) and the

SUS model constructed by Rio (2015), being this last one a framework linked to the study of the Open City of Valparaíso, Chile. As Gerhardt and Silveira (2009) teach, "qualitative research has nothing to do with numerical representation, but with the deepen in comprehension of a social group, organization, etc." In this case of originality and specificity, it was considered the most appropriate for interpreting numerous complex social elements present in both models, once the inherent limitations of the positivist model were observed; this model is also known as "single research model." Therefore, qualitative research focuses on reality aspects that can't be quantified, centered in understanding and explaining the dynamics of social relationships" (Gerhardt and Silveira, 2009).

The goal of this research is finding the contributions of the SUS theoretical models proposed by Rio (2015) and Rio and Amorim (2017) to achieve the refinement of the concept "sustainable", and identifying the correlations among them. Therefore, it would be needed to resort to synthesis that shapes the essence of the SUS model produced by Rio and Amorim (2017), where the model base is formed by three Learning Theories that integrate it: individual, organizational and social. Also, it would be needed to use the work condensation on a SUS published by Rio (2915), particularly, the description of the results obtained in this study. These aspects are key to allow greater clarity and resiliency when proposing the results that generate from the methodology adapted by the present research.

It's important to emphasize the uniqueness of the proposed work, since it's an empiric research that uses the analytical tool called Multilevel Analysis Theory, considered appropriate for this mix of complex variables. Also, it's needed to highlight that Multilevel Analysis can acquire different propositions and implementation facets, since one must consider the size of the sample object that will be studied. Nevertheless, according to Deslauriers (1991) apud Gerhardt and Silveira (2009), "the goal of this sample is producing exhaustive and illustrative information: whether it's small or big, the important thing is that it must be able to produce new information."

In this sense, being aware of the limits of the presented sample in the proposed research, and keeping in mind all the specificity and complexity that surrounds it as well as the restrictions that may appear so the results identified here can be extended to other sample realities, it was decided to use the Multilevel Analysis chain that uses the method known as Quantitative Propositional Analysis (QPA). "This technique is a key tool on multivariate analysis for multivariate analysis for a group of qualitative data due to its facility to be interpreted" (Madeira, Lopes, Giampaoli y Silveira; 2011). The purpose of this qualitative research is promoting the understanding of complexity and the interaction with the research problem without focusing mainly on statistics" (Madeira et al, 2011).

Results and Discussions

Contributions of the model by Rio (2015) to the SUS concept

According to the conclusions on Rio's research (2015), the SUS concept must be considered a complex, dynamic, cyclic and mesoanalytic process, also it must be original and adapted to the reality of each community to be interpreted. When looking at all these elements as a complex and independent net, according to the author, a more flexible reading of the concept is possible, obtaining the needed comprehension to reach all the potential that the created knowledge has. When proposing a dialogical emergency of mesoanalytic rules based on the hospitality and hostility principles in urban communities - Figure 3, recognizes that the

values perceived by the authors must be understood as particulars, this means that they can0t be interpreted or copied outside that community. This is explained thanks to the fact that there's different scales and development levels that social workers must consider and revise constantly.

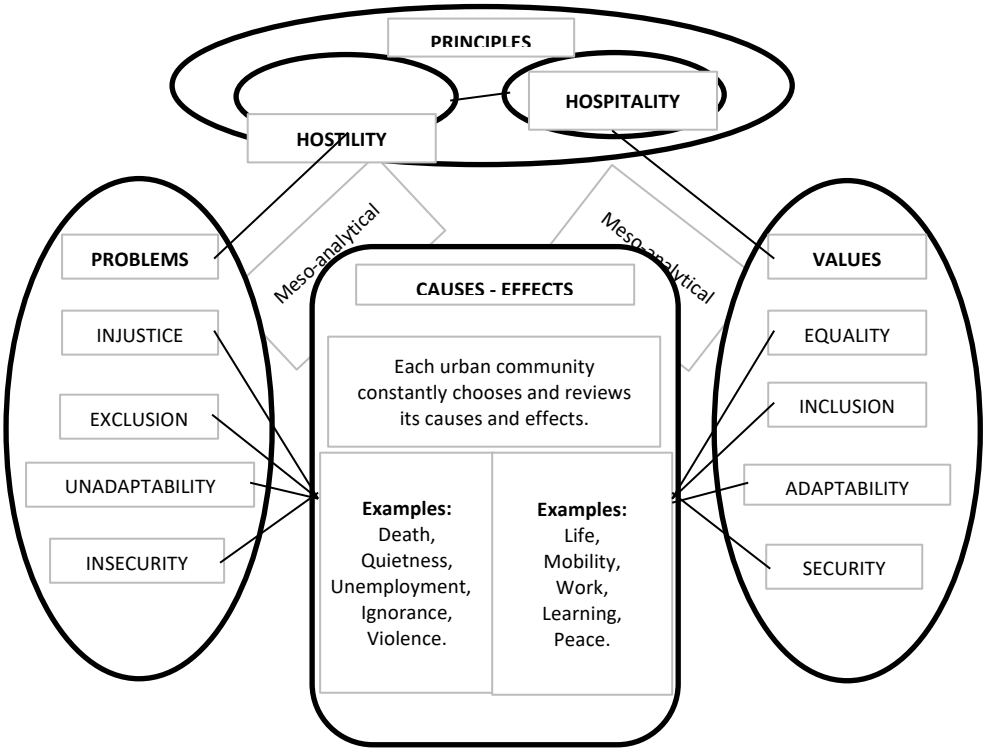

Figure 3. Dialogical Emergency Model of Mesoanalytic Rules based on hospitality and hostility.

Note: Source: Rio (2015)

Rio's interpretation of the SUS model (2015) considers two kinds of mesoanalytic rules articulated with criteria: when connecting the principles with the criteria or value problems, it's a long-path rule (A); when linking value criteria with cause-effect and problems with cause-effect, therefore they're short-path rule (B). The difference between both types is that the long-path rule (A) needs more time to put the learning into practice due to the creation, adoption and rule retention process, which requires a higher reflection level. On the other hand, the short-path rule (B) undergoes a quicker transformation because it's more frequent, the dialogs are common. The numerated stars in figure 3, on the other hand, correspond to 8 principles of the Complexity Theory; to get more details, see Rio's (2015) whole research.

Model contributions of Rio and Amorim (2017) to the SUS concept

Rio and Amorim (2017) proposed the development of a theoretical model for SUS based on three lines of the Learning Theory: individual, organizational and social. The use of Learning Theories to sustain the model proposed by the authors is due to the knowledge that SUS is a learning process, since we can dive into the comprehension of these constructions can make possible to find a route, a way where we can observe how it happens. This process must be cyclic and original for each urban community that wants to be studied. As the authors pointed out, environmental and sustainable problems are, generally, analyzed on very few occasions. Researchers prioritize one of the elements of the sustainable tripod: environment, society, economy, some more, some less, according to their reflections about diverse questions.

From this perspective, Rio and Amorim (2017) consider the adoption using Learning Theories, something never done before, to offer strength and depth to the creation and interpretation of the proposed SUS model, through the recognition of complexity involved in constituent variables that stem from selected doctrines. Also, even though the elements of the doctrines are different the ones from the others, they complement each other and allow us to reach a clearer and more defined comprehension in the middle of the complexity of the problem found in the research. The proposal of a framework that analyzes the learning process, more integral on the mesoanalytic scale, involved elements of the city and the citizens. The interaction between these mediums, a turbulent paradigm from the perspective of social sustainability, was analyzed to comprehend how interactions, social relationships and collaboration nets can conduct to a SUS community and the life quality of citizens.

Figure 1 - The SUS theoretical model, already identified in chapter 2.2, represent the model proposed by Rio and Amorim (2017) to understand the SUS concept seen through the three Learning Theories used, which is used as a tool of deep analysis for the most variable levels of SUS design according to the most diverse realities of urban cities. Finally, Rio and Amorim (2017) conclude that the Learning Theories can and must influence directly on the social-sustainable development, understood as a model of cyclic and continuous learning. Since it's a dynamic, independent, complex and constantly reviewed process, it must be adapted to the reality of each urban community that it's to be analyzed, under the risk of not achieving the initiated objectives.

Correlations between the SUS models of Rio (2015) and de Rio and Amorim (2017)

The deep research of dialogical emergencies of a SUS generic model based on the inherent research of mesoanalytic rules can be highlighted as the main point of a route used by both authors on their respective researches.

A proof of this is that both studies were based on the Complexity Theory and Multilevel Analysis, this one was a main tool to properly research and interpret the different phenomena that stem from complex environments. Even though the research by Rio and Amorim (2017) doesn't use, explicitly, the Multilevel Analysis tool as research element of their model, the insertion of Learning Theories as model foundation suggests a complex reflection that's only possible trough Multilevel Analysis.

Table 1
Mesoanalytic rules based on the Learning Theories

Survey model applied on Rio's research on SUS (2015)		SUS model by Rio (2005)	SUS model by Rio and Amorim (2005)
Rule type			
(1) Cognitive rules of citizens	**Proposed question to analyze the behavior of the survey respondents**	**THEME/AUTHOR**	**THEME/AUTHOR**
Gadget inception			
Mental models	How to construct schemes, mechanisms and structures		Individual Learning (Kolb)
Learning models	Which models stem from the minds of open citizens?		
Heuristics	How do they learn based on these models?		
Algorithms	How do they create and discover those models		
(II) Behavior Rules of Citizens/Organizational Behavior Rules	How do they solve problems?	Rule Taxonomy (Dopfer, 2004)	
Individual behavior			
Creating and adopting the rule	How does the double contingency of relationship between citizens and citizens with objects appear?		Social Learning (Wenger)
Collective behavior	How's the creation and adaptation process of a rule?		
Dependency of rule frequency	How does the urban community behave in different situations?		
Behavioral parameter	Is there a dependency on rule frequency?		
(III) Technical Organizational Rules	Are there any fixed variables to be considered when researching the rules of this community?		
Devices			
Organizational Architecture	Which are the rules for objects or machines?		Organizational Learning (Argyris and Schön)
Technology, design, machines and equipment production	How is it organized?		
Technology, design, machines and equipment production	Can the creation process of architectonic environments be described?		

Note: Source: Adapted from Rio (2015)

The questionnaire model of the mesoanalytic route for the study of SUS for this community by Rio (2015) brings essential elements that cross the structural lines of the Learning Theories found in the Learning Theory's structural lines, found in the research by Rio and Amorim (2017). The last one acts as an alternative followed by Rio (2015) on its research for this community, where it warns about the limits of his research and proposes action possibilities to look for a SUS generic theoretical model that's reinforced by the emergence of mesoanalytic rules trough Learning Theories, seen as central elements to understand these social phenomena by both authors.

Something interesting detected by Rio and Amorim (2017) is the conceptual confusion regarding some terms, including sustainability. These authors observed the difficulties found when mentioning that expression, due to the multiple faces that this concept can acquire according to the perception of each expert and academics on the topic. This can be clearly identified on the graphic sequence 1, 2 and 3, that shows the conceptual comprehension that average people have regarding a specific topic. In this case, data (extracts) were used in Rio's survey (2015) regarding the results obtained on the table 1.

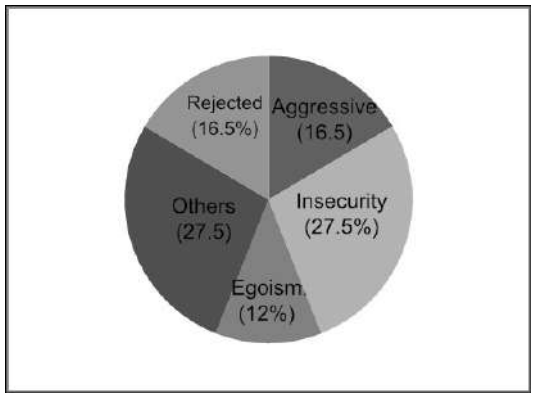

Figure 4. Hostility concept according to the survey respondents of Rio (2015)
Note: Source: Authors

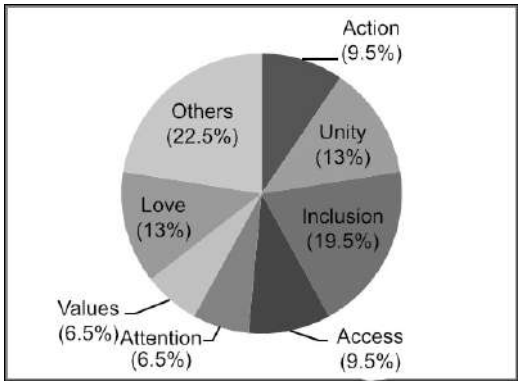

Figure 5. Hospitality concept according to the survey respondents of Rio (2015)
Note: Source: Authors

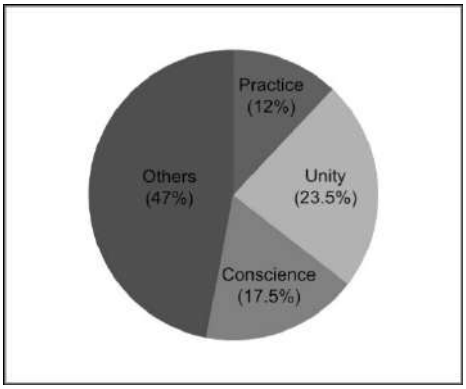

Figure 6: SUS concept according to the survey respondents of Rio (2015)

Note: Source: Authors

Figures 4, 5 and 6 consider the obtained evaluation applying the questionnaire and their respecting answers according to the samples of this research. On each open answer they looked for one or more elements that synthesize the reasoning of the interviewee about the applied question during the interview with the researcher. After the content (the interviewees discourse) was summarized, the segmentation of different responses on multiple questionnaire sections allowed to find simple and common expressions and, in many cases, typeset expressions; this means more than one definition per interviewee. This search for proposition (extracts) through the Quantitative Propositional Analysis (QPA), allowed to identify

elements that are associated to the conceptualization of each topic exposed by this research according to the data presented by these graphics.

Something eye-catching when you revise the graphics, specially the graphic 3, is the remarkable consensus that blurs the SUS concept. This is on the same page as the argument presented by both studies, where said concept is declared as a term in a constant and dynamic (re)building process. Also, the essence of this mesoanalytic study found in both models follows a route based on the weight and the dynamic of complexity, that can only be analyzed from the emergent inquiry of the rules of innovation tracking combined with the Multilevel Theory. This means, that the research about Multilevel Analysis by Dopfer (2004) and the Complexity Theory by Morin (1992, 1999, 2003, 2004, 2007, 2011, 2013), found in the research of Rio (2015) are linked positively with the Learning Theories by Kolb (individual learning), Argyris and Schön (organizational learning and Wegner (social learning), emphasized by Rio and Amorim (2017.

Final Considerations

The search for a generic theoretical model of SUS that could be used as a parameter to study the mesoanalytic rules f learning in urban communities, especially those underdeveloped economically, is a growing and relevant topic that has the goal to determine information that may be useful to interpret the complex and deep dynamic of today's societies to reach auto-sustainable development. In this sense, the present research was developed with the main goal to linking the SUS models of Rio (2015) and Rio and Amorim (2017) to contribute to the SUS concept.

This "test" was considered compulsory because it links the convergence of mesoanalytic rules with the most assertive interpretation of this growing phenomenon. Following this path, this research was developed presenting existing concepts in both SUS models, like the Complexity Theory and Multilevel Analysis, even though these topics aren't mentioned explicitly in the study of Rio and Amorim (2017). Nevertheless, due to this being a complex topic, this work seeped into both concepts when setting the theoretical foundation in Learning Theories, something that was seen as new in the interpretation of mesoanalytic rules.

According to both authors, other topic to be highlighted is understanding that the SUS concept is a new, recent and growing phenomenon, and therefore it must be experimented constantly, cyclic and (re)constructive. On the same line, the dynamics of innovation tracking is a highly potential alternative that can allow a deeper reflection about how learning social interactions occur in the SUS models. This is incredibly relevant from the point of view of implementing possible public politics for community development through the dreamed path of sustainability. On the other hand, this is a topic observed by two previous studies, where the citizen must be considered a central element of the paradigm when looking for the quality of a fulfilling life.

To link the SUS models and identify possible application traces, Multilevel Analysis methodology was proposed, seen as key to interpret correctly the deep and complex qualitative data of the present research, that complies with understanding. Morin (1992) apud Rio (2015); Dimitrov (2003); Dopfer (2004) apud Rio (2015); Silva (2011); Mendonça, Cunha and Nascimento (2013); Kanso (2015); Torres (2018). Also, The Quantitative Propositional Analysis (QPA) was also used to determine quantitative data, even though this wasn't the main goal of the study.

In this sense, one of the recommendations found in the research by Rio (2015) was proposing more studies about mesoanalytic rules trough the inclusion of Learning Theories in the SUS theoretical model to improve the development, interpretation and application. The research by Rio and Amorim (2017) put under the spotlight this possibility when basing their theoretical foundation in deepening these conduct theories. Clearly, studies by the authors about the SUS models must be revised, refined and continuously checked in other realities to extend their application.

Therefore, even though both authors of both researches considered it as evidence, unusual characteristics of originality and cyclic character in which the development processes of each community happen, in a singular sense, that include the learning processes described by Dopfer (2004) apud Rio (2015); Kolb (1997, 2005), Argyris and Schön (1974, 1996), Wenger (1998, 2000) apud Rio and Amorim (2017). This is needed so an interpretative proposal to be carried out is aligned with all the complexity and deepness ever-present in a dynamic, independent and evolving environment.

Nevertheless, as both authors previously pointed out while having the problem presented in this research, the development of generic theoretical models proposed by the SUS must be polished constantly so it fits the interpretative form in a deeper and more real way. Like this, both studies are used as a guide to carry out researches about the development of the SUS, but they can't be considered static and rigid SUS models, since the dynamics of development (evolution) can't be explained only in systemic models, restrictive in the superficial aspect of things.

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SOFT SYSTEM DYNAMICS METHODOLOGY APPLIED TO THE SUPPLY OF LIQUEFIED PETROLEUM GAS (LPG)

Beatriz Juana Adaniya Higa
Supervisory Body for Investment in Energy and Mining (Peru) / National Engineering University (Peru)
badaniya@fip.uni.edu.pe · https://orcid.org/0000-0002-7563-7773

Abstract. This article contributes searching for a sustainable solution to the supply of LPG. A little research has been done in Peru regarding the supply of LPG; it is focused on the analysis of the energy matrix, LPG distribution for vehicles, Government pricing policy or supply sources. The lack of studies that carry out an analysis of the causes or the interrelation between different factors can affect the normal supply of this fuel. An analysis of the problematic situation following the soft system dynamics methodology allows an adequate definition of the problem and events generating of risks that are presented in the LPG Supply. As a result of its application, defining the unstructured problematic situation has included the situation description where events and circumstances are observed without having any kind of structure, arising as the occurrence of the LPG shortage without having a clear idea of the real factors that cause it. On the other hand, defining the structured problematic situation has involved concatenating all the elements that integrate the situation describing and analyzing the whole system, considering historical records of past situations and collecting needs, aspirations and expectations of the different stakeholders, contributing to form an image of the situation that shows the structure, processes, relevant events and interrelations between all the elements involved. Thus, it is observed how the variables in the phases of the value chain of the LPG are related and interact affecting their supply.

Keywords: Supply of LPG, system dynamics, soft systems, soft system dynamics methodology, structured situation, risk generators.

METODOLOGÍA DE LA DINÁMICA DE LOS SISTEMAS BLANDOS APLICADA A LA PROBLEMÁTICA DEL ABASTECIMIENTO DE GAS LICUADO DE PETRÓLEO (GLP)

Resumen. El artículo contribuye a la investigación sobre una solución sostenible para la problemática del abastecimiento del GLP. Hay pocas investigaciones realizadas en el Perú al respecto y se centran en el análisis de la matriz energética, el desabastecimiento de las plantas envasadoras o gasocentros de

GLP vehicular, la política de precios establecidas por el Estado y las fuentes de suministro. Ante la falta de estudios que realicen un análisis de las causas o de la interrelación entre los diferentes factores que pueden afectar el abastecimiento normal de este combustible, el análisis de la situación problemática siguiendo la metodología de la dinámica de los sistemas blandos permite una adecuada definición del problema y de los eventos generadores de riesgos o factores críticos que se presentan. Como resultado de su aplicación, definir la situación problemática no estructurada ha comprendido describir la situación donde se observa acontecimientos y circunstancias sin algún tipo de estructura, presentándose sin una idea clara de los factores reales que la causan. Por otro lado, definir la situación problemática estructurada ha implicado concatenar todos los elementos que integran la situación, describiendo y analizando todo el sistema, considerando los registros históricos de situaciones pasadas y recogiendo las necesidades, aspiraciones y expectativas de los diferentes grupos de interés, contribuyendo a formar una imagen que muestra la estructura, los procesos, los eventos relevantes y las interrelaciones entre todos los elementos involucrados observándose cómo las variables, en cada fase de la cadena de valor del GLP, se relacionan e interactúan afectando su abastecimiento.

Palabras clave: Dinámica de sistemas, sistemas blandos, metodología blanda de dinámica de sistemas, situación estructurada, generadores de riesgos.

Introduction

The article shows that; Using the energetic security concept and his provisional variation, is possible to contribute to the study of the establishment of fuels like Liquified Petrol GAS (LPG) Using the methodology of soft system dynamics. (Rodriguez-Ulloa, R. A., Montbrun, A. y Martinez-Vicente, S., 2011; Rodriguez-Ulloa, R. A., Martinez, S., Dyner, I., Pardo-Figueroa, J., Huaytan, V., Cardenas, W., Navarro, J. y Gonzales, A., 2015). This investigation contributes as a reference to other studies concerning fuel supply that guarantee the energy security In addition, it contributes to an analysis of the benefits of using a methodology that considers the thoughts of each stakeholder involved, directly or indirectly, and relates them to the different variables that act throughout the value chain.

The supply security of LPG, particularly in Peru, is a political and socio-economic issue that moves interests of economic agents and citizens. That seeks to have fuel with easy access at attainable prices. Residential and vehicular shortage generates social conflicts that motivate the study of its value chain by identifying the contribution of each variable involved.

The energy security, supply security or shortage, identifies the existence of criteria and focuses with a great conceptual diversity. In the study cases we see energetic security as the availability of energetics that satisfies the demand in a sustainable way at reasonable prices.

The number of scientific references and international agencies dealing with energy security is an indicator of concern over reliability and ease of access to energy considering price increases or supply problems. The interest, under this context, is to find medium and long-term strategies when studying the external and internal context of a country. The external context includes the possible interruption of access to energy due to geopolitical events as they are subject to risks that may arise at the place of production or on the way to the point of delivery. Thus, the interruption of the LPG supply can originate in the natural gas processing plant or during its transportation (ship or tanker). The challenge is to find means and interest groups that achieve a balance of energy and geographical locations that allow balancing minimum levels of security with adequate costs.

Figure 1 shows that, from the Malvinas processing plant, located in Cusco, there is a dry natural gas (GNS) pipeline and a pipeline that transports natural gas liquids (LGN). On its way to Lima, the GNS undergoes a first compression at the Kepashiato station and a second compression at the Chiquintirca station to finally reach the City Gate located in the district of Lurín - Lima. It should be noted that, from the Chiquintirca station there is a branch that reaches the liquefaction plant of Pampa Melchorita (Chincha - Ica) from which liquefied natural gas (LNG) is exported. The LGN is processed at the Pisco fractionation plant (Ica), where LPG, Nafta and Medium Distillate for Blending Stock (MDBS) are produced. The LPG is transported to Lima by sea and to the south by tank trucks.

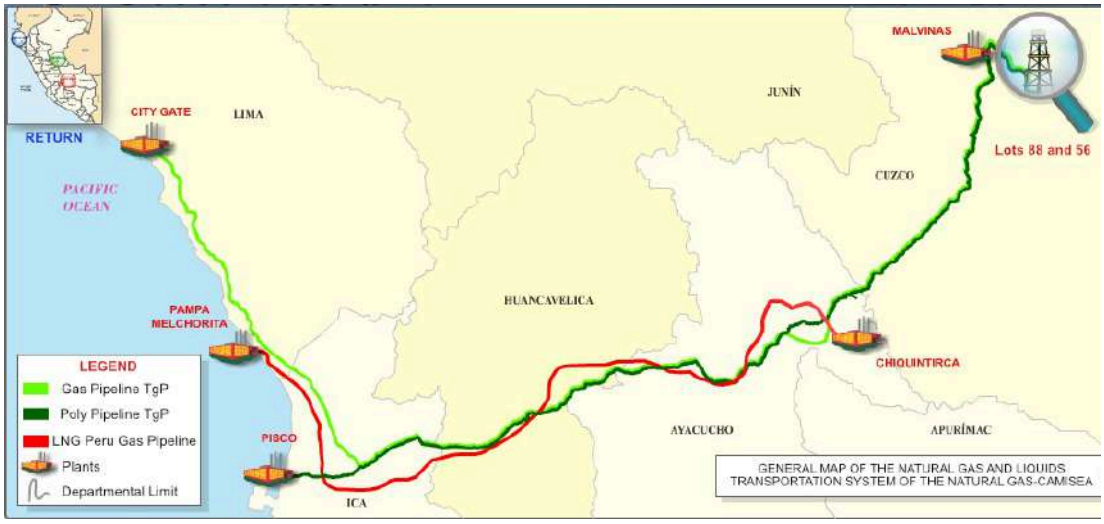

Figure 1. Path of dry natural gas and natural gas liquid pipelines
Notes: Source: Osinergmin

An important fact occurred in July 2010, when a partial shortage was generated, mainly in Lima, due to the strong waves that prevented the discharge of LPG at the terminals of two companies that supply this fuel. Another occurred during the first months of 2015, due to events related to the production of LPG, such as the rupture of the LGN pipeline on the route from Malvinas to Pisco; maintenance operations in one of the condensed natural gas production wells and the existence of anomalous swell periods that determined the closure of ports. These facts demonstrated that the existing storage capacity in the supply plants and the obligation to maintain average and minimum LPG safety inventories were not sufficient factors to guarantee their supply. Actions had to be taken to address this problem.

The study identified aspects that generate alternatives to solve a real problem and was framed in the applied and explanatory research. The design was quantitative, not experimental, longitudinal and trend when analyzing changes through the 2000-2015 period. External validity was achieved by generalizing the results to similar situations of energy supply assurance and internal validity was achieved when the results, properly analyzed and interpreted, showed the relationship between the variables and observing the effect of other variables not involved on the dependent variables.

From the complexity, a phenomenological, hermeneutical and systemic vision was adopted, analyzing the production, transport and processing of natural gas considering human participation, determining the decisions that affect the supply; finding how each part of the processes involved relates and interacts within the problem by proposing various dynamic structures that would explain the real anomalous behavior causing the shortage. All associated factors and risks that are constituted as variables, directly or indirectly, involved in the situation were identified.

In addition, a research horizon was opened using the Soft System Dynamics Methodology that analyzes scenarios of the behavior of the variables over time. The analysis that follows this methodology has adequately defined the problem, conflict situations or critical factors of LPG supply, as well as identified restrictions and alternative solutions. The study can complement the work done by the state officials in charge of developing policies; however, as a limitation, the study does not contemplate the evaluation of the requirements for the implementation of policies.

Method

The analysis of the LPG supply situation, following the methodology allows an adequate definition of the problem and the risk generating events presented. This methodology, used as support to expand and structure the ways of thinking when intervening in complex problems, allows us to observe how many elements interact with each other; considering that, the more elements and greater interactions, the greater the complexity increase Therefore, a methodology that was initially developed for the resolution of management problems in organizations has proven to be useful in the analysis of very complex problems that affect society.

The soft system methodology (SSM), first published in 1981, was developed by Peter Checkland since the early 1960s at Lancaster University in the United Kingdom; belongs to the group of soft operations research methodologies taking into account the world view of the different stakeholders identified in the problem (Rodriguez Ulloa et. al, 2005, Rodriguez Ulloa, et. al, 2012; Rodriguez Ulloa, et. al, 2015) . In the beginning, it was used as a modeling tool; subsequently, it was used as an instrument for learning and knowledge development. Through certain rules and principles of systems, thoughts related to the real world are structured and develop models that contain descriptive and normative elements that allow to manage processes to act in an organized way and react to any change in actions.

In the methodology, it is assumed that each person sees the world based on their culture, traditions, family environment, geographic environment, training and academic environment, among other aspects; Therefore, each one understands and evaluates each situation differently, generating different ideas and proposals for a solution to the same problem. These ideas are gathered and subjected to a discussion, negotiation, argumentation and validation, giving place to alternative solutions. His philosophy holds that people have different points of view, about the same situation generating the "problem" of knowing who is right; presenting the concept of plurality and the need to accept that there are relevant “problems” with the question of what should be done to evaluate the different points of view before making a decision and developing an intervention process.

The analysis Checkland carried out studying social systems and their dynamics led him to conclude that there are two paradigms in systems thinking; the hard paradigm, in which the real world is systemic, so that the methodologies used to investigate reality are systematic methodologies. The soft paradigm is the one that shows the real world as a world where the research process and methodologies can be systemic involving a transfer from systematization to research within the interpretive world of each involved in a given situation.

The soft systems methodology involves four important principles: learning, culture, participation and ways of thinking, so that a research process constitutes a learning system to achieve organized actions in a scenario of changing ideas and events that interact permanently. This learning includes the perception, analysis and evaluation of events before deciding and taking actions that then generate new perceptions, evaluations and emerging actions, constituting a continuous cycle where progress is decided in terms of importance, cultural feasibility and systemic convenience. That is to say, experience is gained by generating knowledge that leads to taking actions with defined objectives in various situations and whose results generate new experiences that, in turn, generate new knowledge reaching to establish a cycle of experience-action. This is replicated in the observed environment or, it is negatively or positively affected by the result of these actions, entering its own experience-action cycle.

This methodology allows to study a problem of the real world, in an unstructured way, developing conceptual models that fit a situation with many objectives and multiple perspectives. Then, develop specific perspectives by building conceptual models to be compared with those of the real world. This comparison could initiate a debate that leads to a decision for an action with a defined purpose that improves the part of real life that is under analysis.

It is necessary to specify that structured problems, well defined and that can be formulated explicitly (the what) use a language that establishes the availability of a theory (the how), support of its solutions and on which it is agreed; whereas, an unstructured problem (problematic situation) cannot be formulated explicitly if a simple way of doing so is not found. This does not have clearly defined objectives with different points of view, it is not understood or it is not clear what the problem is (what); then, the what must be defined before the how can be found. This is where the soft systems methodology comes in to try to structure an unstructured situation and achieve that, from the multiple ideas about the situation, an agreement is reached in order to find a solution or an improvement of it.

In summary, according to Van Mullekom (2000), the methodology supports the objective of solving or introducing improvements in different complex situations by activating a continuous learning cycle among people involved in the situation. This learning is an iterative process, of trial and error, using concepts of systems to reflect and debate the perceptions obtained from the real world, carrying out an action on it and reflecting on the events that were produced by the use of these concepts. Reflection and debate are structured through the assumption of some systemic models because the problem situation is not fully known. The process can be represented according to figure 2.

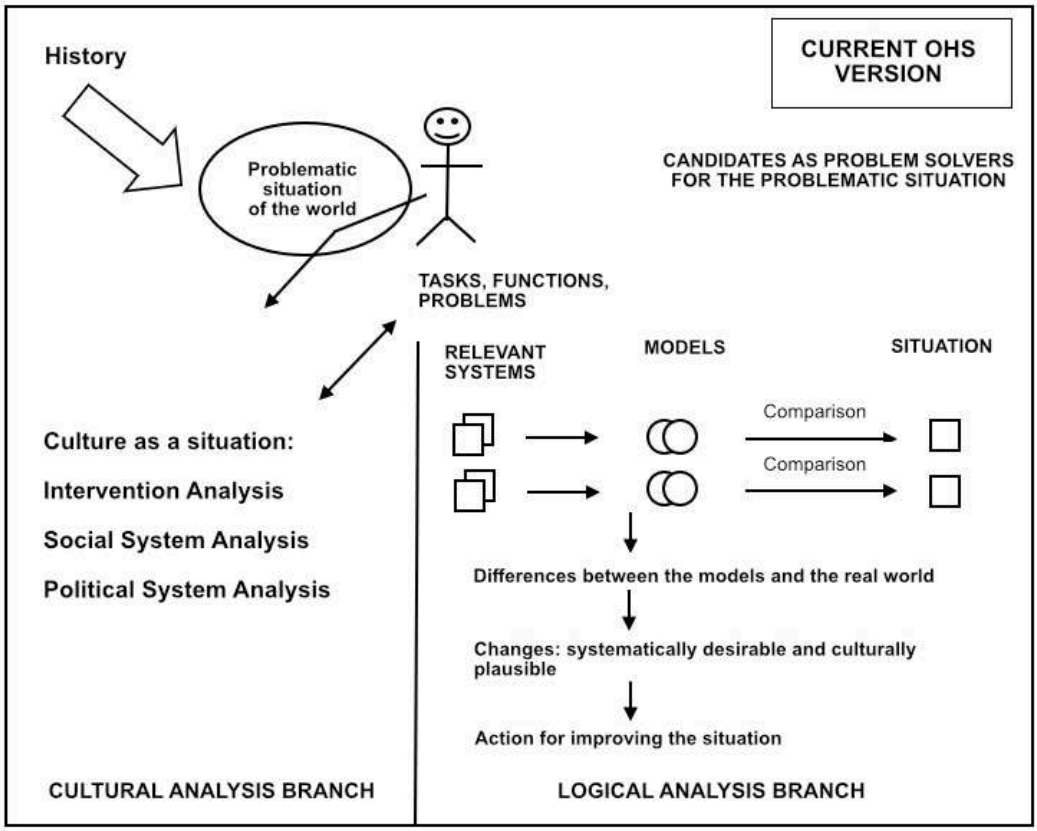

Figure 2. The Soft Systems Methodology process
Notes: Source: Methodology and Soft Systems M. Paz Acosta. Soft Systems Methodology Course. Rodríguez (2017)

The methodology is represented in seven stages that are not necessarily carried out in the order indicated, some are oriented to the real world and others, to the conceptual one. Figure 3 shows the model that, according to Van Mullekom (2000), in the first two stages an organized search is carried out to find situations in which structures, processes and their relationships must be established. In structural terms, power hierarchies, formal and informal communications, geographic environments or others are evaluated; In terms of processes, those basic activities that could be part of decision-making, results, effects and some type of corrective action that resulted were analyzed.

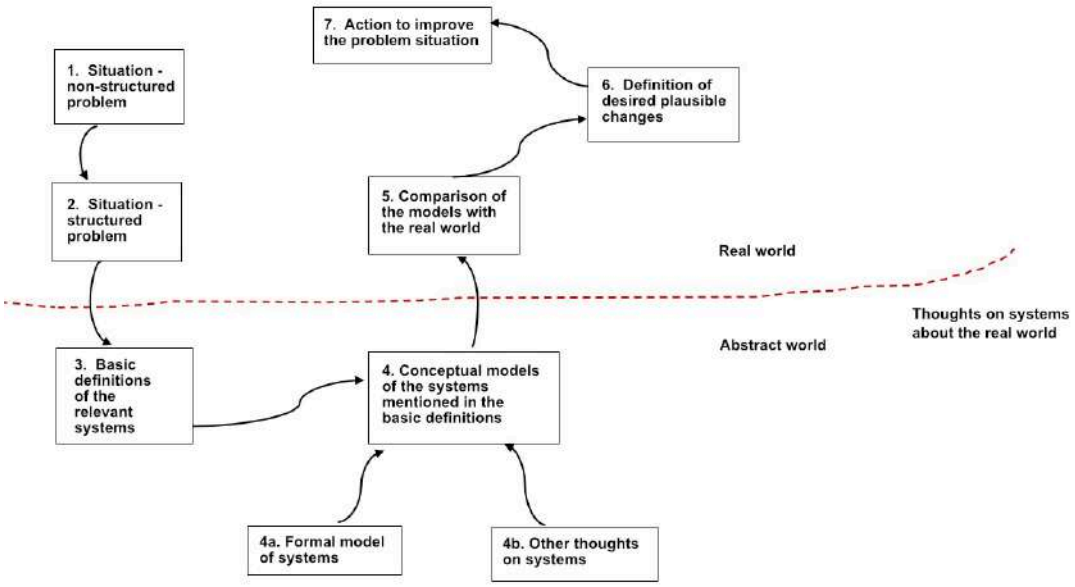

Figure 3 Conventional model for 7 stages of soft systems
Notes: Source: Systemics, Soft systems and the systems of information. Rodriguez (1994).

Figure 4 shows the pictographic chart that illustrates some risks, events and impacts involved in the LPG supply problem and that are collected during the first two stages.

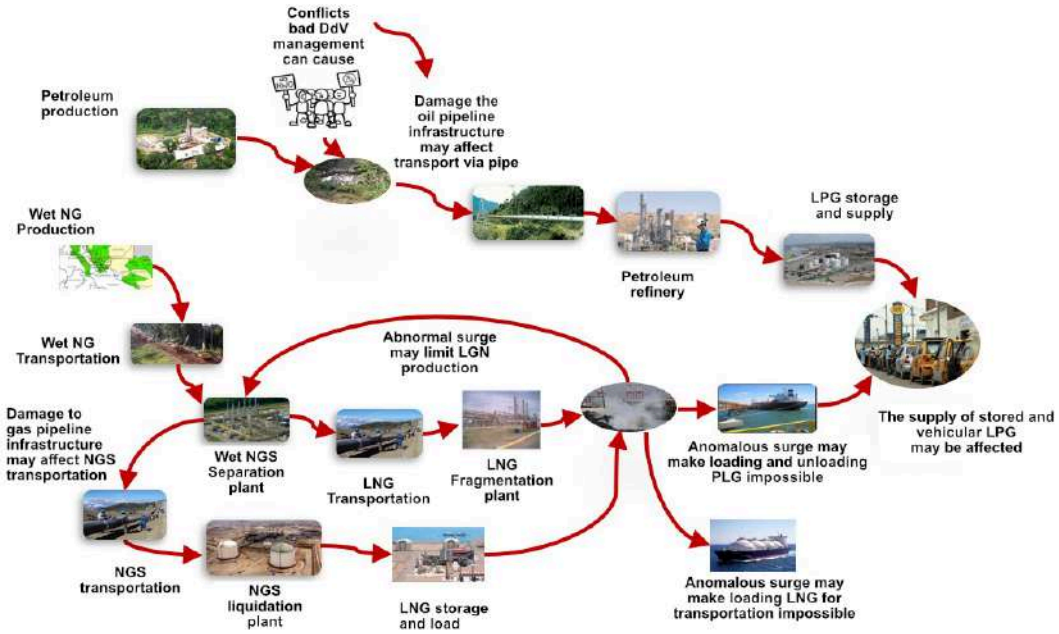

Figure 4. Pictographic chart of risks, events and impacts
Notes: Author's own creation

In stages 3 and 4, the basic definitions and their corresponding conceptual models are developed under an organized search for problematic situations and then

choose the one that will be resolved. This situation contains a model for each point of view observed and how it should be treated.
Each model constitutes a basic definition. These models do not represent the real world and generate a debate structure on how each interest group perceives reality. Then, these basic definitions are transformed into qualitative, conceptual models of activity systems with defined purposes.

To verify that a basic definition has been properly prepared, it is contrasted with a CATWDE analysis, in which C represents customers, who are negatively or positively affected by the transformation; A, represents the actors who carry out the transformation; T identifies the transformation to be performed; W, is the Weltanschauung or world view, the way each person perceives things based on their cultural patterns, training, environment or other aspects that influence each individual and that justifies the transformation; that is, each observer has an interpretation; D, corresponds to the owners who have the power to authorize or stop the transformation and, finally, E refers to the environment. Table 1 shows some examples of relevant systems generated by each Weltanschauung.

Table 1
Basic Definitions

Interest Groups		Weltanschaung	Relevant problem-oriented system
Clients	Indigenous communities	Belief that energy exploration and exploitation projects damage the ecosystem of their communities within the areas of influence and their properties	Belief that energy exploration and exploitation projects damage the ecosystem of their communities within the areas of influence and their properties
Stakeholders	Osinergmin	The belief that Osinergmin is not responsible for regulations in the Natural Gas industry, so it does not have to propose appropriate regulations for the supervision, control and regulation of GN.	Human activity system aimed at maintaining regulatory proposals regarding safety and quality of service in the Natural Gas industry, which do not allow adequate supervision, control and regulation.
	Perupetro	Belief that Perupetro should supervise contracts and evaluate the forecasts of GN and LPG production in addition to the useful life of the deposits from the continuous evaluation of the level of GN reserves	Human activity system aimed at getting new investments in GN projects, based on production forecasts and stock assessment.
	Operating companies	Belief that the levels of exploration and exploitation of the GN are adequate to take advantage of the integral and sustainable exploitation of the GN.	Human activity system aimed at maintaining exploration and exploitation levels.
	State	Belief that the current level of investment in the supply of GN is convenient, although the demand for GN will increase in the coming years.	Human activity system aimed at maintaining levels of investment in GN, without considering that the demand for GN will increase in the coming years, under the program of massification and the needs of

			economic growth of the country.
Owners			
	Operating companies	Belief that the regulations should be updated to promote investment in exploration and ensure GN reserves for the future.	allow greater investments in the exploration phase in GN lots.

Notes: Author's own creation

The basic definition developed will lead to the mapping of the events and their risks involved. For the case investigated, the relevant system is: "Meet the national LPG requirement in an efficient, safe and sustainable way", with its Basic Definition: "An efficient and effective human activity system, which aims to meet the national requirement of LPG in a safe and sustainable way through a policy of prices and incentives for production and investment." This basic definition is performed CATWDE analysis.

In the fifth stage, the conceptual models are compared to the real world, resulting in proposals for changes that generate actions to improve, alleviate or resolve the problem situation. In the sixth stage, the actions (changes) to be implemented (culturally feasible and systemically desirable) will be defined and proposed; and, in the seventh stage, the implementation is carried out.

Results

The SSM based on systems engineering for the solution of technological problems of great complexity, in its beginnings was oriented to hard thinking systems in which the problem is clearly defined to be resolved without questioning about the raised; nevertheless, when the solution of problems related to policies is required, it is not very adequate when not considering the subjective and interpretative elements of the individuals; developing the soft thinking approach when considering that each individual has a personal perception, a particular vision of what is going on around them.

In this study, the occurrence of LPG shortages is presented without having a clear idea of the real factors that cause it. The structured problem situation implies concatenating all the elements that make up the situation, describing and analyzing the entire system, considering the historical records of past situations and collecting the needs, aspirations and expectations of the different interest groups. This will help to form an image of the situation on which the structure, processes, relevant events and interrelations between all the elements involved can be visualized.

A systemic view shows how each variable in the LPG value chain is related and interacts. Within this context and making use of causal relationships, the risk-generating events (human and non-human) were first identified in each of the stages of the natural gas value chain and that of some stage of another value chain interrelated with that of natural gas, such as that of liquid hydrocarbons; Second, causal relationships were determined.

Among the dangerous events that generate human-type risks are those of the internal context or of the environment in which these events have been presented. Those of the internal context may be related to breaches of standards and procedures, good practices, quality of service, state of supplies and materials, infrastructure, technology, information and / or knowledge, financial resources, among others. These events can be casual or intentional, as well as being the product of certain failures causing impacts of various kinds. Events from the environment can be the result of attacks, social conflicts, lack of monitoring of market behavior, impact on the institutional image, among others. These events can be casual or intentional and cause social, economic and political impacts.

Among the dangerous events that generate non-human risks are those that occur due to natural effects and cause major impacts. Once the risk generating events have been identified, the soft system dynamics methodology is used. In a first stage, the unstructured situation of the problematic situation is defined by collecting all possible information to carry out the actions to define the structured situation, in stage 2.

As a result of the analysis of the sources of information collected in the form of an unstructured situation, a series of variables related to the problem of LPG supply were identified. Then, we proceeded to represent all the information collected in a pictographic chart showing the relationships between dangerous events (risk generators), variables and risks. Figure 5 shows a pictographic chart illustrating the effects and impacts generated by events related to the transport of natural gas, GNS and LPG.

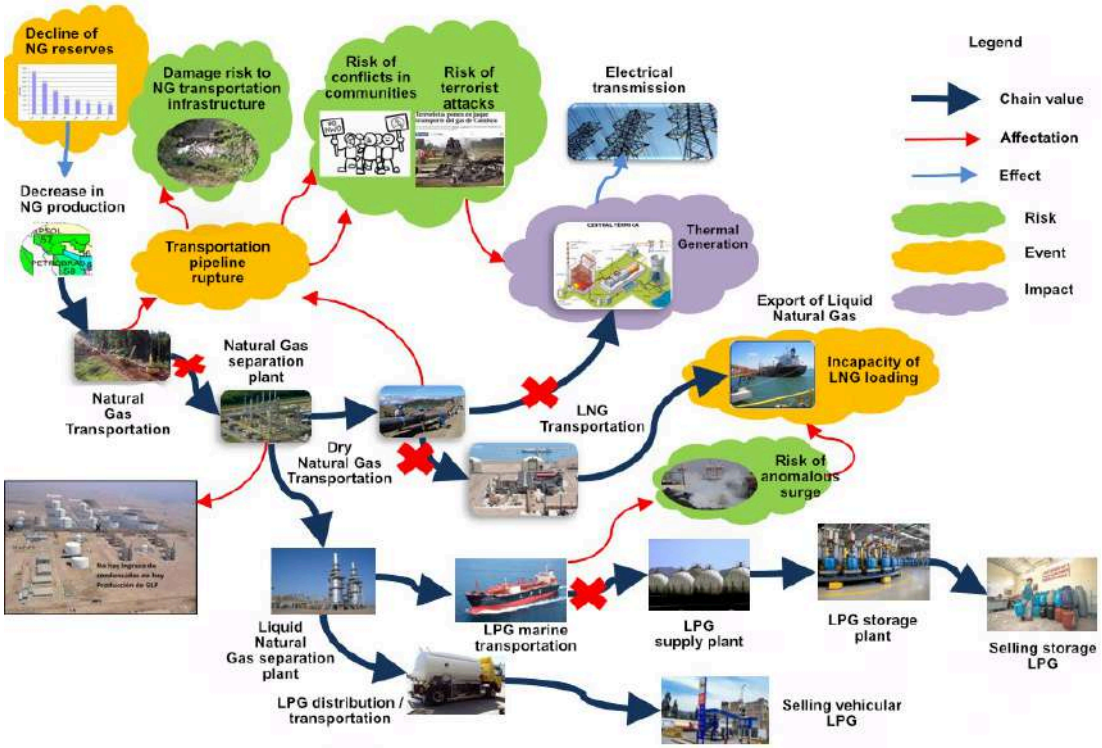

Figure 5 Pictographic table of events and risks in the transport of natural gas
Notes: Author's own creation

Once the analysis of the events was completed, the basic definitions oriented to the problem were elaborated; performing the analysis of the stakeholders and defining the Clients, the Actors and the Owners. Then, they proceeded to identify their worldview (worldview or Weltanschauung), the level and type of power relations existing between them, cultural issues, how they perceive the problem and how they propose a solution. These are the aspects that make the problem situation difficult to understand and establish proposals for solution or improvement. Table 2 presents the interest groups, identified as those most related to the problem of LPG supply, and their respective worldviews.

Table 2
Cosmovision or Weltanschauung of the Interest Groups most related to the supply of LPG

Interest group	Worldview or Weltanschauung, belief that
Ministry of Energy and Mines of Peru. Minem	The current investment level of operators in the liquid hydrocarbons sector is insufficient despite the fact that the greatest need is for natural gas due to the potential increase in LPG demand.
Supervisory Body for Investment in Energy and Mining. Osinergmin	Osinergmin is not responsible for the regulations in the natural gas industry and, therefore, does not necessarily have to propose adequate regulations for the supervision, control and regulation of natural gas.
Companies operating the natural gas lots	The levels of exploration, exploitation and processing of natural gas are adequate to take advantage of the integral and sustainable development of this industry
Companies operating the natural gas and natural gas liquid transport pipelines	by increasing natural gas transport operations, with current systems, the risks and losses due to natural gas and natural gas liquid pipeline ruptures will increase
Natural gas processing plants	Natural gas liquid processing levels are adequate to take advantage of the integral and sustainable development of LPG
Refineries that produce LPG	oil processing levels are adequate to take advantage of the integral and sustainable development of LPG supply
LPG supply plants	LPG storage capacity of plants is insufficient for the integral and sustainable development of LPG supply
LPG Importers	Oil and natural gas processing levels are insufficient to meet national LPG demand
Power Generation Stations	maintaining traditional sources of electricity generation, Peru can maintain sustainable growth and development.
Ministry of Environment Minam	the exploration and exploitation of Natural Gas generates social and environmental conflicts
National Investors	there is no adequate legal and social framework to increase investments in natural gas exploitation and LPG production
Foreign investors	there is no adequate legal and social framework to develop investments in natural gas exploitation and LPG production
Indigenous communities	Oil and natural gas exploration and exploitation projects impact natural areas affecting agriculture and fisheries, the main source of food and income.
LPG end users	Oil and natural gas processing levels are sufficient to meet national LPG demand

Notes: Author' own creation

The problematic situation requires that each interest group propose a transformation process, as illustrated in Table 3.

Table 3
Worldview of the Interest Groups most related to the supply of LPG and Relevant Systems Oriented to the Problem

Interest group	Worldview or Weltanschauung, belief that	Relevant Problem Oriented System. Human activity system oriented to,
Minem	The current investment level of operators in the liquid hydrocarbons sector is insufficient despite the fact that the greatest need is for natural gas due to the potential increase in LPG demand.	increase the levels of investment in liquid hydrocarbons, although the greater need and demand for LPG will increase the need for GN in the coming years due to the country's economic growth needs
Osinergmin	Osinergmin is not responsible for the regulations in the natural gas industry and, therefore, does not necessarily have to propose adequate regulations for the supervision, control and regulation of natural gas.	maintain regulatory proposals regarding the safety and quality of service in the natural gas industry, which do not allow adequate supervision, control and regulation.
Companies operating the natural gas lots	The levels of exploration, exploitation and processing of natural gas are adequate to take advantage of the integral and sustainable development of this industry	wasting the integral and sustainable exploitation of natural gas
Companies operating the natural gas and natural gas liquid transport pipelines	by increasing natural gas transport operations, with current systems, the risks and losses due to natural gas and natural gas liquid pipeline ruptures will increase	Increase losses of natural gas and natural gas liquids as a result of breaks in transport pipelines.
Natural gas processing plants	Natural gas liquid processing levels are adequate to take advantage of the integral and sustainable development of LPG	Maintain natural gas liquid processing levels in the belief that there are sufficient reserves of natural gas liquids.
Refineries that produce LPG	oil processing levels are adequate to take advantage of the integral and sustainable development of LPG supply	Maintain oil processing levels in the belief of contributing to meet the demand for LPG in a high percentage.
LPG supply plants	LPG storage capacity of plants is insufficient for the integral and sustainable development of LPG supply	increase the storage capacity of LPG in strategic points of the country.
LPG Importers	Oil and natural gas processing levels are insufficient to meet national LPG demand	increase import levels of LPG, by sea and land.
Power Generation Stations	maintaining traditional sources of electricity generation, Peru can maintain sustainable growth and development.	use the GN for electric power generation.
Minam	Natural gas exploration and exploitation generates social and environmental conflicts.	increase socio-environmental conflicts produced by activities related to natural gas.
National Investors	there is no adequate legal and social framework to increase investments in natural gas exploitation and LPG production	increase socio-environmental conflicts produced by activities related to natural gas.
Foreign investors	there is no adequate legal and social framework to develop investments in natural gas exploitation and LPG production	maintain the absence of a legal and social framework that allows developing investments in exploitation of the GN

Indigenous communities	Oil and natural gas exploration and exploitation projects impact natural areas affecting agriculture and fisheries, the main source of food and income.	negatively affect agricultural activities, the main source of income and survival, through exploration and exploitation of oil and GN.
LPG end users	Oil and natural gas processing levels are sufficient to meet national LPG demand	Acquire more LPG than necessary for fear of running out of fuel.

Notes: Author's own creation

At this point, basic definitions of the processes of transformation of the real world were elaborated, from each worldview of the stakeholders. See table 4

The correct elaboration of the basic definitions is based on the CATWDE analysis, improving through permanent feedback processes.

Table 4
Basic definition and the elements that define it

Interest group	**Worldview or Weltanschauung, belief that**	**Relevant Problem Oriented System, human activity system oriented to**	**Basic definition. Human activity system**
Minem	The current investment level of operators in the liquid hydrocarbons sector is insufficient despite the fact that the greatest need is for natural gas due to the potential increase in LPG demand.	increase the levels of investment in liquid hydrocarbons, although the greater need and demand for LPG will increase the need for GN in the coming years due to the country's economic growth needs	Del Minem and Perupetro, aimed at promoting investments in hydrocarbons, especially in natural gas. This process, executed by Minem and Perupetro, occurs under the belief that the increase in investments in exploration and discovery of new natural gas deposits condensed with subsequent exploitation will cover the growing demand for LPG for the benefit of the Peruvian community and of the native communities for a greater distribution of the gas canon reducing social conflicts.
	Osinergmin is not responsible for the regulations in the natural gas industry and, therefore, does not necessarily have to	maintain regulatory proposals regarding the safety and quality of service in the natural gas industry, which do not	Belonging to the Presidency of the Council of Ministers, Minem and Osinergmin oriented to propose norms regarding the security and quality of service in the Natural Gas industry, to allow adequate supervision, control and price regulation. This process, executed by Osinergmin, considers the belief that the goals of covering the national LPG

Osinergmin	propose adequate regulations for the supervision, control and regulation of natural gas.	allow adequate supervision, control and regulation.	demand will not be met, due to the maintenance of regulations that discourage investments in expansion and modernization of plants and expansion of LPG storage capacity unless the regulatory entities cover the existing legal gaps.
Companies operating the natural gas lots	The levels of exploration, exploitation and processing of natural gas are adequate to take advantage of the integral and sustainable development of this industry	wasting the integral and sustainable exploitation of natural gas	Oriented to avoid wasting the full and sustainable exploitation of natural gas. This process will be executed by companies operating the natural gas lots
Companies operating the natural gas and natural gas liquid transport pipelines	by increasing natural gas transport operations, with current systems, the risks and losses due to natural gas and natural gas liquid pipeline ruptures will increase	Increase losses of natural gas and natural gas liquids as a result of breaks in transport pipelines.	Oriented to increase the volume of natural gas transport operations for the benefit of the communities of Camisea (Cusco) or by harming communities within the area of influence of the right of way. This process will be executed by natural gas transport companies; it is carried out under the possibility of increasing sabotage and conflicts with the communities; the granting of tenders without an adequate prior study of soils generating poor work when installing the transport pipelines of the GN and LGN; increased landslides due to natural phenomena; environmental pollution and considering the belief that increasing the volume of natural gas transport operations can increase losses due to breakage or taking of facilities.
Natural gas processing plants	Natural gas liquid processing levels are adequate to take advantage of the integral and sustainable development of LPG	Maintain natural gas liquid processing levels in the belief that there are sufficient reserves of natural gas liquids.	Oriented to avoid missing out on the opportunity to expand its facilities to raise the levels of processing of natural gas liquids from other sources. This process will be executed by national or foreign investors under the supervision of Osinergmin.

Refineries that produce LPG	oil processing levels are adequate to take advantage of the integral and sustainable development of LPG supply	Maintain oil processing levels in the belief of contributing to meet the demand for LPG in a high percentage.	Oriented to increase the levels of heavy oil processing due to the belief of contributing to meet the demand for LPG in a high percentage. This process will be executed by national or foreign investors under the supervision of Osinergmin.
LPG supply plants	LPG storage capacity of plants is insufficient for the integral and sustainable development of LPG supply	increase the storage capacity of LPG in strategic points of the country.	Oriented to increase the storage capacity of LPG without considering other strategic points of the country. This process will be executed by national or foreign investors under the supervision of Osinergmin
LPG Importers	Oil and natural gas processing levels are insufficient to meet national LPG demand	increase import levels of LPG, by sea and land.	Oriented to increase the levels of LPG import by sea and land without considering the possibility of consuming national production. This process will be executed by domestic or foreign investors.
Power Generation Stations	maintaining traditional sources of electricity generation, Peru can maintain sustainable growth and development.	use the GN for electric power generation.	Oriented to use GN for the generation of electrical energy. Este proceso será ejecutado por los inversores nacionales o extranjeros bajo la supervisión de COES y Osinergmin.
Minam	Natural gas exploration and exploitation generates social and environmental conflicts.	increase socio-environmental conflicts produced by activities related to natural gas.	This process will be executed by Local and Regional Governments, Indigenous Communities and the Population of the area of direct influence, environmental NGOs, Minam. It is carried out under the implementation of free market policies with rigorous environmental studies, in state contracts of GN avoiding the creation of social conflicts due to the contamination of flora, fauna, air, rivers, land; and considering belief that the

			exploitation of GN generates social and environmental conflicts.
National Investors	there is no adequate legal and social framework to increase investments in natural gas exploitation and LPG production	increase socio-environmental conflicts produced by activities related to natural gas.	Oriented to promote the existence of a legal and social framework that allows a more fluid investment in the exploration of GN. This process will be executed by the Minem.
Foreign investors	there is no adequate legal and social framework to develop investments in natural gas exploitation and LPG production	maintain the absence of a legal and social framework that allows developing investments in the exploration of the GN	Oriented to promote the existence of a legal and social framework that allows greater investment in NG exploration avoiding the use of regulations from a different context to Peru. This process will be executed by the Minem.
Indigenous communities	Oil and natural gas exploration and exploitation projects impact natural areas affecting agriculture and fisheries, the main source of food and income.	negatively affect agricultural activities, the main source of income and survival, through exploration and exploitation of oil and GN.	Oriented to avoid negatively affecting agricultural activities, the main source of income and survival, through the exploration and exploitation of oil and GN. This process will be executed by the Ministry of Culture, Ministry of Agriculture, Minem, Minam.
LPG end users	Oil and natural gas processing levels are sufficient to meet national LPG demand	Acquire more LPG than necessary for fear of running out of fuel.	Oriented to satisfy the demand of LPG avoiding hoarding and speculation.

Notes: Author's own creation

Once these aspects have been defined, problem-oriented conceptual models are established that indicate how to perform the transformation required to solve the problem. This implies generating activities for the achievement of the transformation for each type of interest group. Concluded the task of developing the models identifies the verbs that will define the central activities of the groups involved. These verbs, with their respective activities, are grouped in accordance with similar meanings and in unique activities, established by consensus, producing a tentative primary task model in which the human activity system is established oriented to generate a transformation, identifying the owner of the process, as well as the actors, victims and beneficiaries.

Discussion

A tentative model of primary task would be the human activity system oriented to natural gas, involving exploring a lot, confirming a finding, exploiting the

reservoir, producing wells, transporting natural gas to processing plants, producing and distributing LPG and other products derived from natural gas or transform it into higher value products; negatively affecting the ecological balance of the regions where the exploitation of natural gas takes place; with wasted opportunity to advance the integration, security and welfare of communities through an agile, proactive, creative, rational, ethical and sustainable management of this industry. This would lead to an inefficient and inefficient use of the gas canon in addition to the breach of other goals related to the development of this energy and the progress in road infrastructure, education and health works. Also, the appearance of bureaucratic barriers due to inappropriate regulations; low levels of investment required in the exploitation of natural gas and its impact on electricity generation.

According to the human activity system, this process belongs to Osinergmin, Minem, Minam, national and foreign investors, operating companies that exploit natural gas, mainly. The beneficiaries of this process are companies that exploit natural gas, national and foreign investors, local and regional governments, companies that provide local governments, populations in the direct and indirect area of influence of natural gas exploitation and the communities, among others. As victims, flora, fauna, soil, air, rivers and populations of the area of direct and indirect influence are considered, as well as native communities. The main actors in this process are the companies that exploit natural gas, Osinergmin, Minem, Minam, local and regional governments.

The process would occur under the implementation of a free market policy avoiding the detriment of the rigor of environmental studies in state contracts for natural gas; inadequate regulation of the development of the natural gas industry in all its phases as a result of an outdated legal framework; the existence of social conflicts and inequity.

This primary task model must be validated against the worldview, the relevant system, the basic definition and the conceptual model, oriented to the problem, by all the stakeholders involved, in order to evaluate the consistency; Consistency proven, becomes the primary task model confirmed and validated. An evaluation based on this model allows the development of context diagrams, causal diagrams and models of problem-oriented systems dynamics; From these, the Forrester diagrams are made, establishing indicators to arrive at simulation models of different scenarios that allow to establish the variables that will require particular attention using an appropriate sensitivity analysis; The complexity of this task merits developing a deeper investigation of the problematic situation of LPG supply.

Conclusions

1. The application, even partial, of the methodology of soft system dynamics, showing the necessary steps for the confirmation of the variables involved in the LPG supply problem, based on the cosmovision of the different interest groups, has made it possible to demonstrate and sustain its existence.
2. As a result of the application of this methodology, all the risks that, if materialized, will cause an interruption in the production of LGN and, therefore, a reduction in the production of LPG affecting its distribution and, as a consequence, have been identified Demand satisfaction.

3. With the identification of the risks, the one of the endogenous and exogenous variables involved is also achieved, fulfilling the purpose of verifying the existence of correspondence with the variables identified from the worldview of the interest groups.
4. The methodology of soft system dynamics has proven to be an appropriate analysis tool to detect variables whose level of affectation to the problem can be analyzed using multivariate analysis techniques such as factor analysis or through structural equation models.
5. The application of the factor analysis or the modeling of structural equations allows to find the interrelation between the variables and their respective load factors, which will indicate the relative contribution that each variable makes to the problematic situation.
6. The knowledge of the degree of correlation or causal relationship between the variables, within the different contexts generated from the worldview of the interest groups, allows quantifying and analyzing their relationship, as well as their behavior regarding the behavior of other related variables; this allows to predict with a certain degree of precision, the value of the impact of the variables on the LPG supply problem.
7. Once the entire system is known, and the units of analysis defined, it is possible to develop a modeling of system dynamics and a sensitivity analysis to measure the impacts of the variables, as a function of time.

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DESIGN OF AN INTEGRAL MODEL TO MANAGE SOCIAL INTEREST HOUSING CONSTRUCTION PROJECTS WITH EMPHASIS IN SOCIO-ENVIRONMENTAL VARIABLES IN FAMILY COMPENSATION BOXES

Camilo Andrés Velásquez Triana
Nueva Granada Military University (Colombia)
camiloveltri@hotmail.com

Abstract. At present, the construction sector has an important weight within the trade world economy, in the last decade the construction has had a higher growth than others economics aspects of the nations, different countries have chosen to increase and improve their processes of housing construction. In Colombia, it has been identified that construction encourages at least 32 sectors of the economy, being one of the main actors in the economic leverage of the nation; in which resources are mobilized, jobs are used and the level of quality of life is more improved. However, social interest housing construction projects (VIS) face various problems throughout their life cycle, due to the large part that there is not specialized model that allows the monitoring of the project in each of its stages and that consider the project as a global aspect, it is for this reason that it is proposed within this study the formulation of a model that establishes clear principles under international guidelines and that meet, among other things, the main objectives of the project without set aside socio-environmental variables, thus giving a powerful and very solid tool for project managers, generating value and knowledge for project management.

Keywords: Project Management, Methodologies, Impact, Model, Stages.

Introduction

The construction sector currently holds an important position in the world economy. In has therefore had a greater growth and relevance than other economic fields of the nations in the last decade, and many countries have chosen to increase and improve their housing construction processes, making large financial investments in order to boost the economy of the construction sector and indirectly provide stability to the country. The economic and social nature of this kind of investment has important factors to consider, such as the management of

stakeholders, factors related to the social impact and legal issues. However, there is a major factor that cannot be ignored: the correct methodological use given to the project. The success or failure of the project will depend to a large extent on these good practices. Project management has a crucial role in the realization of the project, as well as the responsibility to carry it out successfully, achieving the best possible results.

The following study deals with a methodological analysis of the different existing methodologies applicable to social housing construction projects, within a logical framework. Therefore, the main purpose of this study is to determine the best practices applied at a methodological level to a series of construction projects, as well as to determine those influential factors that led to the project being more successful. Otherwise, this study also aims to determine the issues that diminish the effectiveness of the project and use this valuable information to take the appropriate measures for the formulation of the model that is to be designed. The Economic Commission for Latin America and the Caribbean (ECLAC) is responsible for the analysis of methodologies to be studied in this paper. The ECLAC is an essential regulatory and mandatory entity within the analysis of social investment projects such as the construction of social and priority interest housing, since it is responsible for setting a focus and providing the framework for monitoring the construction project's life cycle, as well as the basic principles of project operation and management.

This study is carried out in order to identify which factors should be taken into account for a project such as this one to be considered successful. Furthermore, it will also allow to identify the failure (or not success) factors that the managers of the construction project should always bear in mind and be careful about so that their project can be considered to be successful and a value generator.

Family compensation funds in Colombia are currently trying to comply with the existing construction project management methodologies and apply them to their civil works, particularly to social housing construction. However, they are not following a clear and precise methodology in their approach, but are rather wandering between methods and methodologies, hoping and blindly trusting in the result. In addition to this inconvenience, it has been observed that they simply use the methodology in a general way, not focusing on its details or particularities. This often occurs due to lack of knowledge or because the methodology is not precise enough to provide the sufficient level of detail that the project manager requires, since it is evident that the steps are simply executed in broad strokes. But it seems that no effort is being done to specify or elaborate at a greater level each of the activities described in the methodology seeking to enrich the project. Instead, they give rise to errors during the life cycle of the project, as well as dissatisfaction during the execution phases and with the final result of the project.

Method

Nowadays, the decisions taken to perform some kind of social investment are made by adapting the least cost method. This minimization is carried out by governments or public and private non-profit entities, such as family compensation funds. However, the problem with these costs is that only a few direct variables are taken into account, such as construction, land, labor and machinery. The most courageous ones also include indirect variables; however, these variables do not include the costs directed to social or environmental impacts both in the project and in its execution and final result.

The housing sector in Latin America dates back to 1996 at the United Nations conference on human settlements in Istanbul. The countries of the commission prepared and presented a regional plan of action to address the problems that each nation would have to face. Colombia was no exception: the country's priority objective is to overcome poverty, especially urban poverty, which they consider an attainable goal in the medium term. This requires the definition and modernization of planning policies and instruments and urban and housing management.

The objective was to reach the efficiency levels to stagnate the gap - already wide at that time - on population growth against the construction of decent housing. The gap was growing at a rate of 46 to 1 (María, 2005), that is, for every 46 people in the urban population, only one could count and participate in the housing project. This percentage was growing and accelerating every year.

The Government's Housing Plan states mainly that the problem of housing financing is not just a temporary one but requires a series of actions to foresee and solve this conflict. These actions may include the development and implementation of structural and exchange rate reforms to make such financing sustainable in the long term. To this end, the financing system must be strengthened and made viable in the long term. This is done through the development of the secondary mortgage market together with the implementation of an amortization system linked to changes in minimum income (SMLV) and, in general, measures that guarantee the existence of housing financing schemes over time for all Colombian families.

In the area of social housing, which is addressed in this document, the state policy is based on a family subsidy aimed at the poorest population (it is identified). This is complemented by contributions from local administrations, municipal mayors, NGOs and the generation of projects from the community organizations themselves. The government is proposing measures to encourage the production of low-cost housing that makes it possible for the poorest families to have access to it, such as increasing the focus of the subsidy programs. The programs offered are: a) housing, b) improvement of housing and environment and c) title legalization. (Colombia, 1998 - 2002).

In large cities, it is proposed to stimulate the development of urban macro-projects through a competitive system of resources. For this purpose, local administrations are running together with the private sector and the country's compensation funds, which are mostly run by the State. (National Planning Department, 2002).

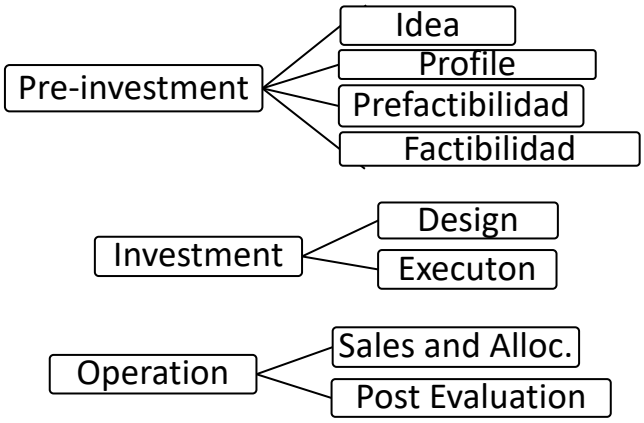

Figure 1. Housing Project Life Cycle

The findings reveal that social housing programs have been developed, in most cases, as programs whose only objective is to provide housing to lower-income people. As a consequence, housing has increased in city suburbs without the minimum provision of basic services, such as education or health, leading to unsafe neighborhoods with poor accessibility to the rest of the city. It is not clear whether the benefits that lower-income people obtain from new housing outweigh the costs of moving to a deprived neighborhood.

Another consequence is that investment in housing forces the infrastructure and equipment sectors to invest in the locations predetermined by the housing projects, in order to solve the deficits in those new sectors that they created. The systems that provide services or equipment would not necessarily have made these investment decisions if the housing location decisions had been made coordinately beforehand. Without coordination, the internal efficiency of each sector could lead to diverse and mutually incompatible solutions, which would be likely to be different from the efficient solution for all sectors.

Due to the previously described, increased tendency of international governments, ECLAC, as a normative and certifying agent, proposes that the construction of social housing should comply with the following minimum requirements so that homes can be inhabited by any type of person, not differentiating their lifestyle. Below we will find the characteristics of social housing construction projects in terms of locative, healthcare, service, environmental and social variables.

The minimum standard of the drinking water service includes water quality, safe supply and distribution mode through public networks with cross-connection control programs. In general, all these characteristics of the drinking water service must be provided by the company or institution in charge of providing the service. However, the location of a new social housing project may offer alternatives to those associated with differences in the way the drinking water service is produced or distributed. These alternatives may imply different costs for the country. (Chiape, 1999).

As a requirement, ECLAC establishes that the minimum standard of wastewater disposal service must be the extraction of water from homes, as well as its collection, treatment and final disposal in a receiving environment or its reuse in an environment-friendly, sustainable and ecological manner, in a similar way to drinking water. (United Nations, 2004).

The electric power service must consider providing sufficient power for lighting on roads and public spaces in the subdivided lots, in order to supply each of the homes. Indoor connections must have individual or shared connections and meters. (United Nations, 2004).

Complementary services to housing, which should be located in the vicinity of the housing projects, also vary from country to country, and even among cities. The most widespread services are education and healthcare. Depending on cultural patterns and the levels of economic and technological development, among other variables, the following are also included among the basic complementary services: recreation, culture, commercial sector, national police, firefighters, public lighting, mail, telephony, communication, etc.

Most likely, depending on the size of the housing project, customs and prevailing standards, there may be complementary services to housing that should be part of the subdivided lots, such as green areas, playgrounds, spaces for community development, spaces for childcare and eldercare, sports spaces, commercial premises, churches, etc.

The services located in the vicinity are not exclusive to the population of the social housing projects. Consequently, they must be shared with the surrounding community. It is necessary to analyze the provision of these services in the neighborhood, as well as the probable availability to assist the new population. It should also be compared with the requirements

imposed by the size of the social housing project. Furthermore, it is also necessary to analyze the eventual deficit situation in the vicinity and the dimension of the projects required to assist the pre-existing population and the new population provided by the project under study.

This natural agent is mainly affected by the solid and liquid waste of highly toxic materials that are generated in the different phases of the process like for example digs, demolitions, flattening, filler, among others. The dumping of fillers such as waste or rubble is an almost universal practice for these companies has negative effects on the environment for example degradation of landscape quality, disuse of soils for crops, irreversible damage to natural drainage, compaction of soil and subsoil layers permanently. During the final course of the useful life of the materials for construction works, they are converted into rubble (often by works managers). According to Lombera's study (2010), it is confirmed that in some cases the amount of waste materials can be up to 50% of the total material used, generating gigantic waste with economic implications for the company and environmental implications for the land.

The air is the second fundamental aspect that must be taken into account in the construction sector, this is especially attacked by the dust generated during the process, the noise produced by the machinery, as well as equipment and some explosions that are made and the CO2 emissions. the air can be seriously polluted due to the indiscriminate use of fossil fuels affecting both people and animals indiscriminately. The air particles, which are released in these processes, are hard particles which are not supported by organisms and neither by the human nor animal respiratory system generating problems such as severe respiratory diseases, and irreversible lung damage. The other aspect that affects the air is the burning of fossil fuels for the continuous work of high performance machinery, transport and the operation of heavy duty tools such as drills which cause environmental damage and contribute to the deterioration of the ozone layer and climate change which is a global phenomenon. And finally, a construction project can, in extreme cases, affect the right to silence, comfort and health of nearby residents and influence the normal activity of education centers such as schools and care centers such as hospitals and nearby clinics.

The third key factor for the construction sector is the water resource, which is divided into two segments. The first one is focused on the indiscriminate expenditure of water to carry out the construction process and the second one is associated with land movements and the elimination of the vegetation cover, which generates an effect due to the alteration of the natural vegetation cover preventing the water bodies flowing naturally and forcing nature to change its course, also generating effects on water quality. Similarly, the water used for construction work and for washing machinery and construction sites contains considerable amounts of suspended solid waste that severely disrupt the sewage system and the water that flows through it, as well as directly to the PETAR wastewater treatment plants.

In the places where construction projects are developed, there is a diverse amount of native vegetation which is seriously and permanently affected by construction projects, cutting of grasses, cutting of trees, burning of bushes, etc. The most shocking aspect of the issue is that construction projects not only generate environmental damage to the flora at the construction site, but also negatively affect the surroundings of the site, expanding the zonal range of affectation. This is largely due to the compaction that occurs in the soil and which was explained above by preventing the trees, bushes and flora. In general access to nutrients in order to survive causing death to them, simultaneously with the loss of the flora the native fauna that survived in these ecosystems is lost, generating irreversible desolation of the wild fauna and generating damage in the food chains. The most common phenomenon is the migration of animal species that affects the ecosystem.

The social characterization for construction projects has been widely underestimated by construction companies and those who manage and lead construction projects, these factors can be catalogued within the following list:

1. Mobility and access to the territory.
2. Productivity, access to goods and services.
3. Territorial balance and social development.
4. Access to schools, hospitals, among others
5. Access and spaces for recreation, cultural services and sports activities
6. Comfort, dignified and safe conditioning of the house.

The social performance of the places where the processes of social housing construction are carried out depends to a great extent on the adaptation of the new residents to the modified space and this is reflected in the interests that the land can acquire by the residents, that is to say, if the use that will be given is for commercial or residential purposes among other, similarly, there is a variable that directly influences these agents of change with regard to price variation, and which in turn is related to territorial planning (that is, how these inhabitants will be organized), valuation, projection and planning of the growth of cities.

The relationship between the construction sector and health is directly proportional; no housing construction project can be conceived without taking into account health provisions, since this is a fundamental and constitutional requirement for the preservation of life. Construction projects must guarantee that the amount of new population that will reach this sector can count on the totality of health and hospital coverage.

Security is a social factor that construction projects must guarantee, since the new upwelling of people and the overcrowding of a neighborhood or locality generates an increase in the rates of insecurity. Therefore, police coverage and immediate response to the danger must be guaranteed; security also has another aspect and is focused on environmental security or the prevention of floods, fires, and landslides, among others.

Education is also extremely important in the construction of social housing, since full coverage and access to basic primary, middle and secondary education must be guaranteed for the children of the people living in these projects. Otherwise the social impact would be considerably negative.

Risk prevention measures and strategies must be included from the design of the project, housing construction companies must have the intention that these are developed in the different stages of construction for all stages of project implementation and even when the project is completed the safety of the inhabitants of the housing must be guaranteed during the life of the built structure.

The methodological model was developed taking into account 18 current construction projects and those in the final stages in the city of Bogotá D.C. and its surroundings, the process of visits and accompaniment to each of the projects took place through direct field work in each of the construction projects to be able to take complete information from the source. The work universe is initially proposed so that the model will be used and adopted by the country's compensation funds, having as test subjects the 2 main compensation funds of the nation, however it is clarified that this model may be operational for any type of private or public entity, construction company or engineering association that wishes to carry out and execute housing construction projects.

The scope of the research is the formulation of a robust model that satisfies the needs of the entire life cycle of the housing construction project, taking into account all the variables that it may have at any given time and that this model is the necessary input for project managers and directors to have a step-by-step guide on how to approach this type of project, thus achieving absolute control over it, it is clarified that the model cannot be tested in a real housing project scenario, however the model will be tested under experimental trial-error simulations based on different scenarios and subject to the necessary sensitivity analysis until its standardization is achieved.

Instrument

For the investigation, a basic information gathering was carried out for each of the projects in the sample, which contextualized us about the particular and peculiar features that each of the social housing projects offered in the last years by the two compensation funds in Bogotá and its surroundings may have. For this small information gathering, each project was reviewed individually, their location and field variables, their limitations and resource availability were studied, minimum performance and completion data were collected as well as the problems each of the projects faced and how these were overcome if at all.

After this initial information gathering, robust information was collected through field work that was carried out in each of the projects that make up the sample. This information is used as a primary source of information and through qualitative and quantitative measurement tools, surveys were taken of approximately 30 key questions to the people involved in each of the social housing projects studied, as well as to the actors involved in the project; This information was analyzed and refined in a series of matrices to calculate both common and specific behaviors and variables for each of the projects. Interviews were also conducted with the different groups of actors in order to qualitatively understand the economic and social impacts that each one faces and to find the basic strategy that allows the solution to each problem from each of the interested points of view or stakeholders, These interviews were analyzed and their content was detailed under common behaviors and discrepancies and for each of the problems found inside and outside the process a strategy was implemented that is included within the proposed model that allows the direct solution and optimization of the respective problem so that it stops being a weak aspect and becomes a strength contributing value to the knowledge.

In the same way, a previously studied and analyzed questionnaire was used as an instrument to help in the elaboration of the interviews and surveys. This questionnaire has a sufficient level of detail and degree of interrogative complexity to determine with the answers given by the actors that interfere with the analysis all the relevant aspects that must be taken into account when including the modular systems that the proposed methodology has.

Results

After the methodological execution, the collection of information, its analysis and the direct link with the international standards of project management, we were able to identify the main success and failure factors that were common to the evaluated sample subjects. These factors are the key piece in the development and approach of the final product model of the study; the success and failure factors found are presented below.

Identification of success and failure factors

According to the results obtained in the study, we can identify some success factors in the construction of social housing projects in Bogotá D.C. and its surroundings. These factors were the ones that had the greatest influence on the projects that were analyzed, but it is clear that they are not the only success factors but the ones that scored the most:

Initiation as a key factor comprises a large part of the previous studies, providing the business case that is fundamental for making decisions at the management and sponsorship level.

Planning includes all the processes of design and planning of works, is perhaps the most important aspect for any type of project, especially construction projects or large works and surfaces.

The definition of resources as a key factor and tolerance limit, is what anticipates what material, equipment, machinery and capital is available to work with.

The definition of the scope is a key factor since it delimits the extent to which the construction process must be projected, delimits the quantity and quality of the final deliverables that will be developed, as well as the cost and estimated time that must be met.

According to the results obtained in the study, and that were identified previously, we can identify some factors of failure in the construction projects of social interest housing in Bogotá D.C. and its surroundings, these factors were the ones that had the most influence for the projects that were analyzed, but it is clarified that they are not the only factors of failure but the ones that had more score.

The construction companies and project managers do not have an environmental management plan; they only commit to meeting the minimum requirements demanded by the law in force.

No attention or constant follow-up is given to the risks, in most housing construction projects. PMs comply with the completion and initial survey but do not commit to updating or subsequent identification, which is a risk in itself.

The community is NOT included since the beginning of the project, in most social housing construction projects. In addition, their needs or minimum requirements are not heard.

There are weaknesses in the communication and integration processes with the different work teams; contractors, supervisors and construction supervisors, a situation which greatly hinders the successful realization of the project.

The relationship between the factors previously identified for the success and failure of projects, is represented graphically, against international standards and the methodologies addressed for project management. Methodological weaknesses are identified according to the main study factors. It is clear that the PMI standard which was the most used by the Project Managers of the 18 construction projects, fully complies with the review and management of the success factors. However, it does NOT comply with the review and analysis of the failure factors found, falling short in the identification and management of social and environmental variables. In addition to this, errors and methodological oversights led to decrease assertiveness in the success of the projects under the framework above mentioned. In the same way, it can be seen that it is necessary that the particular need in the construction sector and specifically the social housing construction sector must have a personalized and an exclusive methodological model in order to manage these factors. Additionally, a specialized model in environmental and social issues. A model that amplifies the scope to the works carried out, allowing a significant improvement to the sector, to the benefited communities, to the environment and to the nation at large, where general welfare prevails over private interest.

Table 1

Correlation between critical failure and success factors vs. GDP standards

International standards	Success factors in construction projects				Failure factors in construction projects			
	Induction	Planning	Recursos	Induction	Planning	Actualización de Riesgos	Induction	Planning
PMI	X	X	X	X		X		X
APM	X	X	X	X		X		X
Prince2	X	X		X		X		X
Scrum	X	X		X				X
(IPMA)		X	X	X	X		X	X
Logical framework.	X	X		X		X		X
Agile FDD		X		X		X		X
Cascade		X		X		X		X
Prims	X	X	X		X	X	X	
Teen step	X	X		X		X		X

Note: Retrieved from the author (2019)

As it can be seen the key factors in the success of construction projects are generally framed within an established methodological model. A model that is being used in today's construction projects. However, thanks to the result and analysis of the information it is discovered that there are some factors of NO success, which direct and guide the project to failure. These modular factors previously mentioned are the purpose of this study and will be the key aspects that the proposed model will be challenged to cover.

According to the data obtained in the fieldwork carried out, the following methodological model is proposed in general as follows:

Figura 2. Integration of the project management model

El The model is based on the cycle of continuous improvement PHVA, contains methodological elements of different methodologies applicable to the sector and complements

the current tools of project management, the fundamental aspect and perhaps the greatest strength of this model is the implementation of plans and environmental and social controls, which begin from very early stages of the project, being cross-cutting with the other areas and fields of knowledge that should normally be developed to achieve project success.

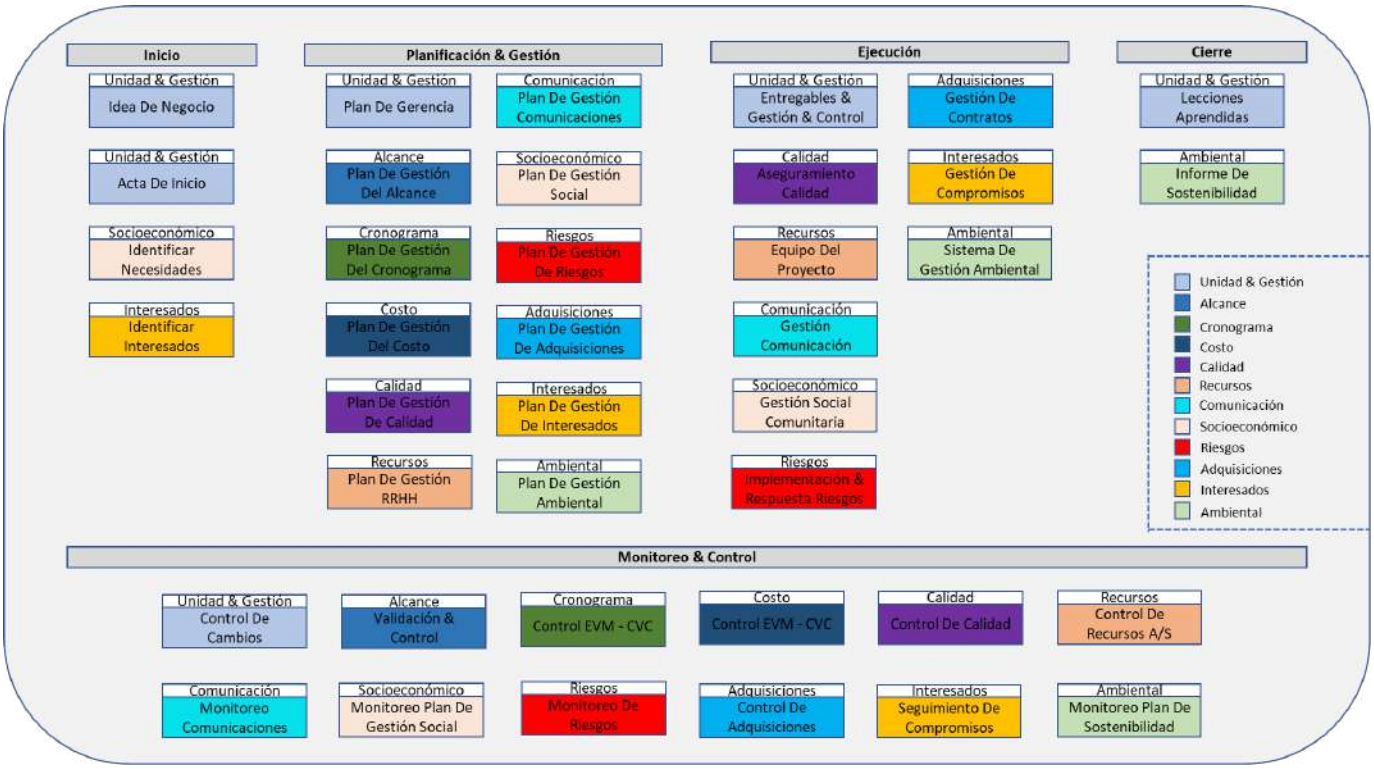

Figure 3. Methodological Model.

Discussion and conclusions

The variables of success and failure of a project are not constant, they change over time, they change between projects, they change between work teams and they change with the environment in which they are working. It is of vital importance that the project manager has the capacity to decipher in advance which are the critical variables of his process and in a way that he can carry out the respective improvement management. However, the identification, analysis, adjustment and evaluation of these factors is difficult without prior knowledge or methodological guidance to guide the manager and the project. For this reason, project management methodologies are of fundamental importance to ensure that the project phases from initiation, formulation, execution, monitoring and control, to final closure, can be carried out in a synchronized and structured manner, always maintaining harmony of processes, resources and time.

Likewise, it is evident that any methodological error can lead to the failure of the project. For this reason, the project manager must understand the methodology and the actions that it develops, must ensure that each aspect is fully complied with however logical it may seem and must implement the best method, Similarly, the importance of variables that are commonly underestimated such as social and environmental variables must be highlighted. These variables are now mandatory and can affect the project both positively and negatively, generating economic losses, dissatisfaction, legal and juridical sanctions among others, which must be dealt with from the beginning of the process, by creating specific management plans allocating time and resources to these tasks and improving these processes day by day so that and with the help of lessons learned the same mistakes are not repeated and the projects have a higher success rate, finally we warn about the role of the project manager which is not only to follow up step by step a methodology implemented to your project, but must always go further, must constantly think how to improve the project, how to optimize activities, how to reduce costs, how to meet the deliverables without abandoning or neglecting the critical variables of the processes such as social and environmental aspects.

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CHARACTERIZATION OF CELLULAR MOBILE OPERATING SYSTEMS: ANDROID, SYMBIAN, IPHONE AND WINDOWS PHONE

Fernando Cassinda Quissanga
Open University of Brazil (Brazil), European University of the Atlantic (Spain)
fernandoquissanga@hotmail.com · https://orcid.org/0000-0003-4468-7206

Abstract: The present theme refers to the characterization of cellular mobile operating systems: Android, Symbian, iPhone, Windows Phone. To present which of the cellular mobile operating systems, is the most secure and the most susceptible to computer viruses, the qualitative methodology based on the bibliographic reference, data collected in books, technical manuals, manufacturer information and on internet sites; to the analysis of the documentary data, done in tables. However, it is concluded that not all types of computer viruses infect cell phones, it depends on the kernel of the operating system. It was possible to know that Symbian is the operating system most prone to contamination of computer viruses, this operating system is made of a C ++ programming language coming from the C language one of the most popular and has many developers. Android is a mobile operating system, not so secure, based on the kernel of Linux, being free software allows more number of developers of the technology. Windows phone is the least susceptible to virtual pests. And Microsoft has invested heavily in their security system, restricted access to the app store to prevent the user from downloading programs out of the market, since every day are placed numerous applications. Bluetooth technology represents a major form of virus transmission.

Keywords: Cellular Phone, computer viruses, operational systems.

CARACTERIZAÇÃO DE SISTEMAS OPERACIONAIS MÓVEIS CELULARES: ANDROID, SYMBIAN, IPHONE E WINDOWS PHONE

Resumo: O presente tema refere-se à caracterização dos sistemas operacionais móveis celulares: Android, Symbian, iPhone, Windows Phone. Apresentar qual dos sistemas operacionais móveis celulares, é mais seguro e o mais susceptível aos vírus informáticos, a metodologia de forma qualitativa baseadapelo referencial bibliográfico, os dados coletados em livros, manuais técnicos, informações de fabricantese em sites da internet; à análise dos dados é documental, feita em tabelas. Entretanto, conclui-se que nemtodo tipo de vírus informáticos infectam os telefones celulares, depende do núcleo (kernel) do

sistemaoperacional. Foi possível saber que o Symbian é o sistema operacional mais propenso a contaminação de vírus informáticos, este sistema operacional é feito de uma linguagem de programação C++ provenienteda linguagem C uma das mais populares e possui muitos desenvolvedores. O Android é um sistema operacional para dispositivos móveis, não tão seguro, baseado no núcleo (kernel) do Linux, sendo um software livre permite maior número de desenvolvedores da tecnologia. O Windows phone é o menos susceptível a pragas virtuais. E a Microsoft investiu bastante no seu sistema de segurança, restringiu o acesso ao app store para impedir que o usuário baixe programas fora do mercado, visto que a cada dia sãocolocados inúmeros aplicativos. A tecnologia bluetooth representa maior forma de transmissão de vírusinformáticos.

Palavras-chave: Telefone Móvel Celular, vírus informáticos, sistemas Operacionais.

CARACTERIZACIÓN DE SISTEMAS OPERACIONALES MÓVILES CELULAR: ANDROID, SYMBIAN, IPHONE Y WINDOWS PHONE

Resumen: El presente tema se refiere a la caracterización de los sistemas operativos móviles móviles: Android, Symbian, iPhone, Windows Phone. En el caso de los sistemas operativos móviles, es más seguro y más susceptible a los virus informáticos, la metodología de forma cualitativa basada en el referencial bibliográfico, los datos recogidos en libros, manuales técnicos, informaciones de fabricante y en sitios de Internet; al análisis de los datos documentales, hecha en tablas. Sin embargo, se concluye que no todo tipo de virus informáticos infectan los teléfonos celulares, depende del núcleo (núcleo) del sistema operativo. Es posible saber que Symbian es el sistema operativo más propenso a la contaminación de los virus informáticos, este sistema operativo está hecho de un lenguaje de programación C ++ proveniente del lenguaje C una de las más populares y posee muchos desarrolladores. Android es un sistema operativo para dispositivos móviles, no tan seguro, basado en el núcleo (Linux) de Linux, siendo un software libre permite mayor número de desarrolladores de la tecnología. Windows Phone es el menos susceptible a las plagas virtuales. Y Microsoft ha invertido bastante en su sistema de seguridad, ha restringido el acceso al app store para impedir que el usuario descargue programas fuera del mercado, ya que cada día se plantean numerosas aplicaciones. La tecnología bluetooth representa una mayor forma de transmisión de virus.

Palabras clave: Teléfono móvil. Virus informáticos. Sistemas operacionales.

Introduction

Nowadays, there is a considerable amount of cell phones, however, these devices currently allow communication, multimedia messages, bank transfers, weather consulting services, geographic location services, global positioning system (GPS), printing of documents, other technological convergence services, calculator, address book, galleries, data exchange, and internet (portable hotspot). They can also transmit the internet signal to 10 or more Bluetooth information transfer devices. They have memories, processors and a built-in operating system, which allows a greater flow, handling and exchange of information between users. However, they spread insecurity, especially related to the loss and theft of information. It should be noted that cybercrime has increased, however, cell phones have become very vulnerable to attacks from computer viruses.

According to Giménez (2011): “The first thing to know is that a mobile security solution is completely different from a desktop or a notebook security solution. For example, according to Symantec, there are more than 286 million computer malwares, there are about 1000 for mobile devices [...]”. Considering this quote, we can see that mobile operating systems are different from each other in terms of their reliability and

vulnerability, however, viruses in an Android operating system do not attack the iOS inversely due to its kernel, i.e. it depends on the source code and its programming language.

General objective: to identify which of the mobile operating systems is the safest and most susceptible to computer viruses.

The research is qualitative and is based on the bibliographic reference, which allowed to evaluate the material of interest for the study of the subject referred to as support of the scientific article. One (1) questionnaire and eight (8) interviews were used as research techniques and instruments. However, we can analyze the definition of Chaer, Diniz and Ribeiro. (1987, p. 15). 260 apud Gil, 1999, p.128): "as the research technique composed of a more or less high number of questions presented in writing to people, with the objective of knowing opinions, beliefs, feelings, interests, expectations, situations, experiences, etc." Through the interviews it was possible to identify differences between the mobile operating systems mentioned.

Regarding the data collected, it is possible to observe a limited number of publications on computer viruses in mobile telephony. However, the research was conducted in books, technical manuals, scientific articles, manufacturer information and on websites. "Documentary analysis, as a process intrinsic to the organization of information in the field of information science, establishes theoretical-methodological descriptive parameters that explain the analytical elaboration procedures that lead to the identification of the concepts found in the document". (Nascimento, 2009)

Computer Viruses on Cell Phones

When talking about viruses in today's society we think of biological viruses (poison, toxins or infectious agents) However, in this chapter we will discuss computer viruses in cell phones, which can be defined as malicious software made by programming language. Programming that infects both the operating system and the hosts in the program and spreads to other locations on the system, corrupts and prevents the software or program from working properly.

> Crackers (computer criminals) are very skilled in the programming language, and have knowledge of computer networks, telecommunications and software engineering, sometimes without having received any education in these fields. They create viruses to take dividends, monitor all possible routes, break down passwords and detect security breaches in different areas, companies, banks and others (Quissanga, 2015, p. 10).

There are stories claiming that some viruses were not made intentionally, but to test the security system in order to learn more about the behavior of viruses. Another reason was to be able to study in labs that allowed greater student interaction. It is also claimed that some were created by amateur programmers and hackers for fun, without actually knowing the risks and thinking about the possible consequences. These viruses are not as well known, but besides damaging the operating systems, they have caused many other problems. There are also specific viruses for information theft, as cell phones are used for many purposes, be it banking operations, transfers, sending emails, messages... It is an example of technological convergence since at first it was only used for calling, but thanks to the internet it now has many other uses such as interacting in social networks, recording, etc. However, this feature of technological convergence, especially when connected to the Internet, allows the transmission of computer viruses to cell phones. That is why we must protect the operating system with antivirus, anti-

malware and anti-spyware. According to Trif and Vişoiu (2011, p.119): "New achievements in mobile technologies have paved the way for new applications designed for mobile devices. Initially, mobile devices offered few features due to low memory, computing power and difficult interaction".

But cell phone theft is done silently, as the user has no idea that their device is vulnerable to cybercrime, and that they are being spied on. These criminals steal users' identities, hack into their emails, and compromise their bank details. Hackers have many reasons for creating viruses and carrying out any cybercrime.

Even though the real motivation for computer programmers to create viruses is to destroy operating systems, they have two other possible purposes.

The programmer creates viruses to:

- Destroy or corrupt cell phone applications;
- Steal users' data through messages.

> The user often facilitates the spread of these viruses due to lack of caution and little knowledge of the ways in which they are transmitted, that is why any manufacturer, developer or law firm should promote conferences, debates, forums and seminars on the causes, forms of propagation, damage and prevention of computer viruses [...] (Quissanga, 2015, p. 10).

Viruses on cell phones originated in 2004, which can be considered very recent compared to the origin of computer viruses in the late 1980s. It was F-Secure Company who discovered the first virus in cell phones.

According to Martinelli, (2008, p. 94):

> The first cell phone virus was discovered in 2004 by the F-Secure Company (a security company) and was called Cabir.A. Cabir.A is actually a worm that spreads only in cell phones that use Bluetooth wireless transmission technology, which affects devices based on the Symbian operating system, better known as the Series 60 platform.

But the plague does not spread to all devices, which means that there are some restrictions for each virus depending on the operating system. Bluetooth technology is one of the wireless network transmission technologies that allows the exchange of information between devices while having a low power consumption. The Cabir.A virus originated from this technology by sending infected messages to the mobile device. It is considered to be the first form of propagation of mobile phone viruses. This technology usually allows a very simple transfer of information from one point to another. Most mobile devices to date are lacking any antivirus to prevent computer viruses from infecting the operating system and, in turn, damaging it or stealing information. Cell phones must be protected because the main transmission route of the virus on these devices has been Bluetooth and the Internet.

Describir los posibles tipos de virus informáticos en la telefonía móvil celular.

After addressing the origin of viruses, it is advisable to mention the types of viruses in cell phones.

However, computer viruses are more focused on how to spread and act on their targets and they have many developers, hence there are many types of viruses, which is not the case with cell phone viruses. Their very recent discovery has limited research and

development, as well as the introduction of viruses to the market and very recent access to the devices that somehow developed them.

Silent viruses are quite common these days. Crackers use them to spy on users and remove any vulnerabilities from the mobile device, such as images, videos, compromising or confidential information, bank codes for multiple transfers. We must be careful with the information we put on our mobile devices when we have no antivirus, antimalware or antispyware.

Cell phone viruses are not as popular as those of computers, which may also be due to the evolution of several generations of cell phones. For example, Nokia and Siemens cell phones used the Symbian operating system. This system classification was single task and single user technology, but rudimentary compared to today's multitasking and multiuser mobile devices. They did not allow large volumes of data or information, videos, images, contacts, SMS, MMS, and emails, therefore the graphical interface was very different from today's mobile devices.

Tabla 1. Computer viruses on cell phones

N°.	**Virus/Worm Name/Year (Updated)**	**Operating System**
1.	Cabir A (June 2004)	Symbian
2.	Caballo de Troya (March 2017)	Symbian, *Windows*, Android and Mac OS X
3.	CommWarrior (October 2018)	Symbian and Android
4.	Crossover (March 2011)	*Windows Mobile*
5.	Doomboot (July 2019)	Symbian
6.	Liberty (September 2007)	*Palm* OS
7.	RedBrowser (September 2017)	J2ME
8.	FlexiSpy (June 2019)	Symbian and Android
9.	Skuller (June 2004)	Symbian
10.	Gingermaster (April 2011)	Android
11.	Ikee (November 2009)	*iPhone* OS (IOS)
12.	DroidKungFu (June 2011)	Android
13.	Zitmo (April 2018)	Symbian, Android, *Windows Mobile* and *Blackberry*
14.	YiSpecter (April 2018)	*iPhone* OS (IOS)

Note: Source: Author's own creation (2018).

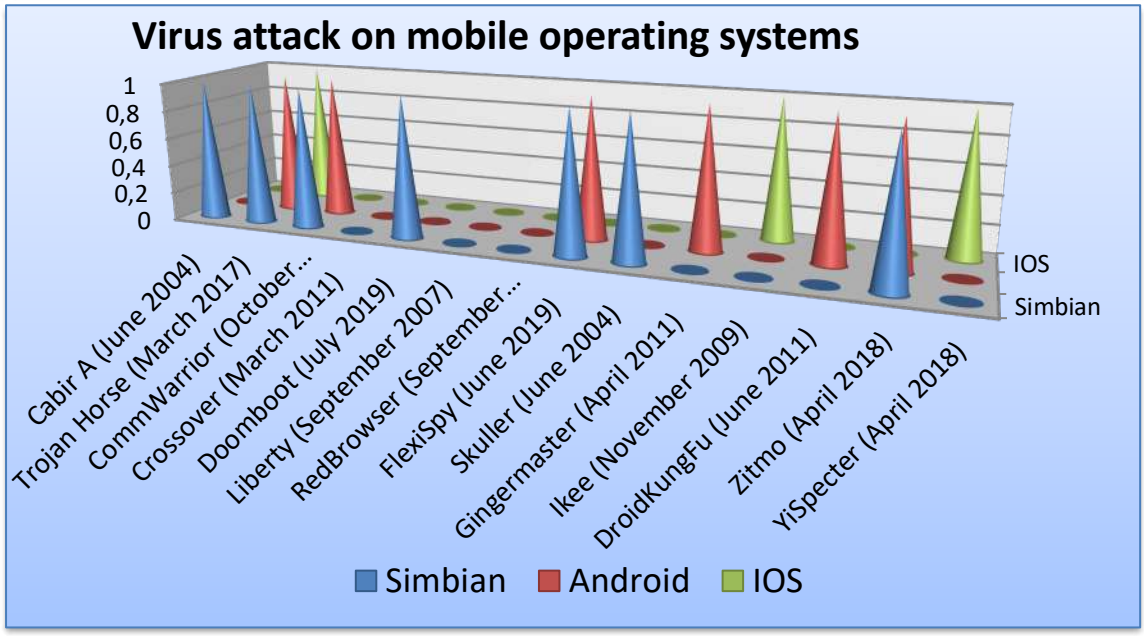

Figure 1. Virus attack on mobile operating system

Note: Source: Author's own creation (2019).

According to Figure 1., it can be seen that the Symbian operating system represents 50% of the 14 viruses, as it has 7 types of viruses that infect the operating system. Secondly, we can see the Android operating system with a total of 6 viruses and finally the IOS with 3 varieties of viruses.

Mac OS X operating system is not impenetrable as it is infected by the Trojan horse. Trojans must spread through user interaction such as opening an email attachment or downloading and running a file from the Internet and when they do so, the system sends instructions to the server.

The Trojan horse virus that infects mobile phones, as shown in Table 1, is the type of virus that attacks the most operating systems. This virus was named this way because of its high-speed transmission characteristic. It also has the ability to hide in the system and attack silently without the user even noticing. Downloads are its favorite hiding place. If a certain program is downloaded, it also installs the virus and slowly destroys the operating system. These viruses have two ways of spreading: one of them is hiding from the user and the other one requires the help of a cybercriminal in order to infect the target.

But the investment made to control these viruses is still not sufficient. Much more investment is needed in information security. There is no consensus in criminal law for cybercrime or cyberterrorism, which increases substantially every day. There should be a universal law to punish criminals or similar laws in each country because this kind of crimes can be transversal, for example, something can be done from a computer in Russia and commit crime in Angola, as it is not easy to detect. Crimes of this kind involve a lot of technology to uncover the criminal.

For all this, it is important to address the different operating systems, to present their strengths and weaknesses and find out which one is the most susceptible to virtual plagues and which one presents greater security against these viruses.

Mobile Operating Systems

Windows Phone 7

Windows Phone is a mobile operating system and the replacement successor to Windows Mobile. MS-Windows Mobile is distributed in cell phones of the main companies in the world; the only exception is Nokia, which uses Symbian in its phones. According to Tumejormovil (2019): "The Windows Phone operating systems, currently Windows 10 Mobile, are owned by Microsoft and are designed to provide the best possible performance for smartphones and tablets. It is closed-source and its kernel are Windows NT".

However, Windows Phone is one of the latest mobile operating systems designed by Microsoft. Built as a large-scale project from the point of view of information security, phones of this operating system have many download limitations in the Marketplace, which reduces the risk of having viruses.

In Sandeep, Chollie and Bandi's article (2012, p. 1575), it is stated that:

> The Windows phone application was designed from scratch and its main priority is security. Windows has added security features for Windows Phone applications. The Windows Phone security model was designed to protect the confidentiality, integrity and availability of information and communications.

The Windows Phone operating system has very simple graphics, but its programming language is not very well known, which prevents hackers from developing malicious software for mobile devices.

Figure 2. Cell phone with Windows Phone 8.1 Mobile Operating System

Note: Source: Buld (2014).

According to Table 1, the virtual plague that generally attacks Windows Mobile is claimed to be Crossover, a type of conceptual virus. This virus removes the "My Documents" directory and self-replicates each time the phone is rebooted.

Windows Mobile is considered to be very vulnerable to this destructive virus. However, the Windows Phone platform is more resistant to the virus, according to Altermann (2013):

> Windows Phone devices are among the safest so far. Since they do not run any files that are not linked to the Marketplace, no viruses developed by the platform have yet been discovered.
>
> The fact that it is a low-selling system also contributes to the fact that not many people are concerned about creating viruses for this platform. But that does not mean they should not pay the same attention as with any other platform.

Nevertheless, it is fair to say that Windows Phone is more resistant than other operating systems, as Sandeep, Cholli and Bandi (2012, p. 1575) state: "Windows Phone 7 is an operating system that brings together a large number of encryption methods including AES, SHA1 and SHAA256. Windows Phone 7 has the security model, which is key to protect the confidentiality, integrity, availability of information and interactions.

Cryptography is also called coded writing, which allows you to write coded messages and decode or encode certain information. Private key, public key, database, and bank data are successful thanks to the fundamental techniques of cryptography and are considered the best forms of authentication. Nowadays it is known that, to ensure efficient security, cryptography is used, as it allows greater security by modifying the different access codes, preventing cybercriminals from discovering the password. For example, both our credit cards and Wi-Fi passwords are encrypted to ensure protection. According to Quissanga (2015, p.14) “Microsoft has invested a lot in safety in Windows Phone 7. For example, restricting access to the application store to prevent users from downloading programs from the market, since many applications are downloaded every day.” For this reason, Windows Phone is very safe from computer attacks. Because of this company's low virus rate, others should take a cue from Microsoft and opt for this security system.

Android 4.3.2

Android is a not so safe mobile operating system based on the Linux kernel and its open source allows more vulnerable to computer attacks. According to Munhoz (2017) "A new virus for Android has emerged now and may be the bane of many people, as malware is downloaded automatically, including paid applications and games".

However, as shown in Table 1, the system is infected by 6 types of viruses. According to Tumejormovil (2019): “In fact, according to studies from 2017, 67.1% of mobile phones worldwide have Android and, specifically in Spain, 90%, which shows that it is a good operating system and could be the best on the market.” The Android operating system is also vulnerable to virtual plague attacks. In the statistics we can see that it is the most prevalent phone on the market, but it has weaknesses in terms of theft by hackers and crackers. The user's ability to use software outside the store allows malware to infect the device. The ease of transferring programs and applications in

addition to the system's unprotected Internet connection leads to contamination of the device.

According to Lima (2003), we can see:

> "Among the five main operating systems available on the market (Android, iOS, Windows Phone, Blackberry OS, Symbian), Windows Phone 8 is considered one of the safest. While 1 in 10 Android applications has malicious content, viruses are very rare in Windows."

However, Lima says the reason for this is that Windows Phone's security system is not vulnerable, while Android is susceptible to cyber-attacks, since its application store contains many suspicious programs that allow contamination of mobile devices. For example, there is an option to enable unknown sources which allows the installation of off-market software or applications.

iPhone 3.1.2

iPhone is a mobile device from Apple, launched on June 29th, 2007. It was one of the main events in the history of mobile telephony. Thousands of people lined up at Apple stores before its launch. About three and a half million iPhones were sold in the United States in the first six months since its launch. According to Tumejormovil (2019): "The IOS, formerly called the iPhone OS, is the second operating system with most smartphones in the world. Unlike Android, it is closed source and is made by Apple's operating kernel, MAC OS, [...]".

As far as operating system security is concerned, Mac OS X is infected with a Trojan virus. One of the main characteristics of this virus is its fast capacity, and that they must spread through user interaction. It often hides in files and when the user runs them, the system sends instructions to the server. According to Power (2018): "First Worm written in C by ikee for iPhone This worm exploits the fact that most jailbroken iPhone/iPod touch users install SSH and also neglect to change the password for root / mobile (which is "alpine" by default)."

The user logs in without even realizing it, sometimes entering his or her credentials or password without knowing that the instructions are not authentic, a feature that makes the virus so dangerous as well as efficient.

The Apple operating system is not perfect, it is also vulnerable to viruses. The social network Reddit, according to Souza (2014) "[...] discovered a new malware called Unflod Baby Panda, the virus affects all devices with jailbreak and is programmed to steal Apple IDs from infected devices by sending these credentials to their creators". It should be noted that the viruses affecting the iPhone are not well known, just as some publications claim that it is less prone to attacks on Android operating system technology because it is less in demand. As far as security is concerned, there is clear evidence on how the Internet is one of the fastest ways of spreading computer viruses. There are some palliative measures to prevent viruses from infecting certain mobile devices but saying that a certain operating system is immune to computer attacks would not be entirely correct as new computer viruses emerge every day. Technology develops as cybercrime evolves. The policy was: restrict your application store to prevent other unauthorized sources from accessing it, preventing any possible transmission of malware.

According to Lima (2013):

> We also know that this virus/operating system relationship is directly proportional to its popularity and the number of active users. Therefore, the

> more popular Windows Phone is, the more likely it is that more viruses and malware will emerge, but that does not mean that their vulnerabilities will necessarily increase.

However, it is impossible to say that we are totally safe when we are connected to the Internet, that is to say, no matter how safe we think we are, we can suddenly be surprised by a technology that can alter our security system by 90° or 100°.

The vulnerability of the iPhone operating system is still addressed as seen by Pandya and Stamp (2010, p. 84):

> Of course, iPhone is a vulnerable device with multiple security holes. The security philosophy of the iPhone itself has a significant flaw. Apple's approach to making the iPhone a secure device was to reduce the "intensity of the device's attack" or the "exposure of the device to vulnerabilities". Apple only allowed write access to one sandbox area in the file system and the unauthorized installation of third-party applications.

Mobile companies have to invest a lot in information security to make their devices more reliable, because nowadays the phone has become quite relevant in our daily life, we store a lot of information that must be protected.

> In case Apple was feeling left out, the first iOS malware for devices without jailbroken arrived in 2015. YiSpecter basically created a backdoor on compromised devices that allowed intruders to install and uninstall applications, download files and display ads, among other things. (Power, 2018).

Apple has a philosophy in its mobile devices that prevents the transfer of information via Bluetooth and it is safe to say that this measure prevented some transmission of computer viruses to other devices. Transmission via Bluetooth is the most common of all forms.

However, when a mobile device prototype is designed or developed, we always think about how it will look from a security point of view, and we never thought that this technology or system could resist several cyber-attacks, like Apple, surprisingly hackers were ready to break into the security system and spread insecurity to the consumers.

Symbian^3

The companies using this system are: Nokia, Sony Ericsson, Panasonic, Siemens and Samsung. Symbian is very vulnerable to virus attacks and is considered the most popular and destructive virus in history. The famous Trojan horse, just like the worm, originated the virtual plague cabir.A, the first mobile virus. According to Martinelli (2008, p. 88): "Cabir was written in the C++ language, originally to infect mobile systems based on the Symbian 60 series. This virus used exclusively Bluetooth technology to spread among cell phones". The C programming language is the most popular, says Olhar Digital (2013), "The C language continues to be the most used language in the world according to a new report from Tiobe Software. By conquering 18.15% of programmers, C expanded its lead over Java, an option for 16.5% of professionals". The C++ language integrates most of it, allowing more developers to create computer viruses to infect the Symbian operating system. However, if there are more developers, it is also possible to have more amateur language creators, just as if there is a large representation of cell phones in the market, this translates into a greater number of possible virus targets. Nowadays, this operating system is in decline, as the international market is conquered

by the two major mobile technology companies, Apple and Samsung, which have the iOS and Android operating systems respectively. Both are the most reliable operating systems on the market.

Results and Discussion

Operating systems have their own graphics, their structure is designed according to their developer but including all universal standards, and each system has its own prototype. These features can make them strong or weak to computer attacks. An example is the Symbin operating system. Symbin has a similar feature according to the analysis. We can see that the systems are created with a well-known and easy to develop programming language, and they allowed a greater programming of computer viruses in the market. The ease of installing software or applications outside the mobile device store, which primarily carry computer viruses, is considered a vulnerability as it damages the device's boot system.

However, unlike the Windows Phone operating system, Symbin has systems with a strong structure, which does not allow downloads outside the store, thus preventing malicious software from being installed. This feature makes it very safe because it does not allow the transmission of viruses easily and does not allow developers to program viruses since they do not know their programming language, because contamination only occurs when it is the same source code or kernel. The Windows Phone 7 operating system uses the system's cryptographic protection methods. This feature prevents many computer attacks on the operating system.

Operating system viruses are not as well known, but we cannot assert that they are not at risk, they are also vulnerable to the Ikee virus. iPhone is not as vulnerable as the Symbian and Android operating systems. However, it is worth mentioning that Apple's iPhone operating system has a feature that prevents programs or some devices from affecting the system. Bluetooth is known to be the fastest way for mobile phones to transmit computer viruses and Apple has restricted the transfer of applications to other devices via Bluetooth. Its programming language does not have many developers. These characteristics make it less vulnerable to computer viruses.

Conclusion

As we learn more about mobile operating systems, we can conclude that: computer virus infections in cell phones have to do with the operating system, its kernel, the technology of the phone and the programming language. Martinelli (2008, p. 32) states "Every operating system has a kernel that delimits its functions. This is one of the reasons why a cell phone virus does not spread easily to other devices, due to the different versions and internal structure of the various mobile operating systems.

It is known that Symbian is the operating system most likely to be contaminated by computer viruses, since it is made of a C++ programming language that comes from the C language, one of the most popular languages, which also has many developers.

Android is a less reliable mobile operating system based on the Linux kernel, and its open source feature allows for a larger number of developers of the technology. Finally, we

conclude that among mobile phone operating systems such as Android, iPhone, Symbian and Windows Phone, the latter is the safest from the virtual attack security point of view, because it is known that Microsoft has invested heavily in its security system, restricting access to the app store to prevent the users from downloading programs off the market, since every day several malicious applications are added in there.

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METHODOLOGICAL GUIDE FOR THE IMPLEMENTATION OF DIGITAL TELEVISION IN BOLIVIA

Alex Fernando Mejia Noe
XTOTV Link (Bolivia)
alexmejian@gmail.com
Jon Arambarri
European University of the Atlantic (Spain)
jon.arambarri@uneatlantico.es

Abstract. The migration to Digital Terrestrial Television or Open Digital Television, with the ISDB-Tb standard, is a transition that involves several changes and heavy investments in the transmission and development of content by television companies and also means a change for users, since they must also adapt their televisions to have access to the new signal with more audio and video quality. It is necessary to study the regulations, to point out the essential requirements for the different phases of implementation, in joint work with companies and specialized professionals, with international recognized good practices in project management. In Bolivia, Telecommunications Law 164 was amended on August 31, 2017 to provide a conglomerate of resolutions and decrees that promote the digital migration of the different analogue television channels and subsequently a series of provisions were established for operating licensing for 15 more years for each current operator, for free. The channels companies have a new digital blackout period for the 3 main cities until November 2021 and others with less coverage until November 2025. The guide resulting from this work has already been applied and its contribution to all other channels is expected.

Keywords: Digital Terrestrial Television, ISDB-Tb, PMBOK and best practices.

GUÍA METODOLÓGICA PARA LA IMPLEMENTACIÓN DE TELEVISIÓN DIGITAL EN BOLIVIA

Resumen. La migración a la Televisión Digital Terrestre o Televisión Digital Abierta, con el estándar ISDB-Tb, es una transición que supone cambios severos y grandes inversiones en la transmisión y elaboración de contenidos por parte de las empresas televisivas y también significa un cambio para la audiencia, ya que también deben adecuar sus televisores para tener acceso a la nueva señal con más calidad de audio y video. Por ello, se hace necesaria una guía metodológica para estudiar la normativa, apuntar los

requisitos esenciales para las distintas fases de implementación, en trabajar mancomunadamente con empresas y profesionales especializados, con buenas prácticas en dirección de proyectos reconocidas a nivel internacional. En Bolivia, la ley de Telecomunicaciones 164 se modificó el 31 de agosto de 2017 para disponer un conglomerado de resoluciones y decretos que promueven la migración digital de los distintos canales de televisión analógicos y posteriormente se estableció una serie de disposiciones para la habilitación de licencias de funcionamiento por 15 años más de forma gratuita para los actuales operadores. Los canales tienen un nuevo plazo de apagón digital para las 3 ciudades principales hasta noviembre de 2021 y otros de menor cobertura hasta noviembre de 2025. La guía resultante de este trabajo, se ha aplicado ya y se espera sea aporte para todos los demás 600 canales que aún no han migrado.

Palabras clave: Televisión Digital Abierta, ISDB-Tb, PMBOK y buenas prácticas.

Introduction

How to address a new important situation in the organization? Where to start? What data and information is available? How much should be invested? These are questions that many managers of television channels are considering in the face of the technological leap towards the new digital television in high definition. These questions are supported (Campero, 2016, p. 62):

> The use of telecommunications and ICT in Bolivia has important scientific, social and cultural implications. As in the rest of the world, telecommunications are one of the fundamental pillars of social and economic development, since they are the tool of information flow and the mechanism used to acquire and apply knowledge.

This article tries to reflect good practices in the development of technological projects. Faced with the imminent change from standard television to the new digital television, it remains only to face it in the best possible way, the opposite would be to disappear from the field. Therefore, it is proposed to develop a methodological guide to enable a successful implementation in a real television network using what has already been advanced in terms of projects by the PMI and its PMBOK guide.

Is it possible to carry out the implementation of digital television based on the best practices of project management and gathering experiences from the region?

The scope of this project is circumscribed by the decrees of the executive body and official resolutions of the Authority for Regulation and Control of Telecommunications and Transportation ATT, of the Bolivian government, concerning the adoption of digital television throughout the territory, which are 10 documents.

Description of the problem

Bolivian Television

Bolivian television enters the air on August 30, 1969 with the state-owned channel 7 from the host city of La Paz government with black and white broadcasts, managed during the government of Gen. René Barrientos, but inaugurated in the short presidency of Luis Adolfo Siles Salinas, in a troubled scenario, television was an instrument of social distraction. Later on, the first network of the Government, advances with the Col. Hugo Banzer, a de facto military president according to Erick Butrón's research. "In 1977, the regime installed the Microwave Trunk Network in La Paz, Oruro, Cochabamba and Santa Cruz." (Butrón, 2018, p. 31). Under the same presidential mandate, state universities are

intervened, but the same Law mandates the creation of the Educational Television System of the Bolivian University and thus establishes the first university channel, in the south of the country, with channel 8 of the Juan Misael Saracho Autonomous University of the city of Tarija in a polychrome signal under the NTSC standard.

The article *Public Television in Latin America: its transition to the digital age* is published in the Mexican Journal of Political and Social Sciences (Toussaint, 2017).

> Where television was managed by governments, - authoritarian regimes- the diversity associated with democracy did not occur. Nor was there -as in Europe- the possibility that an institutional small screen was autonomous and managed separately from power. The countries of Central America and Mexico opted for the commercial scheme and, consequently, the public television service was relegated to the background. In South America, stories differ. In the 1950s and 1960s, military dictatorships and authoritarian governments proliferated and under their aegis, television began. This happened in Brazil, in Venezuela, in Bolivia, in Argentina, in Chile. (p. 226).

A few years later, Butrón (2018, p. 33) writes: "Without consultations, without reflections, without a relevant analysis, only with the dictator's order is it decided that channel 7 begins its color broadcasts under the NTSC standard at the end of 1980." In a 1984 complicated scenario, during the presidency of Dr. Hernán Siles Suazo, according to the investigations of the author Butrón (2018) in his book *Digital Television in Bolivia Challenges for the newcomer*, private channels make the radio spectrum overflow and the first regulations will arrive in 1986.

In 2000, Bolivia had 121 channels in the 9 department capitals and 63 in its provinces. In 2012, the number of channels reaches 577 and in the last publication of the ATT they appear in total 627. On August 30, 2019, Bolivian television turned 50 years old and is the youngest in South America.

State of technology in the country and globally

To describe the state of technology in Bolivia, the data of the 2018 Report of the Global Innovation Index are presented, (Cornell University, 2018) Bolivia occupies the general position No. 117 of 126 countries.

The annualized report provides important data on Information and Communication Technologies indicators, which will be compared with countries in the region and globally with the leaders:

Table 1
Bolivia and region indicators

	Case		South America Region					
POSITION 2018	117		80		64		47	
Country	**BOLIVIA**		ARGENTINA		BRAZIL		CHILE	
GII Indicator	Value	Position	Value	Position	Value	Position	Value	Position
ICTs	46.2	88.0	65.5	47.0	66.4	46.0	68.5	40.0
ICT Access	44.2	95.0	68.7	58.0	62.5	69.0	67.9	60.0
ICT use	33.8	88.0	59.6	47.0	56.9	52.0	53.9	59.0
Online government service	49.3	85.0	71.0	43.0	73.2	37.0	77.5	28.0

Electronic participation	57.6	70.0	62.7	59.0	72.9	37.0	74.6	32.0

Note: Source: The Global Innovation Index 2018

Table 2
Bolivia indicators and leaders

	Case		Global Leaders					
POSITION 2018	117		1		2		3	
Country	**BOLIVIA**		SWITZERLAND		HOLLAND		SWEDEN	
GII Indicator	Value	Position	Value	Position	Value	Position	Value	Position
ICTs	46.2	88.0	73.8	30.0	89.2	3.0	83.4	15.0
ICT Access	44.2	95.0	88.5	7.0	86.5	10.0	85.5	13.0
ICT use	33.8	88.0	88.8	2.0	82.8	9.0	84.0	6.0
Online government service	49.3	85.0	60.1	64.0	92.8	9.0	87.7	15.0
Electronic participation	57.6	70.0	57.6	70.0	94.9	5.0	76.3	27.0

Note: Source: The Global Innovation Index 2018

The contrast of the indices of Bolivia with respect to the countries of the region and more substantial differences with the global leaders is evident, however, digital television is an impulse towards the advancement of the use of new technologies.

Adoption of digital television in Bolivia

Bolivia's path to digital television was formalized in November 2007 with the First Bolivian day "Towards Digital Terrestrial TV", organized by the former SITEL or Superintendency of Telecommunications -today ATT- the Telecommunications and Transportation Regulation and Control Authority. On July 20, 2010, in the government of Evo Morales Ayma, Bolivia signed a memorandum of understanding with Japan, a country that is obliged to donate a test transmission equipment and provide technical assistance, signed by the Secretary of State for Internal Affairs and Communications from Japan, Masamitsu Naito.

As a result of the technical tests carried out in 2010 by the inter-institutional commission made up of the Vice Ministry of Telecommunications, the Telecommunications and Transportation Regularization Authority, Bolivia TV, the Greater University de San Andrés and the Bolivian Catholic University, the implementation of the ISDB-T standard was decided.

The single article of Supreme Decree 0819 of March 2011 states: "The ISDB-T (Integrated Services Digital Broadcasting Terrestrial) standard is adopted, with H.264, MPEG-4 coding with the technological improvements that were available at the time of its implementation, as a system for transmission and reception of Digital Terrestrial Television in the Plurinational State of Bolivia."

The ISDB-T standard was imposed in the South American region, the ATSC[1], North American and Chinese DTMB[2] standards have no presence and the European, DVB-T[3] only in Colombia, Suriname and French Guiana.

ISDB-Tb implementation in the region

[1]Advanced Television Systems Committee
[2] Digital Terrestrial Multimedia Broadcast
[3] Digital Video Broadcasting Terrestrial

The publication of the National Television Council of Chile by the Uruguayan Gustavo Gómez of the Latin American Observatory for Regulation, Media and Convergence gives an account of the experiences of Latin American countries, in Transition to Digital TV and diversity in Latin America. (Gómez, 2018) describes in a very complete way the experience in these countries:

Argentina

Transition Objectives

The deployment of digital television in Argentina is a unique experience, while full of contradictions. In 1998, it was the first country in the region to choose a standard, the US ATSC standard. However, it was never applied. With the economic and political crisis of 2001, DTT-related projects remained in the background until Cristina Fernández's government -in August 2009- decided to adopt the Japanese-Brazilian standard (ISDB-T). From that moment on, a strong campaign was developed regarding digital television, which included the installation of antennas in many cities in the country, the free delivery of Set Top Boxes to adapt analog TVs to digital reception, the creation of a fund for content production and a program to finance the purchase of televisions with digital tuner. As indicated, almost simultaneously with the adoption of the standard, a new regulation for the audiovisual sector was approved (Law 26522/09) that does not comprehensively address the problem of convergence and the transition to the digital environment.

The set of Government policies aimed at promoting digital television found a limit on the high penetration of cable television (approx. 80% of households). The offer of cable systems (60 or more channels, which include sports, movies and series) are, for now, more attractive than digital television, even if it is free, than the offer 16 channels nationwide and 1 or 2 local channels depending on the province (except in the City of Buenos Aires, where the grid is wider since it has 11 local signs). To this, we can add the weakness of the national government in the communication of the plan. The official start of digital television in Argentina took place on September 1, with the publication of decree 1148/09 in the Official Gazette. The Article 1 explained social (inclusion, diversity, industry promotion, etc.) and technological objectives (such as less use of the spectrum, better image and sound quality) to be achieved with the development of DTT. The Article 2 diagrammed institutional structure for the deployment of DTT that fell to the Advisory Council of the Argentine System of Digital Terrestrial Television chaired by the Minister of Federal Planning. Although it also has representatives from eight other ministries and the Headquarters of the Cabinet of Ministers, being under the leadership of the Ministry of Planning, the policy for DTT has been guided by a more industrial than cultural bias. The participation of the industrial sector, broadcasters, workers' associations, the scientific community and consumer associations were reserved for a Consulting Forum that operates under the Council's orbit.

On March 15, 2010, the Government, through decree 364/10, declared the National Terrestrial Digital Television Platform of public interest and designated the Argentine Company of Soluciones Satelitales SA (ARSAT) as responsible for guaranteeing transportation services of signals and their corresponding links for the development, implementation and operation of the infrastructure. A few months later, on July 19, 2010, decree 1010/10 was passed, a key step for the transmission of signals, since it empowered State Radio and Television (RTA) to carry out experimental transmissions of digital TV with signals own or third parties -in the latter case- provided they were assigned free of charge. The first Argentine digital station was state-owned Channel 7.

This decree also enabled private signals to be uploaded to the digital platform on an experimental basis. Although this allowed to expand the offer of digital signals, open channels were created without making the corresponding contest that marks the Law of Audiovisual Communication Services. To this fact, it should be added that the signals that were added to the state platform are mostly of businessmen close to the previous government.

At the end of 2010, the Federal Audiovisual Communication Services Authority (AFSCA) authorized private channels 13, 11, 9 and 2 of the City of Buenos Aires to use UHF channels 33, 34, 35 and 36 respectively for experimental DTT test transmissions.

Technical standards

The decision about the standard for digital television in Argentina involved a complex process with multiple comings and goings, which included decisions made by governments from 1998 onwards, each of which changed the direction of the previous one. The deliberations ended in 2009, with the adoption of the Japanese-Brazilian standard STVDTB. Although the particular thing is that this path did not contemplate democratic debates, but strong business lobbies and defenses of corporate interests. This began with the decision of former President Carlos Menem to adopt the ATSC standard in 1998, when Argentina became the fifth country after the United States, Canada, Taiwan and South Korea, to choose that pattern.

In 2006 the Ministry of Communications created the Commission for Studies and Analysis of Digital Television Systems, made up of representatives of communication companies, private television and related associations, and the Government. In its final report, the proposals of each model were detailed, except for the ISBD-T, which was only mentioned in the introduction as a more existing standard in the market. Despite this, the changes in political dynamics (including the confrontation with the Clarín Group), together with the offers that the representatives of the Japanese norm and the government of that country made, resulted in the decision to adopt STVD-TB, the Brazilian variant of the ISDB-T standard.

Deadlines and stages of the digital transition

The digital ignition was carried out by the State-owned Channel 7, on April 21, 2010. Since then, stations and antennas have been added throughout the country. The distribution of digital television has been left mainly to the state-owned company ARSAT, although private broadcasters are authorized to install their own transmitters. At the moment, the state system distributes 41 signals (16 nationwide), although not all are available at the same time. For example, 25 signals are received in the City of Buenos Aires. The DTT has 86 antennas installed in different provinces of the country with a range of 40 KM, which implies a potential coverage of 85% of the population by land and 100% satellite coverage. The system reaches all provinces, although in several of them with a single antenna in the capital. It highlights the deployment in the province of Buenos Aires (34 antennas), Santa Cruz (8 antennas), Córdoba and Santa Fe (5 antennas), and Mendoza (4 antennas).

Uruguay

The regulatory framework for the transition to open digital TV is developed from Decree 73/012 of March 2012, which identifies the UHF band for the deployment of DTT channels from 20 to 41 (512-638), next 10 TV channels for subscribers (42 to 51 or 638-698 MHz) and 52 to 69 for IV Generation mobile services (698-806 MHz). Also, in that Decree the cleanliness of the 700 MHz Band (Digital Dividend) is determined and the

Communications Services Regulatory Unit -URSEC- is entrusted with the preparation and approval of schedules for the deployment of said services in said band.

In the same year, by decrees 153 and 437 of 2012, the Executive Branch plans DTT services for the entire country distinguishing in the Metropolitan Area of Montevideo (AMM) and the interior of the country, channeling them, dividing the spectrum and the channels to be assigned for commercial, public services (within them, 2 channels were directly awarded for National Television of Uruguay (TNU) and one for the Ministry of Education and Culture (MEC), for use in timeshare- as well as for community TV.

The bases for the new DTT licensing models are generated, foreseeing the entry of new operators, both for Montevideo and for the interior; the specifications and conditions for the procedure for assigning new licenses are determined, both for incoming and existing ones; the deadlines for the procedures and also the date of the analog blackout are established (decree 153, art. 18) that was initially determined for November 21, 2015.

It is noteworthy that the new regulations, endorsed later with the approval of the Audiovisual Communication Services Law, significantly changed the conditions under which licenses or authorizations were previously granted, since it enshrines a competitive procedure for new entrants and, in turn, it sets deadlines for licenses (so far all radio and TV authorizations were precarious and revocable, without deadline) with subsequent procedures for possible renewal. It also enshrines a new service that until now did not exist that is the network operator, in this case the telecommunications company ANTEL and the public television station (TNU) that can carry signals from television dealers, considerably reducing the costs of digital broadcasting.

Technical standards

Uruguay was one of the pioneer countries in Latin America in the election of the DTT standard through the Executive Power resolution No. 315/007 of August 2007, where the European standard DBV-T (and the DBV is chosen) -H for mobile terminals).

However, at the end of 2010 the Executive Branch changes the standard to the Japanese-Brazilian ISDB-Tb standard. President Mujica said the change was due to geopolitical motivations, to align Uruguay with the standard adopted by neighboring countries, especially Brazil. Critics objected that this change was not convenient: the European standard had already been selected and it was said that it would have technical advantages over the ISDB-T and that the funds provided by Europe, as a result of that decision, had already been delivered and were being executed.

Deadlines and stages of the digital transition

Digital television began with the authorization of the experimental digital transmissions of the public broadcaster (National Television of Uruguay - TNU) in August 2012, both in Montevideo and in the City of Colonia, in the southwest of the country with equipment donated by Japan.

The operators of digital TV services (incumbent or incoming) had a maximum term for "digital ignition", set on April 30, 2016 for those installed in the capital and until April 30, 2017 for those located in the rest from the country. The successful bidders of the new authorizations granted by Uruguay should have issued a year after the permission had been delivered, but despite two postponements granted by the Ministry of reference, they never initiated their transmissions and returned their concessions.

The analog blackout was initially determined for November 21, 2015, taking into account the possible advances in digital migration throughout the national territory and to accompany the other countries of the region with the possibility of its revision according to the evaluation of these parameters.

Both countries were visited and the experiences of companies and professionals directly involved in the implementation of television channels were collected, collecting in different interviews good practices, successes and delays in deciding and executing.

The PMBOK guide and project management

There are various management frameworks for IT projects. Dutch analyst Van Haren describes 22 international frameworks in his widely used Frameworks for IT Management book, in the Project Management category, where the focus is on the project, not specifically for IT, highlights MSP, PRINCE2, PMBOK and IPMA Competence Baseline. PMBOK emerges as the best option by owning an entire institution recognized worldwide with many years of experience.

PMBOK appears as the corollary of good practices on which the digital television implementation guide is supported. As rescued from the Spanish Business School website (EAE Business School, 2017), PMBOK stands for Project Management Body of Knowledge, and the realization of its guide is the responsibility of the Project Management Institute (PMI).

It is considered as the manual of good practices, allusions and referrals to the PMBOK project guide are as universal as necessary in the field of project management and management, PMBOK is the convergence of two fundamental elements: macroprocesses, which group all the processes and activities involved in standardized projects, and areas of knowledge, that is, those key aspects whose consideration must intervene in each of the established macroprocesses.

The PMBOK guide establishes a criterion of good practices related to the management, administration and project management through the implementation of techniques and tools that allow the identification of a set of 49 processes, distributed in turn in 5 general macro processes.

The macroprocesses of the PMBOK guide

The PMBOK guide identifies 5 macroprocesses that include the 49 standard processes involved in any project:

1. Start: consisting of 2 minor processes, whose purpose is to define a new project or a new phase of its execution, and obtain the necessary authorization to carry it out.
2. Planning: This macroprocess includes 24 processes aimed at the realization and establishment of objectives, and the design of the most appropriate strategies to achieve its achievement.
3. Execution: includes 10 processes involved in the correct performance, according to the strategy adopted, of the activities defined in the project to achieve the established goals.
4. Control and monitoring: twelve processes are part of this macroprocess, all of them related to the supervision and evaluation of project performance.

5. Closing: last macroprocess, formed by two minor processes, which closes the project in its entirety or some phase of it, referring to the degree of acceptance and satisfaction with the result obtained.

Description of the proposed solution

The project is organized in four phases.

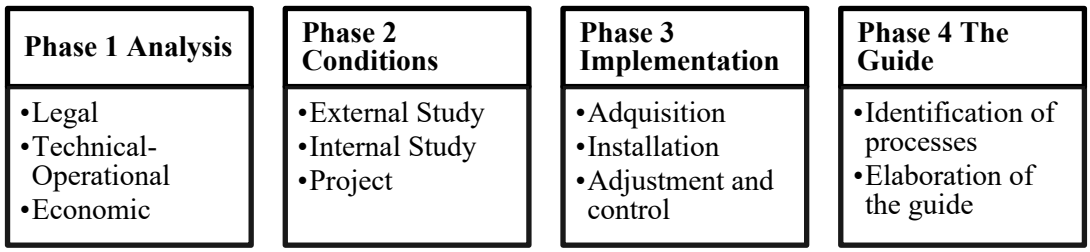

Figure 2. Proposed solution

Phase 1: of analysis

Legal analysis

Taking into account all the regulations indicated in previous chapters, there are legal, technical and economic requirements.

The requirements obtained refer to an existing channel, with the expiration date of its current license as of November 2019, extendable for 15 years without a free tender.

That will begin its digital broadcast in November 2020, one year before the date of analog blackout in the City of La Paz.

On the other hand, the channel is part of the Television Broadcasting Services Operator modality and must implement the entire technological structure to transmit and host, in the future, signal providers.

The television channel must have up to date all its formal registration and trade obligations, taxes, tax solvency and registration before the ATT, with that support, the regulations were analyzed and there are 11[4] **legal** requirements of commercial television:

a) Note or memorial specifying the territorial scope of the proposed license.
b) Name, address, telephone number (s), email and, if applicable, fax, postal box of the bidder.
c) Documents certifying the nature of the applicant.
d) In the case of natural persons, identity card.
e) Photocopy of the Identity Document of the Legal Representative or the designated Holder.
f) Certificate of Fiscal Solvency granted by the State Comptroller General, if applicable.
g) Special Power that proves the legal representative's personality that specifies the powers of nomination and to carry out procedures before the ATT.
h) Photocopy of the Tax Identification Number (TIN).

[4] The Digital Platform called OTTO SYSTEM GRANTING IN TELECOMMUNICATIONS - OTTO, in compliance with the provisions of operative paragraph eight of the Regulatory Administrative Resolution ATT-DJ-RAR-TL LP 919/2018 of December 10, 2018, for the digital management of the granting process is where a television channel must enter the information of the official requirements.

i) Payroll and photocopies or identity documents of all board members or board of directors or partners of legal persons.
j) Affidavit of natural or legal persons, all board members or board of directors that are not included within the prohibitions of General Telecommunications Law No. 164.
k) Certificate of judicial criminal record of the owner or legal representative issued by the competent authority.

Technical analysis – operational

Within the proposed solution, this subchapter is responsible for observing all technical requirements.

However, it should be noted that in order to ensure the high definition quality line it is also important to look towards the television channel's own infrastructure both in the studio and on the transmission site. On the other hand, the production and/or programming line must also carry out its work cycle in the format for digital television.

As a summary, the following instructions and their operational parameters are available.

Table 4.

Technical-operational requirements

Transmission Equipment	**of Description**	**Parameters**
Transmission System	Main and backup transmitter, wiring, Multiplexer, One-Seg, EPG electronic programming guide, EWBS early warning system and GINGA Interactivity.	Cover service area in 3 years. Type A 22 Km, 13 dBK at Field strength, protected contour 60 dBμV/m and interfering contour 41 dBμV/m.
Monitoring System	Monitoring of your signal and that of the suppliers.	Transfer rate, resolution, SEE, MER and others.
Radiant System	Arrangement of antennas.	Tower height 75 m.
Repeater System Link	Gap Filler in SFN.	Type B 13 Km and Type C 9 Km.
System Electrical	Fiber optic or microwave.	Change Encoder - Decoder HD.
System Backup	Generator or Second connection.	Redundancy.
Ground Systems	2 independents	According to Bolivian Standard NB-148009 IBNORCA
Model of planning	1 Full HD Digital Channel p. 1 Full HD Digital Channel and + 1 HD Digital Channel. 1 HD Digital Channel + 1 HD Digital Channel. 1 HD Digital Channel + 2 SD Digital Channels.	1920x1080p, 15 Mbps 1920x1080e, 10 Mbps 1280x720p, 6 Mbps 720x480p, 3 Mbps

4 SD Digital Channels.

In the resolution of the ATT-DJ-RAR-TL LP 584/2017, the Technical Instruction for the operation and operation of Digital Terrestrial Television broadcasting stations with ISDB-Tb technology is established.

The ATT, on the OTTO portal, requests the project itself and specifies the start date of operations on digital television, 13 being all technical requirements, supported by a report endorsed by an engineer of the field belonging to the Society of Engineers from Bolivia, with authorized signature:

a) Geographic coordinates of the stations and descriptive locations of said stations. DATA
b) Elevation of transmission sites (m.a.s.l.). DATA
c) Frequencies to be renewed. DATA
d) Description of emissions according to nomenclature of the Radiocommunication Sector of the International Telecommunications Union - ITU-R DATA
e) Nominal power and Calculation of Effective Radiated Power. DATA
f) Type of tower, total height of the infrastructure and location height of the antennas in the infrastructure. DATA
g) Types of transmitting antennas and their irradiation diagrams. DATA
h) Type of electromagnetic polarization of the radio link, if applicable. DATA
i) Protection system (lightning rod - ground - beacon). DATA
j) Coverage area, attaching corresponding technical study. DATA
k) Study of interference in adjacent channel and co-channel. DATA
l) Technical Study on exposure limits to radiofrequency electromagnetic fields. Data for the television broadcasting service with analogue technology
m) Implementation schedule of the digital television network which will establish the start date of its digital broadcasts, which shall not exceed the date of the analogical blackout corresponding to its service area and group, in accordance with the provisions of the Digital Terrestrial Television Implementation Plan approved by Supreme Decree No. 3152 of April 19, 2017. DATA

Economic Analysis

This is the most delicate aspect in the political arena, since all television companies met and together with the Association of Broadcasters of Bolivia requested an extension of the analog blackout because they lacked the resources to implement digital television and therefore renew their licenses. The presidency extended the term in response to this request and watching over the population that for the most part does not have televisions or receivers to watch digital television.

The digital transition demands an investment in a new technological infrastructure, since all similar equipment is not useful for operating in the digital age. Each of the technical-operational requirements means the disbursement of money, and precisely in this analysis the participation of local and foreign companies was necessary to quote the transmission, coding, services and irradiating system phase. At the same time, the quotes had to be technically validated in terms of the operation requirements of each of the equipment and a specific service area. For this project, 3 main quotes were

obtained, where the technical, operational and service aspects of the company were reviewed.

The ATT requires that the requesting channel, in the first instance, must collect its Financial Obligations Form with the Income Unit dependent on the Financial Administrative Directorate, a document that will reflect whether or not the Operator has outstanding obligations, that is, when submitting physically each of the requirements described above, this Financial Obligations Form WITHOUT DEBTS[5] must be submitted.

Phase 2: Specification of Conditions

External studies

The channel internally provides companies specialized in the field, a list of minimum but complete requirements for the realization of quotes and simulations. Contact is made with leading Bolivian and foreign companies on the issue of digital transition.

Table 5.

Specification of conditions for companies

	ATT 584 DIGITALIZATION				
	TASKS and ACTIVITIES	STARTING DATE	EXPIRING DATE	% COMPLETED	NOTES
1	Separate adjacent stations	Date	Date	0%	2 Km with front and rear channels
2	Quality of service	Date	Date	0%	C. Protected 60 dBu V/m, Interfering C 41 dBu V/m
3	Coverage	Date	Date	0%	A: 22Km/75m, B: 13 Km/37m, C: 9Km/37m and D: 6Km/20m
4	Repeater stations GAP FILLER	Date	Date	0%	Submit registration to ATT
5	Early warning EWBS	Date	Date	0%	24 months from the granting of the qualifying title
6	Mobile signal ONE SEG	Date	Date	0%	Submit implementation schedule
7	Middleware GINGA	Date	Date	0%	24 months from the granting of the qualifying title
8	EPG Programming Guide	Date	Date	0%	At the time of airing

[5] Administrative Resolution of the ATT 919/2018 pag. 4/14

9	Backup power Syst.	Date	Date	0%	To avoid interruption of the service
10	Grounding Environment Syst.	Date	Date	0%	Independent
11	Grounding Antennas Syst.	Date	Date	50%	Independent update. Paint Tower
12	Main transmitter	Date	Date	0%	2.5 KW
13	Auxiliary transmitter	Date	Date	0%	1.3 KW
14	Monitoring Equipment	Date	Date	0%	Transf Rate, Resolution, BER, MER, etc.

The details of the transmission plant and the frequency of the channel enabled in the spectrum were also provided to perform the simulations to comply with the service area:

Table 6.

Parameters for business simulations

Information	**Broadcasting Plant**	**Studies**
Address	Av. Panoramica Nº 2 - Alpacoma Zone, Satellite City - El Alto City - Murillo Province – Department of La Paz.	Calle Guerrilleros Lanza, Passage 1445 Nº 1215 - Miraflores Zone City of La Paz - Murillo Province - Department of La Paz.
Coordinates	Latitude: S. 16 ° - 31 '- 38.20" Longitude: W. 68 ° - 8' - 44.10"	Latitude: S. 16 ° - 29 '- 47" Longitude: W. 68 ° - 7'- 22.10"
Elevation	4.066 m.a.s.l	3.615 m.a.s.l.
Operating frequency	548 to 554 MHz	21,225 GHz

The purpose of the data provided is to achieve the ideal coverage for the cities of La Paz, El Alto, Achocalla, Viacha, Palca, Mecapaca and Laja.

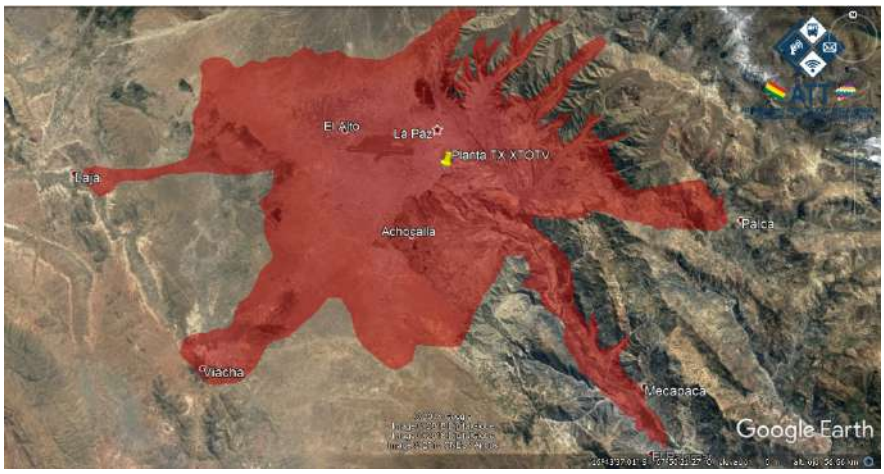

Figure 3. Service area for *La Paz*

Note: Source: Ministry of Public Works, Ministerial Resolution 227, Determination of service areas.

Internal studies

The channel required the production, press, programming and technical departments to study the adequacy of their processes and digital television equipment. The result is indicated in table 7, in which are the general components of a television studio.

Table 7

Channel study improvements

Equipment of Studies	Description
Set equipments	Cameras, lenses, cables, monitors
Master Control	Matrix 20x20,
Central Control	Recorder, PC VTR, Mixer, Console, mixer, converters, Character generators
Emission Control	Automator
Illumination System	Lights led
NLE Press Systems	4 HD equipments
NLE Production Systems	5 HD equipments
Electrical System	AC
Network System	Switcher and connection Cat 6
File System	NAS

In addition, adequacy tests were carried out every six months to refine both the processes and the use of new technological tools.

Project

With the complete picture, as regards all aspects of the standard, it was necessary to formalize a document with a project format, with clear objectives, goals, budget and schedule. It was submitted to the General Management and the National Directorate, the initial dispositions were approved and followed.

Content Project

1. General information
2. Background and description of the project
3. Scope of the project
4. High-level requirements
5. Objectives
6. Regulatory Framework

ANNEX SUMMARY D.S. N° 3152

DIGITAL TERRESTRIAL TELEVISION IMPLEMENTATION PLAN

8. Theoretical - technological framework
9. Methodology
10. Project proposal
11. Specifications for External Study
12. Time Scale Implementation
13. Conclusions and recommendations
14. Approval and authority to continue

The document would allow to take the case as a model for the start of a program of activities for the channel to digitalize its operations in the constitutional framework in the future determined by the terms of the ATT of other 4 channels in other cities of the country, that is to say Cochabamba, Oruro, Potosí and Sucre (capital of Bolivia).

Budget

The first budget in an approximate calculation of access to budgets in the region, that is to say in Ecuador and in the state channel Bolivia TV and another network that gave public information.

The initial calculation was close to $ 200,000 - US dollars, based on a transmitter of only 1.4 KW, since the simulations ensure the coverage of the service area. However, after the offers of the companies, the number of transmitters reached around $180,000 - US dollars, an amount that ignores the entire implementation of studies, civil works, infrastructure and various systems.

Phase 3: Implementation

The implementation phase requires obtaining a coherent study between the legal, technical and economic, but also that it was necessary to validate the experience of the company that would provide support throughout the process from the authorization of the ATT. In this way, meetings were held with different companies with the idea of minimizing risks and costs on the one hand and on the other to ensure emission quality.

In this pre-acquisition phase, the knowledge acquired in technical, strategic direction, the endorsement of experts in regulation, implementation, foreign trade, importation and attendance at events, seminars and companies specialized in ISDB-Tb was very valuable. In this sense, the decision was made to take the services of a foreign company with the experience of implementing more than 100 digital television channels in Uruguay and Argentina, which in the telecommunications market is known as an integrating company, that is, which offers individualized solutions to its customers with the support of a group of manufacturers and international support.

Acquisition

The simulation obtained from the specialist company in the figure is the one that validates the purchase of the transmission equipment. It covers the service area requested for La Paz.

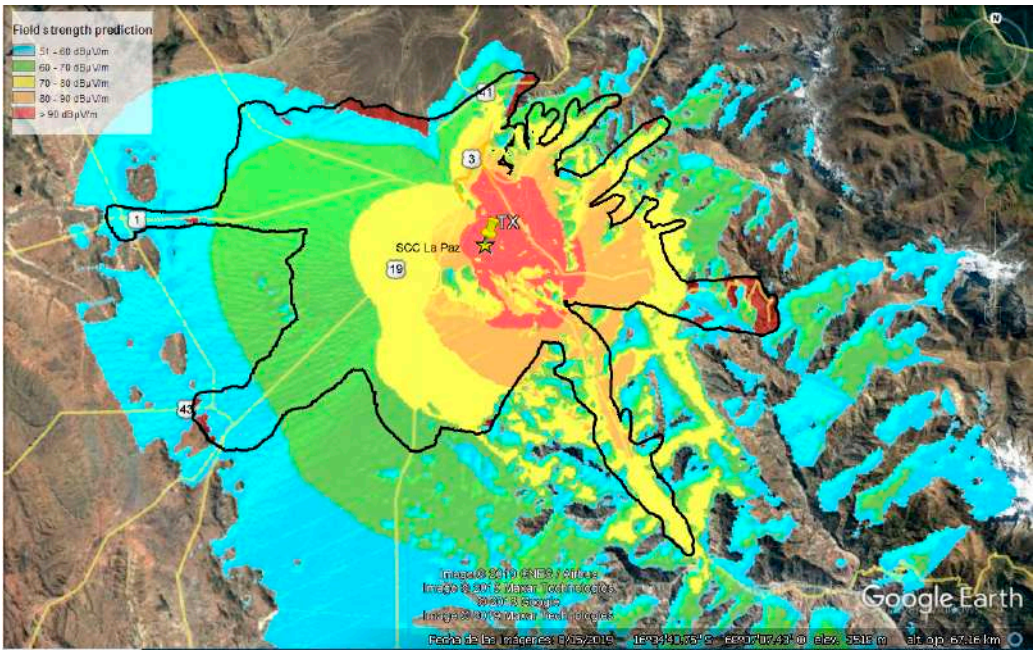

Figure 4. Simulation of the service area for La Paz

Note: Source: RFS company simulation for XTOTV

According to the studies carried out and with the simulation covering the La Paz service area, the list of items for transmission is as follows:

- Air-cooled 1.4 Kw transmitter
- Mask filter
- H.264 encoder

- Multiplexer
- EPG server
- Slot antenna
- GPS antenna
- Connection cable
- Switcher

In the list of items for the improvement of the transmission plant, it is required to acquire signal maintenance and distribution services:

- Independent earthing
- Redundant electrical system
- Signal monitoring system
- Transmission tower maintenance
- Study link and transmitter

Installation

Due to the new deadlines in the analogue blackout in Bolivia, the initially planned for 2019 moves to 2020, where the company selected by the channel will execute the installation and will do the initial tests of operation, measurement studies and training of technical personnel.

The installation will take place in November 2020, for this there are preconditions such as approval, process by which the ATT certifies that the equipment to be purchased possess all the technical characteristics established in the resolutions referring to the equipment. Other details are the purchase of the equipment, the transfer of equipment from bordering or transoceanic countries, the importation into the country, the concretion of the services of technicians that fix the antennas in a place, previously studied, of the tower.

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	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7
Notification by the ATT to begin the trasition							
Beginning transtition							
Start date of Emissions in Digital Format and completion of respective adjustements							

Figure 5. Installation schedule

Adjustments and Control

Adjustments and control have been permanent in the development of the phases of the proposed solution, in meetings held with both high level and middle level stakeholders.

Budget, risk and quality control adjustments were made in the case of equipment operating parameters and in simulations with different antenna brands and with different transmitter powers.

The implementation guide

In the case of a digital television implementation project in Bolivia, the 5 processes are based (Start, Planning, Execution, Control and Closing). In each of them, the processes that were experienced in the phases already completed are consolidated and the tasks in the closing phase are studied.

The proposed guide coincides with all the tasks and the flow described above and they are:

Start Process:

- The objectives of the project are defined.
- The main stakeholders are identified.
- The sponsor assigns the project manager.
- The start of the project is formally authorized.

Tasks:

- Select a project administrator.
- Know the culture of the organization.
- Know the existing processes and procedures and the historical information of other projects of the organization.
- Divide the project into phases.
- Understand the business case, that is, identify in broad strokes what needs to be done.
- Identify initial requirements, assumptions, risks and restrictions in addition to existing agreements.
- Determine if it is feasible to carry out the project.
- Determine general objectives that are measurable.

Planning Process:

- The scope of the project is defined.
- The objectives are refined.
- The plan for project management is developed.

Tasks:

- Identify how to plan each area of knowledge.
- Determine the requirements in detail.
- Develop the statement of the scope of the project.
- Evaluate the purchases that have to be made and generate your documents.
- Make a list of activities.
- Create a network diagram of the activities.
- Estimate the resources required.
- Estimate time and costs.
- Develop the schedule.
- Develop the budget.
- Determine quality standards, processes and metrics.
- Create a process improvement plan.

- Define roles and responsibilities.
- Define communication channels and stakeholder participation.
- Identify risks, make a qualitative, quantitative analysis and plan the response to them.
- Iterate if necessary.
- Finish purchasing documents.
- Define change management.
- Finalize how to execute and control everything defined in the plans.
- Realistically determine the plan and define a baseline.
- Obtain formal approval of the project plan.
- Hold the project start meeting.

Execution Process

- All resources are coordinated to implement the project management plan.

Tasks:

- Perform the work according to the plan.
- Make deliverables.
- Collect work performance data.
- Request changes.
- Implement only approved change requests.
- Continuous improvement.
- Follow the quality processes.
- Determine which processes are effective.
- Perform quality audits.
- Acquire the work team.
- Manage the team.
- Evaluate the team and individual performance.
- Perform team activities.
- Register in logbooks.
- Manage conflict resolution.
- Release project resources.
- Send and receive information, request feedback.
- Work performance reports.
- Manage stakeholder participation and expectations.
- Hold meetings.

Monitoring Process:

The scope of the project is monitored and corrective actions are applied.

Tasks:

- Measure performance against the baseline.
- Analyze and evaluate performance.
- Determine if it is necessary to implement corrective actions or change requests.
- Perform integrated change control.
- Approve or reject change requests.
- Communicate to the interested parties the results of the changes.
- Monitor stakeholder participation.
- Manage the configuration.
- Develop forecasts.

- Obtain acceptance of the deliverables by the client.
- Perform quality control.
- Control the risks.
- Manage reservations.
- Control acquisitions.

Closing Process:

Project deliverables are formally accepted.

Tasks:

- Confirm that the work has been done according to the requirements.
- Complete the purchases.
- Obtain formal product approval.
- Finalize financial requirements.
- Request feedback from the client.
- Complete performance reports.
- Store reports and project information.
- Generate the lessons learned and update the knowledge base.

Validation Results

The methodological guide for the implementation of digital television in Bolivia that meets all legal and technical requirements under the good practices of PMBOK. Each of the activities are part of the overall objective for the design of the implementation guide included in the schedule.

Communication, integration and risks were a valuable contribution to the project that came from the application of the PMBOK processes. Documents were generated for each phase recorded in the guide.

The good practices of the companies that supported the project allow a justified selection of the new technologies to be adopted, which will have an impact on the use of the technology and on the costs.

The schedule that meets all the deadlines established in the regulations. The time factor in the regulations is crucial, reports are presented in digital and physical format to the Telecommunications Regulatory Authority. Due to the extension of the analog blackout, the Implementation phase has not yet been completed.

The clearest proof of the success of the methodological guide is that the requirements were accepted by the Bolivian Government's Telecommunications Regulation and Control Authority in its OTTO portal and weeks later physically in a folded folder with all the original documentation.

The budget presented meets all technical requirements, with quotes from three national and foreign companies.

Conclusions

Based on each case studied of experiences in the real implementation of digital television, in Argentina and Uruguay, the visits made to telecommunications fairs in Bolivia, the United States and Argentina, the training and courses carried out in Digital Television, the external engineering work simulation of irradiating systems to define the equipment necessary to comply with the Bolivian standard, interviews with businessmen, engineers, regulators, consultants and other media, allow the methodological guide to select the best practices of the project management published by the PMI. Therefore, the optimization of economic resources for the television channel is achieved.

The guide does not have a commercial purpose, but rather regulatory/legal compliance for the permanence of the media. Although it can be used as the basis for the construction of a knowledge platform to provide consulting and training services, new job management schemes for technology projects. This constitutes a task in the process of closing the PMBOK, the knowledge base.

Finally, to date there are 21 digital channels in HD, but the total number of channels in Bolivia is 637, which means that, until November 2025, 96.7% of Bolivian channels can use the guide to implement their channels in digital mode in response to the questions raised at the beginning of this article.

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