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Editorial

In this issue, MLS Project Design & Management reflects and strengthens, once again, the joint work of our group of collaborators, highlighting innovation in scientific-technological development as a fundamental tool. In addition, it encourages collaborative and integral work as a key element in the development of cultural and social knowledge for the design of new projects. This new edition presents eight selected papers, which address topics ranging from legislation for the accession of countries to the International Criminal Court, covering issues related to project management, analysis and evaluation in planning to papers that evaluate the execution process of construction projects, providing tools, suggestions and maturity models for the improvement in the management of this type of projects.

The first article addresses the divergences created by the limitations to the constitutional competence of the Assembly of the Republic of Mozambique, demonstrating through statistical methodologies focused and validated in specialized software the need for a new Constitution and the adoption of measures with the Mozambican Legal System to achieve adequate adherence to the International Criminal Court.

The second article provides a maturity model applied to the organizational context of project management in which a projective research is used with a non-experimental and transversal field design based on a mixed approach with descriptive and inferential statistical processing, which allows basing the OPM3 Maturity Model in public sector projects, this model was tested in the Mayor's Office of Chinácota-Colombia, and the results reflected a low maturity and inaccurate knowledge problems within the project area that need to be addressed.

In the third article, we find the methodology for the creation of two types of indexes through the promotion of creativity and the prioritization of innovation in business strategy. The first index reflects innovation management activities and the second reflects the innovative performance of a marketing strategy and its internationalization.

The fourth article provides suggestions for quality and performance improvements generated by the qualitative approach of a semi-structured survey and quantitative data analysis in SPSS and Excel, verifying the performance of projects with high failure rates in megaprojects using as a case study the performance analysis of the project to build the second bridge over the Wouri in Cameroon.

The fifth article generates a tool oriented to the optimization of safety, administrative, operational and continuous improvement processes that guarantee the best economic sustainability in an industrial trading company, which was tested in Ecuador.

The analysis of tools and methodologies used in project management is presented in the sixth article, resulting in a hierarchy of lessons that enable the identification of failures and successes in order to achieve adequate efficiency and sustainability of projects, and finally, it generates recommendations to correct and improve the current methodology in projects under execution and future execution.

On the other hand, the seventh article offers a proposal in business implementation management that allows improving the performance of nonprofit entities by combining the identification of instruments used in project implementation planning and practices from the business world adapted to a greater or lesser degree.

Finally, the last article in this issue describes a comprehensive tool of processes and resources that determines the main and secondary causes that affect the productivity of supply chains in high-rise housing construction projects, demonstrating through analytical surveys, the separate operation of its links such as suppliers, delivery of orders and storage, which delimits the generation of value in these companies.

Before concluding this editorial, it is important for all of us who collaborate in this new project to thank the team of collaborators, IT and technical, as well as the Ibero-American University Foundation (FUNIBER) and the Universities that have provided all the material support so that this issue can be carried out, with the conviction that we are on the right path towards international recognition.

Dr. Luis A. Dzul López
Dr. Roberto M. Alvarez
Editors-in-Chief

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PERSPECTIVA DE ADESÃO DE MOÇAMBIQUE AO TRIBUNAL PENAL INTERNACIONAL: UM OLHAR PARA AS VANTAGENS E DESVANTAGENS

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Resumo. A adesão de um Estado ao tratado internacional constitui a demonstração de interesse e que desagua na ratificação do mesmo, o que no final consistirá em norma ou regra a ser seguida pelo Estado assinante. Isto significa que o Estado assume a obrigação de cumprir as cláusulas nele elencado. Estudar as vantagens e desvantagens da adesão de Moçambique ao Tribunal Penal Internacional foi realizada com intuito de perceber as divergências da instalação do Direito Internacional sobre o Direito Moçambicano, descrever os principais desafios e examinar o nível de perspectiva vantajosa e desvantajosa na adesão de Moçambique no Tribunal Penal Internacional. Para a sua prossecução, foi privilegiada o inquérito por questionário via online, onde os dados foram processados no pacote estatístico SPSS para analisar as variâncias e as correlações estatísticas e regressões lineares e na construção de gráficos e tabelas. Os resultados mostram que a instalação do Tribunal Penal Internacional traz divergências sobre o Direito Moçambicano, sendo que apenas garante ao Estado Moçambicano à entrega de cidadãos ao Tribunal, criando limitações na competência constitucional da Assembleia da República em conceder amnistia ou perdão de penas, apresenta ainda distinções nas molduras penais aplicáveis por este Tribunal em relação ao Ordenamento Jurídico Moçambicano e a sua intromissão na Constituição da República de Moçambique. E o estudo recomenda para adopção de medidas preventivas para acomodar o legislado e aplicado pela lei penal internacional, uma nova Constituição, leis e Regulamentos assim como a perca de certos poderes que neste momento estão centralizados.

Palavras-chave: Sujeitos de Direito Internacional Público; Tribunal Penal Internacional; Adesão de Moçambique ao TPI; Vantagens e desvantagens na adesão ao TPI.

PERSPECTIVE OF MOZAMBIQUE'S ACCESSION TO THE INTERNATIONAL CRIMINAL COURT: A LOOK AT THE ADVANTAGES AND DISADVANTAGES

Abstract: The accession of a State to a particular treaty constitutes a demonstration of interest and which results in its ratification, which in the end will be the norm or rule to be followed by the signing State. This means that the State assumes the obligation to comply with the clauses listed therein. To study the advantages and disadvantages of Mozambique's accession to the International Criminal Court it was carried out in order to understand the divergences of the installation of International Law on Mozambican Law, describe the main challenges and examine the level of advantageous and disadvantageous perspective on Mozambique's accession to the International Criminal Law Court. For its continuation has been privileged the survey by online questionnaire, where the data were processed in the statistical packages SPSS to analyze the variances and statistical correlations and linear regressions and in the construction of graphs and tables. The results show that the installation of the International Criminal Court brings divergences on Mozambican Law, and it only guarantees the Mozambican State the delivery of citizens to the Court, creating limitations on the constitutional competence of the Assembly of the Republic to grant amnesty or pardon of sentences, also presents distinctions in the penal frameworks applicable by this Court in relation to the Mozambican Legal Order and its interference in the Constitution of the Republic of Mozambique. And the study recommends for the adoption of preventive measures to accommodate the legislated and applied by the international criminal law, a new Constitution, laws and Regulations as well as the loss of certain powers that are currently centralized.

Keywords: Subjects of Public International Law; International Criminal Court; Mozambique's accession to the ICC; Advantages and disadvantages of joining the ICC.

PERSPECTIVA DE LA ADHESIÓN DE MOZAMBIQUE A LA CORTE PENAL INTERNACIONAL: UNA MIRADA A LAS VENTAJAS Y DESVENTAJAS

Resumen. La adhesión de un Estado al tratado internacional constituye una demostración de interés y conduce a su ratificación, que al final será una norma o regla a seguir por el Estado signatario. Esto significa que el Estado asume la obligación de cumplir con las cláusulas allí enumeradas. Se llevó a cabo un estudio de las ventajas y desventajas de la adhesión de Mozambique a la Corte Penal Internacional para comprender las divergencias en la instalación del derecho internacional en el derecho mozambiqueño, describir los principales desafíos y examinar el nivel de perspectiva ventajosa y desventajosa en la adhesión de Mozambique a la Corte Penal Internacional. Para su continuación, se privilegió la encuesta vía cuestionario online, donde los datos fueron procesados en los paquetes estadísticos SPSS para analizar las varianzas y correlaciones estadísticas y regresiones lineales y en la construcción de gráficos y tablas. Los resultados muestran que la instalación de la Corte Penal Internacional trae divergencias en el Derecho mozambiqueño, ya que solo garantiza al Estado mozambiqueño entregar ciudadanos a la Corte, creando limitaciones a la competencia constitucional de la Asamblea de la República para otorgar amnistía o indulto de sentencias, distinciones en el marco penal aplicables por esta Corte en relación con el Sistema Legal de Mozambique y su injerencia en la Constitución de la República de Mozambique. Y el estudio recomienda la adopción de medidas preventivas para acomodar lo legislado y aplicado por el derecho penal internacional, una nueva Constitución, leyes y reglamentos, así como la pérdida de ciertos poderes que actualmente se encuentran centralizados.

Palabras clave: Sujetos de Derecho Internacional Público; Corte Criminal Internacional; Adhesión de Mozambique a la CPI; Ventajas y desventajas de unirse a la CPI.

Introduction

The concept of human rights, according to Peterke (2010), constitutes one of the requirements for the construction of life in freedom, equality, and dignity for human societies and recognized within International Law[1], where it includes their beliefs, habits, and customs. The attempt to organize these societies begins in the mid-seventeenth century by the State model and acquires in the twentieth century density, multiplication, and settlement on the earth's surface, against the current, (Seitenfus, 2012).

Borrowing knowledge from Neto (2008) and Mazzuoli (2011), International Criminal Law at the expense of the civil liability of General International Law arises to impose certain obligations of behaviors on all individuals of the international society and to punish those guilty of serious wrongful acts that injure human life.

According to Seitenfus (2012), the resolution of the multiple and divergent aspects and interests that could occur within the international relations between States would be through the creation of new institutions, the *International Organizations,* which would be a new external element, to the States and holder of an objective existence of international character.

According to the teachings of Professor Jorge Miranda (1991), International Organizations are institutions conceived by States and, eventually, by other subjects of International Law, which intend to permanently and independently develop purposes common to them, where the basis of their international legal institutionalization they participate as active subjects of relations, endowed at least with the right to enter into contracts, *jus tractuum* and *jus legationis,* to receive and send diplomatic representatives.

In the group of international institutions, we find the International Criminal Court, an organ of international jurisdiction, the result of a long analysis in the history of the preservation of human rights, appearing as a reliever and condemner of the perpetrators of criminal acts that embrace the international community, that is, a court that rules on cases of barbarism that shock human rights. This court is the first permanent International Criminal Court, created in 2002 in the Netherlands to promote international law with the

[1] Seitenfus argues that international law laid the foundations for the organization of international society by codifying custom and establishing the basic principles and rules of coexistence among states.

mandate to judge individuals and not States, and its jurisdiction is over crimes such as genocide[2], crimes against humanity[3], war crimes[4], and crimes of aggression.

The important fact is that the ICC fills the existing gap in the international legal arena, being that its jurisdiction focuses on individuals who committed crimes in a specific conflict during a specific period of time and acts promptly with respect to acts of atrocities (art. 11 of the ICC Statute), which differs from the International Court of Justice, which deals with questions of responsibility before States and other *ad hoc* tribunals created by the Security Council, such as the ICTY/R - *International Criminal Tribunal for* the *former Yugoslavia and Rwanda*[5] . (Art. 17), which means that the ICC does not invade the jurisdiction of a State.

In Mozambique, some politicians and military leaders use pretexts to delay ratification of the Treaty out of ignorance, believing that Mozambicans who potentially commit such crimes in Mozambique, or abroad and take refuge on their own soil, will find a legal loophole and, therefore, will not face international justice. Such thinking does not take into account that the UN Security Council, under Chapter VII of the UN Charter, can also submit a complaint to the ICC Prosecutor in which case it is not necessary to observe the aforementioned preconditions of ratification of the Rome Treaty by the State in question (Do Amaral, 2011).

This research was based on this presentation, posing the following guiding question: *Will Mozambique's accession to the International Criminal Court bring advantages or disadvantages*?

To address the issue under study, it is important to bring up the concept of the International Criminal Court. That is, the ICC, which is the subject of this article. Thus, according to the Organization's *website*[6], the ICC is a permanent and independent court of last resort that judges individuals and not States[7], as has been so often confused. These

[2] According to Article 6 of the Rome Statute of the ICC, genocide is any of the acts (killing members of the group; causing serious bodily or mental harm to members of the group; intentionally inflicting on the group conditions of life calculated to bring about its physical destruction in whole or in part; imposing measures intended to prevent births within the group; and forcibly transferring children of the group to another group) committed with intent to destroy, in whole or in part, a national, ethnical, racial, or religious group.

[3] Acts of murder, extermination, enslavement, deportation or forcible transfer of a population, imprisonment or other severe deprivation of physical liberty in violation of the fundamental rules of international law, torture, rape, sexual slavery, enforced prostitution, forced pregnancy, enforced sterilization, or any other form of sexual violence of comparable gravity, persecution of an identifiable group or collectivity on political, racial, national, ethnic, cultural, religious, or gender grounds, or on other criteria universally recognized as unacceptable in international law, enforced disappearance of persons, the crime of apartheid, and other inhumane acts of inhumane treatment or punishment, national, ethnic, cultural, religious, gender-based, or other criteria universally recognized as unacceptable in international law, enforced disappearance of persons, the crime of apartheid and other inhumane acts of a similar character intentionally causing great suffering, serious injury, or mental or physical harm, when committed as part of a widespread or systematic attack directed against any civilian population, with knowledge of the attack (art. 7 of the SPRT).

[4] War crimes are understood to be all those which involve a grave breach of the Geneva Conventions of 12 August 1949, directed against persons or property protected by the Geneva Convention, such as murder, torture, or other inhuman treatment, including biological experiments, the intentional infliction of great suffering or serious injury to body or health, the large-scale destruction or appropriation of property when not justified by any military necessity and carried out unlawfully and arbitrarily, the act of compelling a prisoner of war or other protected person to serve in the armed forces of an enemy power, the intentional deprivation of a prisoner of war or other protected person of his right to a fair and impartial trial, deportation or transfer, or unlawful deprivation of liberty; (viii) hostage-taking and other serious violations of the laws and customs applicable in international armed conflicts under international law, such as intentional attacks against the civilian population and civilian objects.

[5] International Criminal Tribunals for the former Yugoslavia and Rwanda

[6] http://www.icc-cpi.int/. Accessed 02.07.2020.

[7] States are tried by another tribunal, the International Court of Justice (which is not the subject of this research), which also deserves attention for future research.

individuals are accused of crimes of international concern, especially genocide, crimes against humanity, and war crimes.

Article 1 of the Rome Statute of the International Criminal Court establishes that the ICC is a permanent institution with jurisdiction over persons responsible for the most serious crimes of international concern and complementary to national criminal jurisdictions.

The creation and functioning of the International Criminal Court

After the failure of the attempt to draft the Statute of the International Criminal Court in 1950 by the UN (United Nations Organization), because the permanent organizations did not adhere to the initiative, in 1973, with resolution 3166 (XXVIII) of 12.14.1973 of the League of Nations (LN) or, simply, of the UN, which referred to the *Principles of International Cooperation in the Identification, Arrest, Extradition, and Punishment of Persons Guilty of Crimes against Humanity,* it was established that all countries should cooperate in the prosecution of those responsible for such acts. However, the ICC was not ready to enter into force, since only in July 1998 the representatives of 120 nations at the Rome Conference approved the project to create the ICC, with the exception of the United States, China, Israel, Yemen, Iraq, Libya, and Qatar (Santos Junior, 2017).

In official terms, the ICC began operating in July 2002, with its headquarters in The Hague, in the Netherlands, and its action only affects the national courts of the States Parties, in the event that they are unable or unwilling to carry out criminal proceedings, which means that the ICC operates under the principle of complementarity, since its intervention manifests itself when a given responsible State is unable or unwilling to act on an unlawful act, and the ICC does not replace the State's national jurisdiction. Regarding Article 4(1) and (2) of the ETPI, they argue as follows:

> [....]1. The Tribunal shall have international legal personality. It shall have the legal capacity necessary for the performance of its functions and the furtherance of its purposes. The Court may exercise its powers and perform its functions in accordance with this Statute in the territory of any State Party and, by special agreement, in the territory of any other State.

In other words, if a national citizen commits a crime outside its territory and after committing it returns to his country, that State, if it has signed and ratified the ICC Statute, as well as if the State accepts the jurisdiction of the ICC, must extradite him and hand him over for international prosecution, depending on the nature or type of crime and the domestic legislation of the State to which that citizen belongs.

In addition, and in accordance with Article 12 of the Statute and the arguments of Sabóia (2000), which requires that the State where the conduct was committed or, alternatively, the State of nationality of the accused must have ratified the Treaty or accept the jurisdiction of the Court for the trial of the specific crime. In this sense, the International Court will try the individual and not the State itself. In addition, the State of nationality of the accused will also have jurisdiction over the crime and may try the accused or request his extradition, under the terms of Article 90 of the Rome Statute.

It is important to note that the ICC acts to punish individuals, not States, that have committed the four types of international crimes established in Article 5 of the Statute (genocide, crimes against humanity, war crimes, and crimes of aggression). In addition to the above, the ICC faces the great challenge of not having its own mechanism of coercion regarding its deliberations, so it respects the autonomy of each nation since not all are signatories to it, and it only acts if the crime has been committed in a State Party or in any other, provided that they have special agreements and in the case of accession, the ICC can only investigate the act committed by the individual after the accession of the respective State to which it belongs.

An example of this is the barbarity perpetuated by former General Augusto Pinochet (1973 to 1988) against Chile, which culminated in the death of 3,197 leftist militants, without Chilean justice condemning those responsible for the coup and subsequent violations. It was necessary for other countries to take the initiative to punish, given that, under domestic jurisdiction, the crimes committed would be amnestied and prescribed, given the political contingencies in Chile (Miranda, 2000).

Do Amaral (2011) states that the UN Security Council, in the use of its competence, can lift the veil of sovereignty and recommend the investigation, prosecution, and trial of suspects of crimes regulated by the ICC Treaty, even if those States have not ratified it, as was the case of Sudan's President Omar Al Bashir and Libya's President Muhamad Gaddafi. Therefore, not ratifying the Rome Treaty does not mean that Mozambican politicians and military leaders are safe from the ICC.

States Parties have a special relationship with the ICC, particularly with regard to the provision of legal assistance, mainly in the arrest and surrender of suspects, and must comply with these requests in accordance with the Treaty and that the accused may challenge his arrest and surrender to the ICC in local courts on the basis of the principle of *ne bis in idem*, i.e., no one may be prosecuted more than once for the same offense, but that the accused should not be disqualified from being punished twice for the same

offense, as the unlawful conduct may involve a principal and an accessory penalty or the simultaneous imposition of a penalty and an administrative sanction, e.g., a disciplinary or administrative sanction.

For Mozambique, as Do Amaral (2011) states, the creation of the ICC is an affirmation that the most serious crimes that affect the international community as a whole must not go unpunished, and that their repression must be effectively ensured through the adoption of measures at the national level and the strengthening of international cooperation. States that are determined to put an end to impunity for the perpetrators of these crimes, and so contribute to the prevention of such crimes, should, therefore, adopt and ratify it.

Implications of the ICC for States Parties

According to Cardoso (2012), the establishment of the International Criminal Court in Brazil did not encounter obstacles despite not having participated fully in its creation. But its position of adherence was clearly seen in the signature and ratification in February 2000 and June 2002. Respectively, the advantages of which were presented by the Ambassador and Head of the Brazilian Delegation, Gilberto Sabóia, in which he highlighted the main elements surrounding the position transcribed below (excerpt translated from English):

> Brazil is committed to the creation of an effective international criminal court. We believe that a universal, impartial and independent ICC will be a great achievement for the international community in promoting respect for international humanitarian law and human rights. [...]. This judicial body will go a long way towards achieving the goal of fighting impunity and bringing the perpetrators of the most heinous crimes to justice [...]. Brazil was a member of the Security Council when it created the ad hoc tribunals for the former Yugoslavia and Rwanda. As we said at the time, our preferred method for the creation of an international criminal tribunal was the conclusion of a convention [...]. We voted in favor of the establishment of these tribunals because of the exceptionally grave circumstances [...] and as a political expression of our condemnation of the atrocities committed in those regions.

In addition, on September 27, 2008, during the 73rd session of the United Nations General Assembly in New York, the Minister of Foreign Affairs, Aloysio Nunes Ferreira, signed the declaration of support for the ICC, an act carried out by 34 other countries, which reaffirmed their commitment to speak out and defend the Court, justified by the general erosion of the rules-based international order to establish trade, disarmament, climate change, and the rule of law and human rights. One can read in the statement of

commitment the duty to honor the significance that the ICC represents especially for victims of cruel crimes.[8]

On the other hand, African countries, in particular Benin, Botswana, Burkina Faso, Cape Verde, Chad, Comoros, Congo, Djibouti, Gabon, Gambia, Ghana, Guinea, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Namibia, Niger, Nigeria, Kenya, Central African Republic and South Africa, Democratic Republic of Congo, Senegal, Sierra Leone, Seychelles, Tanzania, Tunisia, Uganda, Zambia, only Portuguese-speaking Cape Verde signed and ratified the treaty, and Angola advocates a promising future for the ICC, believing it can bring solutions to the discord in Africa.

At the 2017 African Union Summit, the head of Angolan diplomacy, George Chikoti, said that it is not in the interest of African countries for the ICC to be victimized, as there have been arrests even without formalizing their guilt, adding that it is not a court for Africans[9]. At the same summit, Mozambique, represented by the then Minister of Foreign Affairs and Cooperation, Oldemiro Baloi, and the Prime Minister of Sao Tome and Principe, Patrice Trovoada, affirmed that membership or withdrawal from the ICC is a sovereign decision, and that the organization must respect the African continent[10] . Only Cape Verde, through the voice of its statesman, Jorge Carlos Fonseca, finds an agreement between his nation and the ICC because he considers that his country is a democratic state based on the rule of law and fights for international justice, especially criminal justice.

The relationship between the ICC and States Parties

The binding and action of the ICC, on the signatory or accepting states, is based on two principles (precepts, laws or assumptions considered universal, with a scope superior to the rules, which must be observed by both the legislator and the operator of the law), in particular, the principle of complementarity (much criticized for the alleged possibility of destruction of evidence by the agents involved in a given case even before investigations are initiated) and the principle of cooperation.

The principle of complementarity, according to Piovesan and Ikawa (2009), establishes that the ICC will not exercise its jurisdiction when the State where the criminal conduct occurred or the State of which the accused is a national is investigating, prosecuting, or has already tried the person in question.

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[8] *http://www.brazil.gov.br/about-brazil/news/2018/10/brazil-declares-support-for-the-international-criminal-court-icc*. Accessed 07.03.2020

[9] Fly Journal of Wednesday, 02.02.2017. Available at: https://www.voaportugues.com/a/paises-africanos-divergem-tpi/3703493.html.. Accessed 07.04.2020.

[10] ibdem

Canedo (2017) refers that the principle of complementarity stipulates that the ICC does not have primacy to judge the individual who will commit the crime provided in its Statute, but acts subsidiary to the State of who committed the wrongful act when (i) the process has been initiated, is pending, or the resolution has been issued in the State in order to exempt the interested party from criminal responsibility; (ii) there is excessive delay in the processing of the case; (iii) the proceedings are not being conducted in an independent and impartial manner, which conflicts with the intention to bring the person concerned to justice.

This rule, however, presents exceptions, not applying when: i) the State that investigates, prosecutes, or has already judged is incapable or does not intend to do so; ii) the case has not been judged in accordance with the rules of Article 20, paragraph 3 of the Statute; or iii) the case is not sufficiently serious (Piovesan; Ikawa, 2009).

Regarding the principle of cooperation, Schabas (2001) shows that States Parties are imposed an obligation to cooperate fully with the ICC in the investigation, which, at some point, may be carried out without the consent of the State Party, being exceptional in cases where it is done by authorization when the State is unable to execute a request for cooperation due to the absence of any authority or any component of its competent judicial system to give effect to the request for cooperation, which includes preventive arrests, production of evidence, searches and seizures, and witness protection.

If Mozambique is a party to the Treaty, it may report evidence of international crimes directly to the Prosecutor of the ICC and request the Prosecutor to investigate in order to determine whether one or more identified persons should be charged with such crimes.

International law deviates from national norms

According to Moreira (2015), international human rights treaties in Brazil were elevated to the category of sources of state law by the Federal Constitution of 1988, although it caused divergences in the Supreme Court in recognizing the hierarchy of laws, since a certain wing defended the norms as constitutional and another as infra-constitutional, treaties enjoying normative parity with ordinary laws.

The author adds that, by virtue of the principles *pacta sunt servanda*, good faith and the imperativeness of *jus cogens* norms, the Brazilian State complies with international commitments, under penalty of accountability and international sanctions by the International Courts and Tribunals in case of non-compliance, (Moreira, 2015).

In the Mozambican context, the sources of international law are incorporated into the legal system without losing their *ius international* character (Pereira Coutinho, 2018). In light of Article 18 of the Constitution of the Republic of Mozambique, international treaties and agreements, validly approved and ratified, are in force after their official publication and as long as they bind internationally the State of Mozambique (see paragraph 1), and the norms of international law have the same value in the domestic legal order as infra-constitutional normative acts issued by the Assembly of the Republic and the Government, according to their respective form of reception (see paragraph 2).

Borrowing from Bastos (2007), the Mozambican Constitution, understood as the source of legitimacy of political power and state sovereignty, functions as the referent of validity used to evaluate all normative acts of a legal system, regardless of their origin or nature.

The same author (2007) adds that the clauses located in paragraphs 1 and 2 of the aforementioned article 18 are deployed on the distinction between treaties and international agreements; the method of incorporation of international obligations (treaties in the broad sense) in the Mozambican legal system; the requirement of internal publication of international commitments (treaties in the broad sense) assumed by the Mozambican State; the provision for the production of legal effects in the Mozambican legal system of sources of international law other than international obligations (treaties in the broad sense); the method of incorporation of other sources of international law in addition to international obligations (treaties in the broad sense) in the Mozambican legal system and the hierarchical position of the sources of international law within the Mozambican legal system, which in his opinion, the participation of Mozambique in an international treaty is primarily a manifestation of political power, resulting from an assessment of the individual interests of the respective State (Bastos, 2007).

At the Rome Conference, held between June 15 and July 17, 1998, which created the International Criminal Court, Mozambique was one of the 120 countries that voted in favor of its creation, thus accepting its existence and relevance. The only step, the most important one, that Mozambique has not yet taken is to ratify it in order for it to enter into force in the internal legal system, justified by the fact that it creates burdens or commitments for the State, and so must be submitted to public appreciation and debate, with the Assembly of the Republic at the head.

In addition to what was said in the previous paragraph, Do Amaral (2011) states that the political leadership of Mozambique justifies that ratification requires

harmonization between the ICC and the Constitution of the Republic, that in technical and legal terms the Mother Law does not have to be harmonized with a treaty, but on the contrary, that it seems wrong to have the Constitution harmonized with the Treaty to allow its ratification by Mozambique.

In addition, the International Criminal Court prescribes the penalty of life imprisonment for crimes within its jurisdiction, when the extreme gravity of the crime and the individual circumstances of the convicted person justify it, whereas, in the Mozambican legal system, the maximum possible prison sentence is 30 years, as can be seen in Article 67(3), which is consistent with Article 61(2), cited above:

> "penalties and security measures that deprive or restrict the liberty of life or of unlimited or indefinite duration are prohibited" (art. 67, 3);
> "extradition for offenses punishable by death or life imprisonment under the law of the requesting State, or when there are reasonable grounds to believe that the extradited person may be subjected to torture or inhuman, degrading, or cruel treatment" (art. 61, 2).

Method

The methodology includes the presentation of the procedure used to achieve the objectives set out in the research, i.e., the paths followed by the author to carry out the research.

Therefore, to address the advantages and disadvantages of Mozambique's accession to this court, the divergences in the installation of international law on Mozambican law were listed, describing the main challenges in relation to the advantages and disadvantages, including the level of perspective on Mozambique's accession to the ICC, as it is one of the major challenges for the justice sector.

For its materialization, bibliographic research was used, which consisted of an exhaustive search for information relevant to the topic, in books, articles, theses available on various digital platforms that have already gone through the publication process, and a questionnaire survey to jurists, criminalists, technicians in international relations, and academics to have an idea capable of providing a critical analysis of the author in relation to the positive and negative facts of Mozambique's accession to the ICC.

This survey was sent to 87 experts and students of law and international relations, of which 64 surveys were processable for completion, 41 male and 23 female, corresponding to 64.17% and 35.9%, respectively, as shown in Table 1.

The data collected in the interviews were selected, coded, and entered into the *Microsoft Excel* program and tabulated in the SPSS statistical package in the *Analyze-Frequencies, Descriptive Statistics,* and *Graphics* extensions for the elaboration of graphs, tables, and statistical analyses in order to analyze the level of significance of the advantageous and disadvantageous perspective of Mozambique's accession to the ICC.

Table 1

Distribution of respondents by gender

Respondents	Frequency	Percentage	Cumulative percentage
Men	41	64.1%	100,0%
Women	23	35.9%	**100%**
Total	**64**	**100%**	

Although the number corresponds to 79.31% of the surveys sent, the data were sufficient for the author to develop his reasoning and critical analysis, as well as to master the objectivity of the same, taking into account the level of specialization of the respondents, as can be seen in the graph in Figure 1.

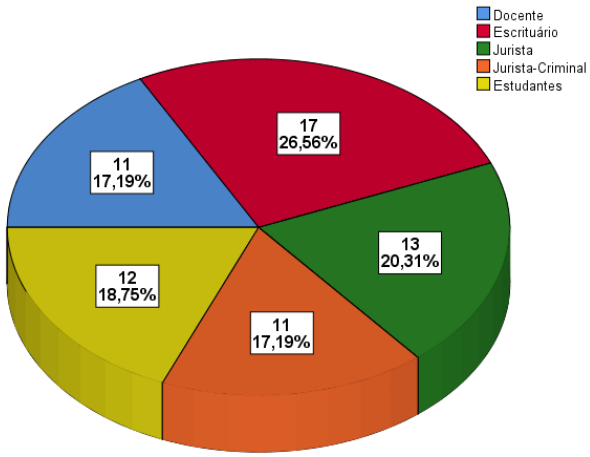

Figure 1. Graph of the percentage distribution of respondents regarding their profession.

As can be seen in the graph in Figure 1 on the percentage distribution of respondents in relation to their profession, the majority is made up of jurists (37.5%), divided into 20.31% for jurists, and another 17.19% for criminal lawyers. The remaining percentages correspond to students, with 18.75%, and to professors and administrative staff (technicians in various areas, especially international relations), with 17.19% each, corresponding to 12 and 11 respondents, respectively.

Results

The international norm and the other infra-constitutional norms in force in the Republic of Mozambique have the same value. Thus, to understand whether the installation of the International Criminal Court in Mozambican law would bring some divergence, 87.5% of respondents stated that it would bring divergence, while the remaining 12.5% stated that its insertion would not bring any divergence in Mozambican law, as can be seen in Table 2.

Table 2

Percentage distribution of respondents on the divergence of the creation of the International Criminal Court from Mozambican law

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	YES	56	87,5	87,5	87,5
	NO	8	12,5	12,5	100,0
	Total	64	100,0	100,0	

It should be noted that the installation of the International Criminal Court in Mozambican law presents divergences due to the imposition of some rules that do not apply to the Mozambican reality, the disarticulation with the constitution, the death penalty, and justice in Mozambique is not yet separate from the government, nor is it free to be independent. These divergences may, in a way, provoke in Mozambican law a prior revision of Art. 67 as alluded to by Pereira Coutinho (2018), to overcome the prohibition of expulsion or extradition of nationals (paragraph 4), and the prohibition of extradition for crimes corresponding in the requesting State to a life sentence (paragraph 3).

However, there are both advantages and disadvantages to the creation of the Court, which in some ways weigh more towards the disadvantages than the advantages. On the advantageous side, accession to the ICC, Mozambique will ensure the surrender of citizens to the Court, as respondents were unanimous in stating (see graph in Figure 3).

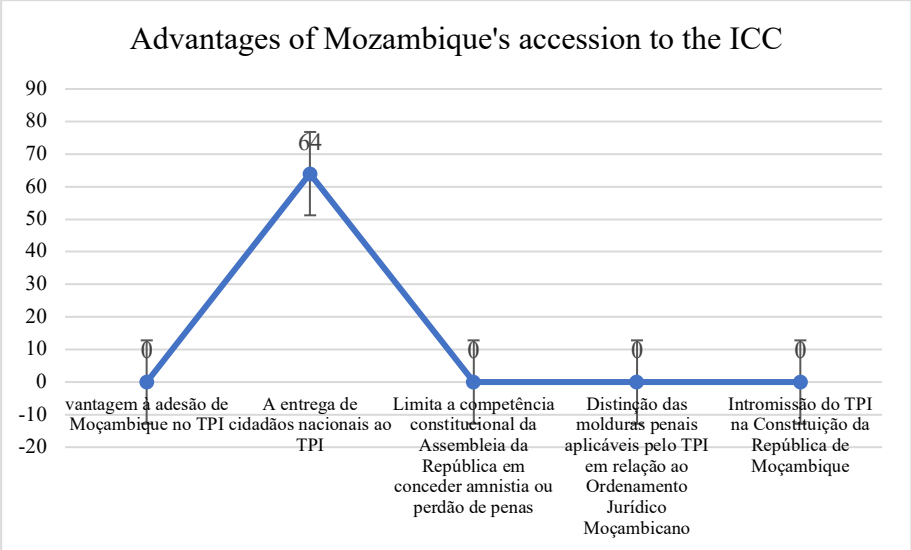

Figure 3. Graph showing respondents' answers on the advantages of Mozambique's accession to the ICC.

The analysis of variance shows that there are no statistically significant differences between the means of the variables analyzed, since the p factor was below the 5% significance level, having presented a level of 0.000% (see Table 3).

Table 3

Statistical significance analysis of the benefits of Mozambique's accession to the ICC

Source of variation	*SS*	*df*	*MS*	*F*	*P-value*
Between groups	.000	2	.000	.	.000
Within groups	.000	61	.000		
Total	**.000**	**63**			

The statistical analysis of variance with *p-value* (0.05) showed that there are no differences between the averages of the points of view, even if the variable delivery of national citizens to the CPI is isolated. In statistical terms, it is not significant, since the *p-value* was below the 5% significance level, with a variance of 0.333, as can be seen in Table 4 below.

Table 4

Statistical significance test of the benefits of Mozambique's accession to the ICC

Groups	*Account*	*Sum*	*Mean*	*Deviation*
Surrender of nationals to the ICC	3	64	21.333333	0.3333333
Limits the constitutional power of the Assembly of the Republic to grant amnesty or pardon of penalties	3	0	0	0
Distinction between the criminal frameworks applicable by the ICC in relation to the Mozambican legal system	3	0	0	0
Interference of the ICC in the Constitution of the Republic of Mozambique	3	0	0	0

On the other hand, accession is seen as an encroachment on the Constitution of the Republic and as such will limit the constitutional competence of the Assembly of the Republic to grant amnesties or pardons of penalties to nationals, in addition to the fact that there is a difference in the penal frameworks that are applicable by the ICC in relation to the Mozambican Legal System, as can be seen in the graph in Figure 4.

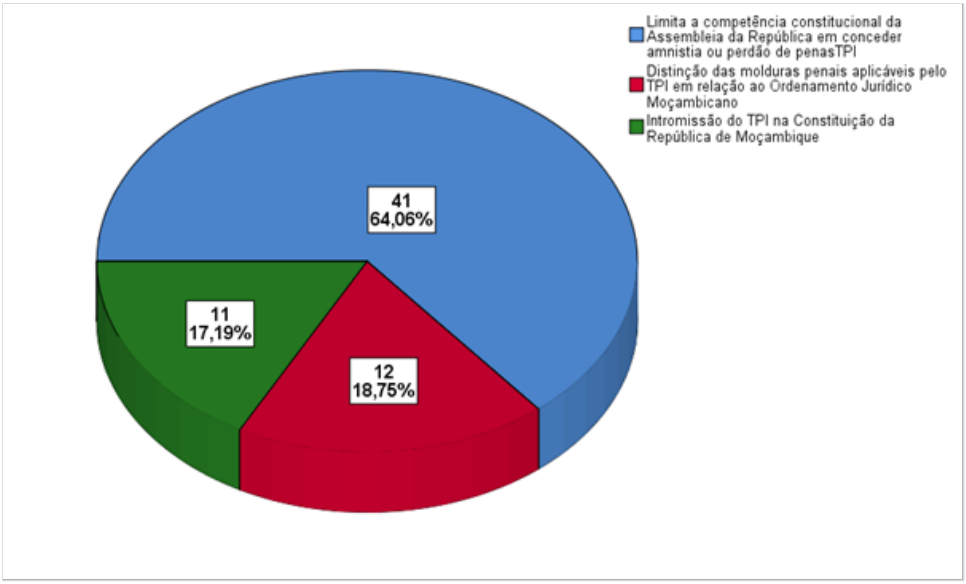

Figure 4. Graph of respondents' answers on the disadvantages of Mozambique's accession to the ICC.

From the descriptive statistical analysis, all the negative aspects of Mozambique's adherence to the ICC did not show statistically significant differences between the means of the variables analyzed, since the p factor was below the 5% significance level, presenting a level of 0.02% (see table below).

Table 5

Statistical significance analysis of the disadvantages of Mozambique's accession to the ICC

Source of variation	*SS*	*Df*	*MS*	*F*	*P-value*	*Criticism F*
Between groups	2048	1	2048	2	0.0207031	5.987378
Within groups	6144	6	1024			
Total	**8192**	**7**				

The significance test of the unfavorable items of Mozambique's accession to the ICC, with a *p-value* of 0.05, allowed finding that the averages of the items do not present differences in variance among them, but the *p-value* of the limitation of the constitutional competence of the Assembly of the Republic in granting amnesty or pardon of sentences, the distinction of the criminal frameworks applicable by the ICC in relation to the Mozambican Legal System, and the intrusion of the ICC in the Constitution of the Republic of Mozambique turned out to be higher than the 5% significance level, having been observed 13.66667, 4 and 3,6666667, respectively, as can be seen in Table 6.

Table 6

Statistical significance test for the disadvantages of Mozambique's accession to the ICC.

Groups	*Account*	*Sum*	*Media*	*Deviation*
Surrender of nationals to the ICC	3	0	0	0
Limits the constitutional power of the Assembly of the Republic to grant amnesty or pardon of penalties	3	41	13.666667	0.333333
Distinction between the criminal frameworks applicable by the ICC in relation to the Mozambican legal system	3	12	4	0.333333
Interference of the ICC in the Constitution of the Republic of Mozambique	3	11	3.6666667	0.333333

Discussion and conclusions

The main objective of this study is to provide an approach on the advantages and disadvantages of Mozambique's accession to the International Criminal Court, a Court that judges individuals and not States, which is said to be efficient, impartial, and independent, but finds divergences in Mozambican law in the aspects of the imposition of some rules that do not apply to the Mozambican reality, the disarticulation with the constitution, the death penalty, and justice in Mozambique that is not yet separated from the government.

However, its installation would help the country in the investigative process of finding information that often goes beyond the jurisdiction of national courts, international crimes committed on the territory of Mozambique without the ability to criminal management against offenders. And this makes Mozambique lose the strengths that the existing democracy has built in the country and the limitation of administrative, judicial, and executive powers, which means that there are offenders of international crimes against humanity without due punishment for not having constitutional legal provisions against gross violations of human rights. But it would also entail numerous drawbacks, such as limiting the constitutional competence of the Assembly of the Republic to grant amnesties or pardons of sentences and distinguishing the criminal frameworks applicable by the ICC in relation to the Mozambican legal system.

These drawbacks in statistical terms clearly present the existence of significant differences, as the *p* factor was shown to be above the 5% significance level or $p > 0.05$. Hence, the research recommends the separation of powers, which as of today is centralized, and which should begin with the adoption of preventive measures to accommodate the legislation and application of international criminal law, a new Constitution, laws, and regulations.

The fact that the Rome Statute, the agreement by which countries adhere to it, demonstrates that there is equality of human rights, must be verified even in the application of penal frameworks without taking into account the social *status* of the offenders. This situation leads Mozambique to prepare and change the molds of the existing democracy, as well as to have a new vision of the legislator regarding the benefits granted to certain figures according to their social *status.*

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MATURITY MODEL APPLIED TO THE ORGANIZATIONAL CONTEXT OF PROJECT MANAGEMENT FOR THE MAYOR'S OFFICE OF CHINACOTA-COLOMBIA

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Summary. The research was based on the Chinácota-Colombia Mayor's Office Public Sector Project Management Maturity Model. Its objective was to identify the practices applied by the organization in the maturity of its processes; applying the Maturity Model, the capabilities and performance of the members of the project management area were evaluated. For the development of the work, projective research, a non-experimental and cross-sectional field design, a mixed approach, observation, SWOT analysis, survey and literature review were used; SPSS was used to process the information and descriptive and inferential statistics were applied for the analysis and treatment of the results. The theoretical approach provided the basis for the OPM3 Maturity Model for Project Management in the organization; in addition, the legal framework and standards of the Public Investment Project Bank in Colombia were analyzed. In conclusion, the resulting degree of maturity was 24.99% (low) related to knowledge, the internal-external factors show problems of inaccurate knowledge within the project area, there is a high turnover of its employees, there are not enough resources for its management; the practice of projects shows lack of definition and outdated maturity in its management. Also, it was detected that all practices associated with risk management and procurement have excessive bureaucracy, in the standardization processes there is a high degree of compliance in the management of scope, time, integration and risk.

Key words: Project Management; Maturity Model; Public Investment; Project Bank; Continuous Improvement.

MODELO DE MADUREZ APLICADO AL CONTEXTO ORGANIZACIONAL DE LA GESTIÓN DE PROYECTOS PARA LA ALCALDÍA DE CHINACOTA-COLOMBIA

Resumen. La investigación se basó en el Modelo de madurez para la gestión de proyectos del sector público de la Alcaldía de Chinácota-Colombia. Su objetivo fue identificar las prácticas aplicadas por la organización en la madurez de sus procesos; aplicando el Modelo de madurez, se evaluó las capacidades y desempeño de los integrantes del área de gestión de proyectos. Para el desarrollo del trabajo se aplicó la investigación proyectiva, un diseño de campo No Experimental y Transversal, se empleó un enfoque mixto, la observación, el análisis FODA, la encuesta y la revisión bibliográfica; para el procesamiento de la información se empleó el SPSS y se aplicó la estadística descriptiva e inferencial para el análisis y tratamiento de los resultados. El enfoque teórico permitió fundamentar el Modelo de Madurez OPM3 para la Gestión de Proyectos en la organización; además, se analizó el marco legal y normas del Banco de proyectos de la inversión pública en Colombia. En conclusión, el grado de madurez resultante fue del 24,99% (bajo) relacionado al conocimiento, los factores internos-externos muestran problemas de conocimientos imprecisos dentro del área de proyectos, existe alta rotación de sus funcionarios, no se cuenta con suficientes recursos para su gestión; la práctica de proyectos evidencia indefinición y desactualización de la madurez en su gestión. También, se detectó que todas las prácticas asociadas a la gestión de riesgo y adquisiciones tienen exceso de burocracia, en los procesos de estandarización tienen alto grado de cumplimiento en la gestión del alcance, tiempo, integración y riesgo.

Palabras clave: Gestión de Proyectos; Modelo de Madurez; Inversión Pública; Banco de Proyectos; Mejora continua.

Introduction

In the Mayor's Office of Chinácota, its Development Plan is executed, based on seven strategic lines to meet the needs of its 16,021 inhabitants (DANE, 2018). Welfare is achieved by executing projects planned in the fiscal year; however, the results have not had a positive perception by the inhabitants, nor the achievement of the strategic objectives in the management of projects of the Institution; in contrast to the developed plan, there is no evidence of improvements in good practices in project management, hence the expected results in time, scope and costs, among others are not sufficient, also, it is worth mentioning that the difficulties caused by the Pandemic COVID 19, has led to difficult changes for the development of projects in their different phases.

Likewise, since there is no structured project office, there is no evidence of systematized records or solutions to the main gaps in project management; consequently, there are no good practices in the management of methodologies in the public sector in the case study.

The main cause of this conflict is uncertainty within the institution, insufficient knowledge, scarce resources, high turnover of civil servants and inappropriate political impositions, which consider the project field as bureaucratic units that increase the budget.

The research was developed to establish an approach to the case study, from the analysis of the relevance of the current situation of the municipal administration in the project management processes, culminating in a projective research.

The research based the study on the substantive theoretical framework of the Project Management Maturity Model. A substantial characterization of the Maturity Model for project management in the public sector was carried out, emphasizing two key aspects. The first focused on the Maturity Model for project management in the public sector and the second

referenced important concepts, as well as developed the state of the art related to scientific articles published by other authors, and publications generated by institutions that have addressed the subject under study.

Finally, a summary approach of the knowledge that allowed to base the conclusions and results obtained in the study on the Maturity Model for project management in the public sector based on the principles and standards is shown.

Claros (2015, p. 8) defines the project management maturity model as a structured set of elements (best practices, measurement tools, analysis criteria, etc.) that allows identifying the installed capabilities in project management in the organization, comparing them with standards, identifying gaps or weaknesses and establishing continuous improvement processes.

On the other hand, the Project Management Maturity models focus on the analysis and degree of maturity of the processes involved in the development of a project (FUNIBER, n.d., p.156).

In addition, FUNIBER (n.d., p. 157-158), states that this model was created by the Project Management Institute (PMI), and defines organizational project management in terms of processes; for example:

- Strategic planning process.
- Project upload process.
- Project prioritization process.
- Project planning and portfolio management process.
- Individual project management process.
- Environment management process.

The Organizational Project Management Maturity Model (OPM3) is a project management capability maturity model for organizations, which allows you to evaluate the level of project management maturity of your organization according to best practices and to outline an improvement plan to achieve a project management culture in the organization and a return on investment. The OPM3 model is composed of a series of best practices that will provide great value to your organization (PPMC Consultores Internacionales Ltda., n.d.).

Regarding the structure of the OPM3 model, Bonilla & Suarez (2017), mention that OPM3 helps organizations to measure and develop their skills for the delivery of successful and consistent projects, collaborating with the achievement of their goals, improving their overall effectiveness, this improvement process includes stages to standardize, measure, control and improve; further details see its dimensions in Figure 1.

Figure 1. The OPM3 standard - Dimensions

Note: Source: Organizational Project Maturity Model (2003, p. 19).

As for the OPM3 model cycle, according to Acevedo et al. (2014, p. 31-32), the cycles of the OPM3 model are divided into:

- Knowledge: At this stage, the content of the model, its development and familiarization with project management must be known, and it also includes a database of best practices.
- Valuation: Initially, the best practices that apply in the organization are assessed, the state of maturity according to the model and the specific capabilities of each best practice of the organization are investigated.
- Improvement: The basis for an improvement plan to increase the maturity of the organization is acquired. It evaluates the organization's existing and non-existing components, allowing the development of a plan that replaces the primary needs of project management.
- Repetition: In this cycle it is examined whether to return to cycle 2 and 3 and thus re-evaluate the state of organizational maturity or simply return to the improvement step so that best practices that have not been considered are evaluated.

For Acevedo et al. (2014, p.32), best practices, capabilities, results and performance indicators, OPM3 associates organizational maturity in project management through best practices. A best practice is an industry-recognized best way to achieve an objective. For project management at the organizational level, it includes the ability to execute predictable, consistent and successful projects, always within the framework of the organization's strategies. Implementing best practices increases the likelihood of achieving objectives.

Likewise, Acevedo et al. (2014, p. 34), mention, that the adoption of OPM3 best practices, capabilities, or results can enable an organization:

- Provide more effective information to support project management measures.
- Accelerate organizational success and minimize unnecessary risk through the use of proven best practices.
- Stimulate the identification and selection of projects that support the implementation of the strategy.

- Increase understanding and transparency of project portfolio costs, risks and benefits, enabling management decision making.
- Certify that project/portfolio management includes the investment mix that supports the execution of strategies and risk tolerance.
- Perceive, analyze and respond to incremental changes within the organization, or changes precipitated by external factors such as competition or regulatory requirements.
- Reduce the risk of high impact failures at the project, program or portfolio level.

Instead, capabilities and best practices are associated with three (3) types of domains:

- Project or Project Management Domain
- Program Domain or Program Management
- Proficiency in Portfolio or Portfolio Management.

According to Acevedo et al (2014, p.34), the above are related to each group of processes given by the PMBOK and are linked to each other through information flows.

On the other hand, according to the DNP (National Planning Department) (2016, p. 9), through the Guidance Booklet Implementation and Management of Territorial Program and Project Banks, establishes that the legal framework governing Program and Project Banks is based on five key criteria in the public investment cycle: (i) planning as a support for public investment; (ii) planning tools; (iii) monitoring and evaluation of public investment; (iv) integration of planning and the budget system; and (v) transparency and citizen participation; base criteria for the creation and implementation of the Territorial Program and Project Banks and are configured in the legal recital part of the administrative act creating the Bank.

Method

For the development of this work, projective research was used through the development of a proposal, through which we sought to solve the research problem identified and posed in a practical way, trying to respond through assumptions based on the initial information.

On the other hand, a non-experimental and cross-sectional field research design was applied, with a mixed approach (quantitative-qualitative).

With the mixed approach applied, it was possible to obtain specific information that helped in the valid formulation of the conclusions, the purpose of which was to find the coherent relationships of the study variables.

Deduction and comparison were used as analysis techniques, the results of which made it possible to infer the answers to the questions Why and How, through the observation of the municipal administration's philosophy and the bank of current projects on the platform; a SWOT analysis was also applied to the municipal administration and the survey model applied was the OPM3.

An analysis was also made of the bank of current projects in the virtual platform of the Mayor's Office of Chinácota.

SPSS was used to process the information and descriptive and inferential statistics were applied for the analysis and treatment of the results.

The following steps were taken to analyze the results:

- Determine the unit of analysis.

- Codify the units (assignment of categories).
- Collect data.
- Review data (reading and observation).
- Organize and tabulate data.
- Analyze and discuss results.
- Generate conclusions and/or explanations.

Information was collected through the SWOT analysis, which allowed adapting the appropriate OPM3 type survey, in its different areas of knowledge, to determine the performance of the project officers.

The development of the study allowed identifying the variables of the problem, such as the lack of efforts to improve some management practices, programs and project portfolios, not being able to determine if they are delivering the expected results in time, scope and costs. Likewise, in the absence of a structured project office, the main gaps in project management and performance cannot be found and solved, which leads to the lack of clear processes in planning, budget structure and execution; the organization has limited itself to executing public administration guidelines, without further improving its management levels.

Based on the methodological design applied, the type of study was developed and applied to a universe and sampling unit, using validated instruments to collect data and analyze the results of the information and data collected.

In addition, the research had a conceptual baseline, it started as descriptive and ended as an explanatory research; it was descriptive because it was estimated to characterize the vision, mission and organizational structure of the Chinácota mayor's office; SWOT analysis, which allowed adapting the OPM3 survey form, in its different areas of knowledge.

The instruments were applied in the areas of knowledge: Time, Scope, Quality, Integration, Procurement, Communications, Costs, Stakeholders, Human Resources and Risks.

And with the categories of variables, the explanatory technique was applied because the effects and possible consequences related to the identified problem were determined in order to determine the impacts of the lack of efforts within the municipal administration to improve some practices in the administration, programs and project portfolios; ~~also,~~since there is no structured project office, it is not possible to solve the gaps in project management and performance, leading to the lack of definition of clear processes in planning, budget structure and execution; only the organization has limited itself to execute the guidelines of the public administration in project management, without worrying about improving its management levels.

Official arrangements were made with the municipal administration to access the information and to apply the Maturity Model in the organizational context of project management, and the authorization to carry out the study and meet the objectives set out in this research; the secretary of planning was the key informant in the information gatheringprocess.

Once the information was collected, it was classified, the SWOT was immediately applied to the municipal administration and the OPM3 survey in its different areas of knowledge, the analysis of the Philosophy of the Mayor's Office and a description of the Project Bank; bibliographic information was also reviewed to support the study.

For the description and analysis of the results, descriptive statistics and graphic representation were applied, and the results obtained according to the study variables and categories were shown in tables; this representation made it possible to analyze the data with a mixed approach.

In addition, it is specified that the correlations of causality are factors that originate the central problem identified and that through inferential statistics the general conclusions of the research were determined for the universe and sample unit case of study; also, the degree of reliability and significance of the results obtained, were initiated with formal interviews by applying a pilot instrument to the municipal administration officials. Subsequently, the degree of agreement between a group of items (K) and a group of characteristics (n) was measured, resulting in ordinal responses. In addition, the survey instrument was validated in terms of content (applying Kendall's concordance coefficient), reliability (used to measure internal consistency by calculating Cronbach's Alpha coefficient) and construct (referring to the correlation of the total domain). Also, a validation instrument was determined for the items-dominance, clarity, impartiality or biases and observations framed in the scenarios of concordance and non-concordance of criteria. In terms of parameters, the correspondence showed representative technical quality by applying appropriate language. In general, the survey instrument was validated in its content; the factor index was used to evaluate the items of the instrument in order to establish their correlation, achieving the reliability of consistent and coherent results; a capture index greater than 0.7 was obtained with a high relationship between the items of the instrument. On the other hand, the feasibility of performing a factorial analysis was determined; and the validity of the construct had characteristics of valid scientific utility in the design of the instrument with a previously designed pattern that allowed measuring the variables that were sought to be measured, this allowed explaining the maximum information implicit in the data, and in its significance evidenced a remarkable correlation. In conclusion, the validation of the instrument was based on the reliability, content and construct parameters, factors that were favorable, the results were validated and therefore it was feasible to apply to the selected sample unit.

Results

The results obtained allowed enriching, modifying and/or perfecting the scientific and empirical theory of this research, with the contribution of knowledge about the object of study and the research methods applied.

In practice, the science and the contribution of the information treatment allowed to transmit a better approach to the results obtained and of great utility, hence the socialization of the results; it was also important to show a summary of the construction of knowledge on the project research for the topic and case study raised on the Maturity Model for the management of projects in the public sector in the Municipality of Chinácota.

OPM3 model application (Municipality of Chinácota - Case Study)

Prior to the results obtained, the philosophy of the Mayor's Office of Chinácota (Mission and Vision) is shown in Table 1 and Figure 2 shows the organization chart of the municipal administration, while Table 3 details the Maturity Process Flow of the Mayor's Office of Chinácota-Colombia.

Table 1
Current philosophy of the Mayor's Office of Chinácota

Mission	Vision
Improve the quality of life of the people of Chinacot, through the development and implementation of projects that tend to solve the problems of education, health and housing, and the realization of infrastructure works (roads and services, especially) that serve to attract private investment. With the consequent generation of employment for the population.	To turn Chinácota into a tourist destination at the level of the best in the country, attracting visitors from all over the country and abroad, and to position the municipality as the first in its category by 2023.

Note: Source: Chinacota Mayor's Office (2020). http://www.chinacota-nortedesantander.gov.co/alcaldia/mision-y-vision

Figure 2. Chinácota Mayor's Office Organizational Chart

Note: Source: Chinacota Mayor's Office (2020). http://www.chinacotanortedesantander.gov.co/alcaldia/organigrama.

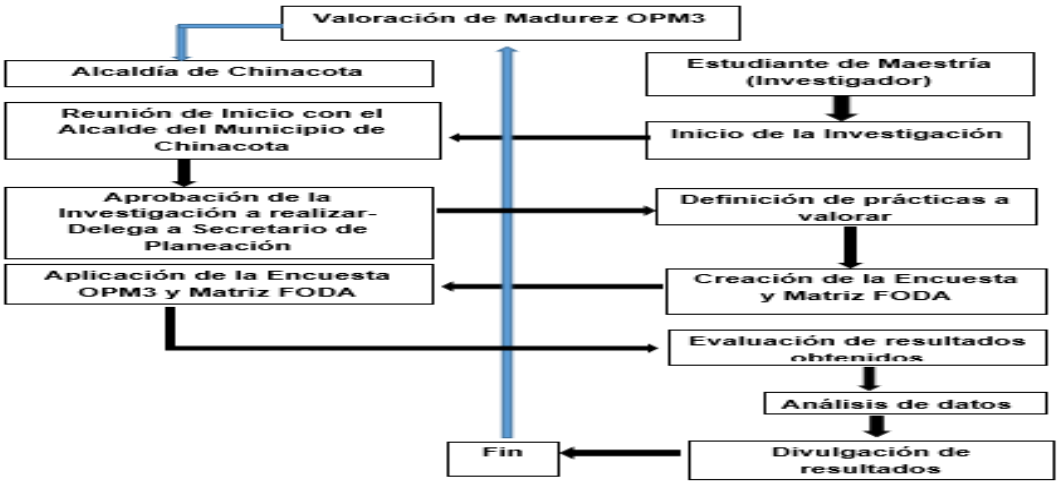

Figure 3. Maturity process flow of the Chinácota-Colombia Mayor's Office

The results of the SWOT analysis are shown in Table 2, which shows all the Strengths, Weaknesses, Opportunities and Threats of the internal and external context in which the organization operates.

Table 2
SWOT Matrix - Projects Area of the Mayor's Office of Chinácota

Aspects	Favorable	Unfavorable
	Strengths	Weaknesses
Internal Analysis	1. It has a legalized administrative structure. 2. Continuous learning and updating of new trends in project management. 3. Sufficient personnel.	1. Incomplete administrative structure. 2. Insufficient resources for its operation. 3. Document management (limited archiving and no technological automation) 4. Apathy in processes of continuous improvement of projects improvement processes. 5. Limited schedule due to project time availability.
	Opportunities	Threats.
External Analysis	1. Population growth. 2. New EOT (Territorial Organization Scheme). 3. New planning tools. 4. Generate expectations in project maturity.	1. High demand for public resources due to population growth. 2. Corruption. 3. The COVID 19 pandemic 4. Public order. 5. Resistance to change due to new directions in project management.

In the research only the organizational maturity in the project domain was evaluated, for the effect 182 questions were taken in its different areas of knowledge and processes; specifically, for the variables constructive processes, a weighted valuation was applied to select in an objective way the degree of valuation of the indicators, and to be able to determine the areas of knowledge to the case study.

Table 3 and Figure 3 below show the results of the construction processes variable. The total relation of the number of processes of the different areas of knowledge object of the investigation, it was possible to establish that the project management in the municipal administration, only within its development plan is governed to comply with the requirements

demanded by the public administration in the projects, within its Development Plan (partial compliance) of 100%.

Table 3
Relationship of the number of processes of the areas of knowledge

Type of Management	Process group total	Percentage of application (%)
Time Management	27	14,84%
Scope Management	23	12,64%
Quality Management	11	6,04%
Integration Management	23	12,64%
Procurement Management	16	8,79%
Communication Management	16	8,79%
Cost Management	16	8,79%
Stakeholder Management	16	8,79%
Human Resources Management	15	8,24%
Risk Management	19	10,44%
TOTAL	182	100%

It can be seen in Table 4, that in Time Management its application corresponded to 14.84% and in Quality Management it was 6.04%, corresponding to the maximum and minimum applied when relating them to the groups of processes in accordance with the types of management.

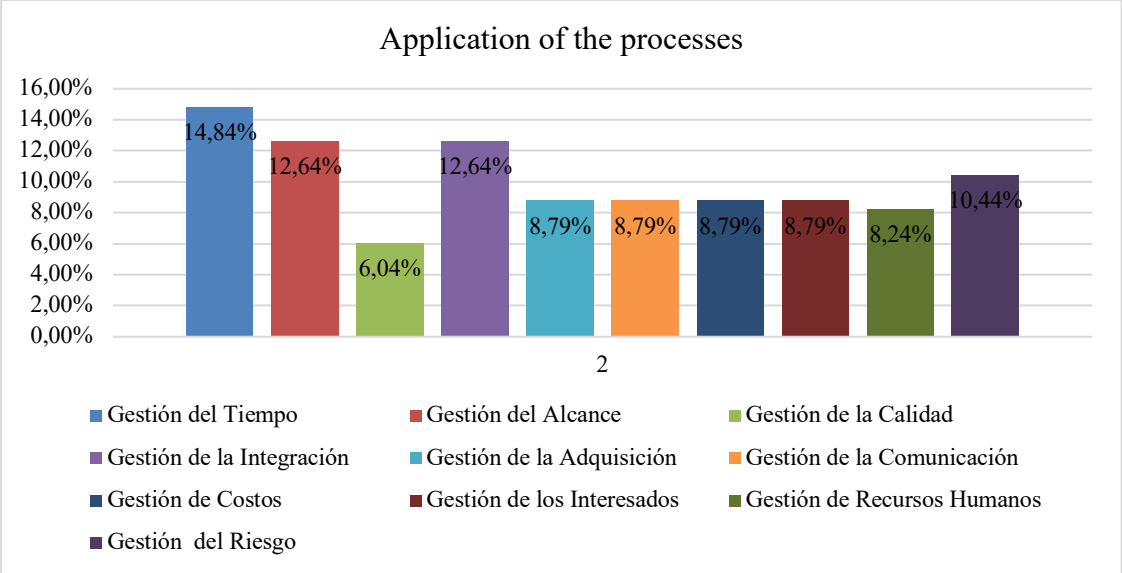

Figure 4. Percentages of the number of processes in the areas of knowledge

Figure 4 shows that according to the 182 questions applied in all the organization's knowledge areas, from 11 (quality management) to 27 (time management) questions were used as a minimum and maximum in each of the areas.

Table 4 and Figure 5 show the results of the degree of maturity by category. For this work, the level of maturity in the Chinácota Mayor's Office was evaluated in the project domain, in the best practices, whose maximum total score is 182 questions, which were distributed by categories as follows:

Table 4
Maturity level by category

Category	Maximum Score	Score Obtained	Degree of Compliance
Measurement	182	47	25,82%
Control	182	47	25,82%
Improvement	182	47	25,82%
Standardization	182	41	22,53%

Practically, the resulting degree of compliance by category was equal in all (25.82%) and usually the trend of the degree of compliance corresponds to a quarter of the maximum permissible score.

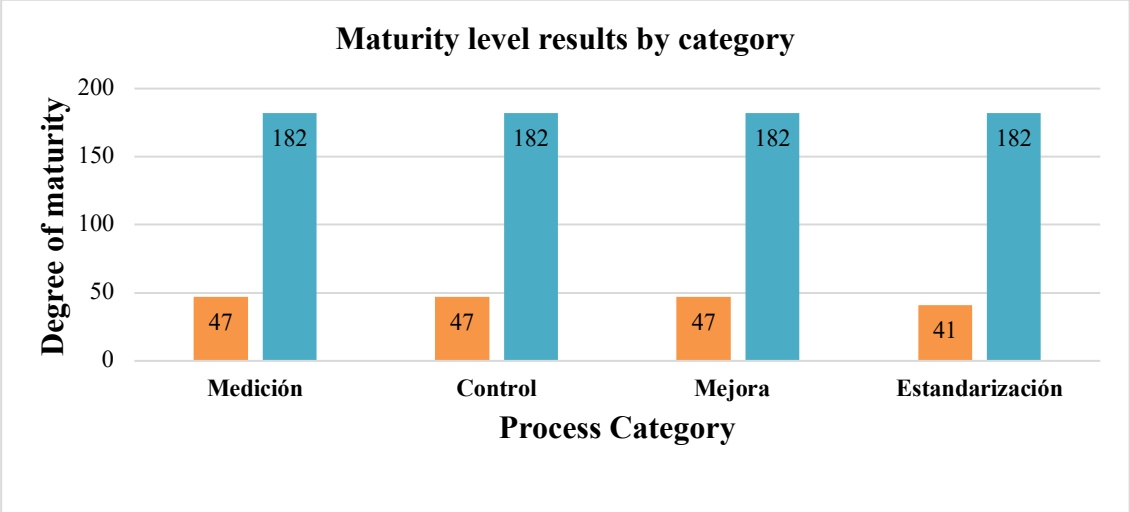

Figure 5. Maturity level by category

Table 5 shows the degree of maturity in project management compliance in general of the Chinácota Mayor's Office in the project domain, distributed as follows:

Table 5
Degree of maturity by category in Project Management-Mayor's Office of Chinacota.

Average number of internships	45,5
Actual number of questions applied and investigated	182
Average degree of compliance	24,99%

Note: Own elaboration. Field work

It is evident that in project management the average maturity level per category is 24.99% in 45.5 average practices.

In the Municipality of Chinácota, eight (8) projects were identified and registered in the virtual platform of the Project Bank, whose characterization is detailed in Table 6.

Table 6
Project database - Project exchange - Chinacota's Mayor's Office

Project Name	Validity	Creation	Type of Resources	Value ($)
Strengthening of the Justice and Security Sector, Fiscal Year 2019.	2019	26/11/2018	Own	$ 186. 000.000.00
			Free destination	$ 35. 000.000.00
			SGP-Free Investment	$ 68. 000.000.00
			Total	$ 289. 000.000. 00
Strengthening of the Environmental Sector.	2019	30/11/2018	Free destination	$ 88.400.000,00
			SGP-Free Investment	$ 31.000.000,00
			Total	$ 119.400.000,00
Strengthening of the Education Sector.	2019	19/11/2018	Own	$ 156.600.000,00
			SGP - Food	$ 58.000.000,00
			SGP- Education	$ 462.000.000,00
			Total	$ 676.600.000,00
Strengthening of the Sports and Recreation Sector 2019.	2019	21/11/2018	Own	$ 2.000.000,00
			Free destination	$ 35.000.000,00
			SGP-Sport.	$ 37.000.000,00
			Total	$ 74.000.000,00
Strengthening of the Community Development Sector, effective 2019.	2019	27/11/2018	SGP-Free Investment	$ 10.000.000,00
			Total	$ 10.000.000,00
Strengthening of the Equipment Sector for 2019.	2019	04/12/2018	Own	$ 7.800.000,00
			Free destination	$ 30.000.000,00
			SGP-Free Investment	$ 20.000.000,00
			Total	$ 57.800.000,00
Strengthening of the Agricultural and Livestock Sector, 2019.	2019	28/11/2018	Free destination	$ 40.000.000,00
			SGP-Free Investment	$ 94.000.000,00
			Total	$ 134.000.000,00
Strengthening of the Prison Sector, 2019.	2019	07/12/2018	Own	$ 5.000.000,00
			Total	$ 5.000.000,00

Note: Source: Chinacota Mayor's Office (2020). http://www.chinacota-nortedesantander.gov.co/banco-de-proyectos-2019/fortalecimiento-al-sector-deporte-y-recreacion-en-la

It is noted that all projects were created in 2018 and were in force throughout 2019, of which at least seven (7) had mixed resources (own, free destination-investment, SGP-Free investment). Only one (1) had its own resources.

The results obtained for the management variable under study (see Table 7) are related to the number of processes of the different areas of knowledge, and based on a scalar table of weighted valuation, the survey aligned to OPM3 was applied with a total of 182, whose degree of valuation was 100%, and also shows the percentage of participation of each one with its resulting interpretation:

Table 7
Relationship of the number of indicators of the areas of knowledge

Type of Management	Indicators	Participation	Interpretation
Time Management	Monitoring and control. Planning	14,84 %	It is evident that in the assessed process, the projects executed by the municipal administration are within the contractual terms and the control within the minimum established limits.
Scope Management	Monitoring and control. Planning.	12,64%	The projects meet their contractual objective.
Quality Management	Monitoring and control. Planning. Execution	6,04%	The quality of the projects is within the contractual parameters of their required technical specifications.
Integration Management	Monitoring and control. Planning. Execution Home Closing	12,64%	It identifies, defines, combines, unifies and coordinates the processes and activities of the related projects in force.
Procurement Management	Monitoring and control. Planning. Execution Closing	8,79%	Procurement management processes are coordinated with suppliers and contractors.
Communication Management	Monitoring and control. Planning. Execution	8,79%	Informationis socialized with stakeholders, the information to be communicated is official, essential and relevant, and communication strategies are applied.
Cost Management	Monitoring and control. Planning	8,79%	The municipal administration estimates, budgets and controls project costs in accordance with the Annual Procurement Operating Plan with certification of budget availability.
Stakeholder Management	Monitoring and control. Planning. Execution Home	8,79%	Municipal administration includes processes to identify individuals, groups or organizations that may affect or be affected by the Project.
Human Resources Management	Planning. Execution	8,24%	The municipal administration organizes the hiring process of the work team according to the profile required for the roles within the technical team of the projects.
Risk Management	Monitoring and control. Planning	10,44%	The municipal administration identifies, assesses, budgets and creates contingency plans for project risks.

The indicators are different for each type of management, the participation results are consistent with those presented in Table 3 and Figure 3.

Regarding the interpretation of the projects in the ex ante evaluation, the distribution of resources according to the number of inhabitants is detailed (See Table 8).

Table 8
Information table - General system of participations and resource distribution

PRIORITY AND SPECIFIC DESTINATIONS	
1. Forced investment or forced investment.	**2. Free investment, free investment or free destination.**
17% of the SGP resources will be distributed among municipalities with a population of less than 25,000. These resources will be used exclusively for investment, in accordance with the powers assigned by law. These resources will be distributed based on the same population and poverty criteria defined by law for the general purpose participation. (Art. 357 Inc. 3º).	The municipalities classified in the fourth, fifth and sixth categories, in accordance with the regulations in force, may freely allocate, for investment and other expenses inherent to the operation of the municipal administration, up to forty-two (42%) of the resources they receive for general purposes, except for those assigned to them because they have less than 25,000 inhabitants. (Art. 357 Inc. 5).

Note: Source: Chinacota Mayor's Office (2020). https://constituciondecolombia.com.co/cpcart357.html.

Details on the OPM3 model cycle related to the number of processes in the knowledge areas are shown in Table 9.

Table 9
Cycle of the OPM3 model applied in municipal administration

Knowledge	It allowed to know the content of the best practices of the project area according to the PMI, and how the OPM3 model should be applied, complemented with the guidelines of the public administration in project management.
Valuation	TheOPM3 survey model was applied, with a total of 182 questions divided into 4 categories of processes, in 10 areas of knowledge related to the project area, the baseline allows the application of continuous improvementprocesses in public project management.
Improvement	The results obtained in the field work, suggests implementing an improvement plan, to increase organizational maturity in the field of public project management, since the organization demonstrates in practice approximately 24% of project maturity, many aspects should be improved.
Repetition	For the case does not apply, the municipal administration must know, value and improve everything related to the field of projects, so as to consolidate better project management processes.

Regarding the situational diagnosis and with the exposed background (research results) and in accordance with the defined variables of the problem and the research objectives set out in this work, the maturity model applied to the organizational context of the Chinácota mayor's office was determined, once the relevant information was collected, the informative data of the case study project was established (See Table 10).

Table 10
Background information on the case study project

1.1. Project Name	Maturity Model applied to the organizational context of Project Management for the Mayor's Office of Chinácota- Colombia.
1.2. Entity	Mayor's Office of Chinácota- Colombia.
1.3. Dependency	Secretary of Planning
1.4. Address	Carrera 4 No. 4-01 Municipal Palace-Barrio El Centro. Chinácota -Norte de Santander.

Discussion and conclusions

On the analysis of the philosophy of the Mayor's Office of Chinácota, this is projected to 2023, as a tourist destination and be at the forefront. But, to do so, it is necessary to lead organized projects, not only in this sector, but it is necessary that these projects are focused on strengthening:

- Primary sector, in respective projects, taking advantage of natural resources and agriculture; generally, they do not involve transformation processes, the products are transferred without added value.
- Secondary Sector, projects that strengthen the manufacturing industry, such as cottage industries, construction and the transformation of materials into a final product.
- Tertiary sector or services, through projects, generating commercial agreements within the municipality with small businessmen, where the municipal administration leads the way, directly attacking the difficult social causes faced and being able to improve competitiveness and development.

The municipality currently faces high poverty rates (90%), as contemplated in the current administration's Development Plan (Page 33); the municipality is in the process of territorial organization and project management must be in line with this.

Likewise, analyzing the organization chart of the municipal administration, there is no clear organization regarding the projects area, nor is there an office that relates all its projects, which does not reflect clarity nor is it coherent with the mission and vision of the Municipality of Chinácota.

The Mayor's Office of Chinácota, whose government executes its Development Plan (2020-2023), based on seven strategic lines and in order to satisfy the needs of its inhabitants. Its welfare is obtained through the execution of projects planned in the fiscal year; although the results have not had a positive perception by the citizens, nor a full compliance with the strategic objectives and project management of the institution; for the variables Bank of projects, which are registered in the virtual platform of the municipal administration, it was evidenced that their projects are formulated with validity of the previous administration, each one approved with its respective budget availability, source of investment and destination; however, they are being executed by the current administration, without any news in the platform of its control, execution, follow-up and closing process; especially, to date the projects are already underfinanced due to sustained increases in inflation, salaries, unit costs, among others, which is a clear indicator of the low management of good practices in project management.

Also, there is no evidence in the project bank platform of the current municipal administration of systematized records of its current projects that are contemplated in the Development Plan; they are only in the budgetary programming in the unified public investment system for the formulation, evaluation, registration, programming, execution and subsequent evaluation of investment projects. It is mandatory to register the investment programs and projects in the Project Bank so that they can be executed during the mayor's term.

The above, it can be concluded that the Mayor's Office of Chinácota, by not having a structured projects office within its administrative distribution officially legalized, no records can be seen in the Bank of projects of the virtual platform; since it has a limited file and it is not systematized, consequently, the document management is insufficient or null, therefore, there is no evidence of solutions to the main gaps in the area of projects of the organization, due to; there is no regulated control of good practices in the handling of project management methodologies by the public sector in the area of projects in its different phases.

On the other hand, for a better understanding of the reader, as a reflection, it is necessary to specify the following question to the case study: Is every need that the municipality has a project? The answer is no, because all the needs derive from a period of municipal administration, they come from the proposal planned in theprevious administration, since it was presented with the government plan of the candidates to the public election position. When elected, all these projects are included in the Development Plan, which becomes a guide of projects to be developed during the four-year period, aligned with the budgetary capacity of the municipality and under the guidelines of the public administration that are planned in the fiscal year in accordance with the National Development Plan; it

is not only enough with the resources, but the municipal administration must meet the current expenditure obligations of the municipality.

In addition, not all the needs of a municipality become an executable project in the medium term, since they are included in the candidate's government plan, and once the candidate wins, they are materialized in the Development Plan, whose projects must be executed in four years; however, what happens with the needs that remain outside the Development Plan, because at this point is where the Mayor has the opportunity to manage outside the Development Plan the registration or prioritization with endorsement of possible projects or longer term in execution, either departmental or national order that generates the entire process of implementation of these projects; it should be noted that these projects also include good practices within them.

On the other hand, the interpretation of results of the study management variable, according to the results obtained regarding the number of processes of the different areas of knowledge, and from a scalar table of weighted valuation, the OPM3 survey was applied with a total of 182 questions asked in the different areas of knowledge, whose degree of valuation was 100% to the proposed case study, and the percentage of participation of each one; its theoretical approach allowed to base the OPM3 Maturity Model for Project Management in the municipal administration; in addition, the legal framework and norms of the Bank of public investment projects in Colombia were analyzed. In conclusion, the resulting degree of maturity was 24.99% (low) related to knowledge, the internal-external factors show problems of inaccurate knowledge within the project area, the existence of a high turnover of its employees was evidenced, there are not enough resources for its management; the practice of projects shows lack of definition and outdated maturity in its management. Also, it was detected that all practices associated with risk management and procurement have excessive bureaucracy, standardization processes have a high degree of compliance in the management of scope, time, integration and risk.

The OPM3 maturity level contributes to the best practices of the project domain and the standardization process towards higher domains and processes, necessary for the competencies of the municipal administration, in order for this to become an opportunity, it must take advantage of the reference contributions of the studied maturity model.

Through the application of the OPM3 model, the Mayor's Office of Chinácota identified the best practices applied by the municipal administration in the maturity of its project management processes, carrying out a survey of processes in the different areas of knowledge, performing internal and external analysis, identifying the inadequate definition of the planning and execution processes, determining the causes of inefficient management and determining the impact results generated by the practices of the maturity model in project management; all this to improve time and budgets, improve life cycles and increase the productivity of projects.

Finally, the design of a proposal for the creation of a knowledge center (PMO) was contemplated in the organizational context of the case study, as a solution to the topic studied, where new currents and perspectives for future research are proposed; this office has the integral components for good management of best practices, programs and project portfolios; furthermore, this center is disaggregated in its design (general description, functions, purpose, location, supply, supply, resources involved, relevant users, constituent elements, identification of the operating unit, investment schedule, risk analysis, among others).

With the Maturity Model applied to the case study, it was of great importance within the analysis of public administration in project management, allowing the socialization of the proposal for the design of a knowledge center (PMO) for the Planning Secretariat of the municipal administration.

With this proposal, in this basic research applying the OPM3 survey model complemented with the analysis of the municipal administration's Project Bank, it became evident that the function and role of the planning secretary has an opportunity for improvement. In particular, strengthen the Project Bank, the formulation and execution, which is typically limited to the registration of an inventory of public investment initiatives, to a higher level of management to ensure project control, monitoring and evaluation.

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INNOVATION MANAGEMENT ACTIVITIES AS EXPLANATORY DETERMINANTS OF THE INNOVATIVE PERFORMANCE OF INDUSTRIAL MSMES IN CORDOBA, ARGENTINA. CASE STUDY 2015-2020

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Summary. This research identifies the performance and management of innovation in micro, small and medium-sized industrial enterprises (MSMEs) in Córdoba, Argentina during the period 2015-2020. The information is taken from a questionnaire applied to 90 companies in the region. Two indices are created, one reflecting innovation management activities and the other reflecting innovation performance. A relevant number of companies assume positive results in their innovative performance, with product innovation and process innovation being the most significant, followed by organizational innovation and commercial innovation. Among the most important innovation management activities that show a low to moderate positive correlation with innovation performance are thepromotion of creativity, prioritization of innovation in business strategy, the design of a marketing strategy and activities related to internationalization, but their causality has not been demonstrated. An analysis that underlies the above is based on considering the multiple factors that affect both performance and innovation management indexes, which are part of a much more complex process strongly conditioned by the external and intrinsic context of the firms.

Key words: Innovation, innovation management, innovative performance.

LAS ACTIVIDADES DE GESTIÓN DE LA INNOVACIÓN COMO DETERMINANTES EXPLICATIVAS DEL DESEMPEÑO INNOVADOR DE LAS MIPYMES INDUSTRIALES EN CÓRDOBA, ARGENTINA. ESTUDIO DE CASO 2015-2020

Resumen. En esta investigación se identifica el desempeño y la gestión de la innovación en las empresas industriales micro, pequeñas y medianas (mipymes) de Córdoba, Argentina durante el periodo 2015-2020. La información se toma a partir de un cuestionario aplicado a 90 empresas de la región. Se crean dos índices, uno que refleja las actividades de gestión de la innovación y otro que refleja el desempeño innovador. Un relevante número de empresas asume resultados positivos en su desempeño innovador, siendo la innovación en productos y la innovación en procesos las más significativas, seguidas por la innovación organizativa y la innovación comercial. Entre las actividades de gestión de la innovación más importantes y que muestran correlacion positiva baja a moderada en el desempeño innovador, se destacan el fomento a la creatividad; la priorización de la innovación en la estrategia empresarial; el diseño de una estrategia de marketing y las actividades relacionadas con la internacionalización, sin embargo, no se demuestra su causalidad. Un análisis que subyace de lo anterior, se basa en considerar los múltiples factores que afectan a los índices tanto de desempeño como de gestión de la innovación y que forman parte de un proceso mucho más complejo y fuertemente condicionado por el contexto externo e intrínseco a las firmas.

Palabras clave: Innovación, gestión de la innovación, desempeño innovador.

Introduction

In a global, dynamic and technologically accessible context, the generation of value is strongly linked to the ability to adapt to this reality. Innovation is not a new concept and is recognized as an instrument capable of promoting the creation and maintenance of competitive advantages, especially if technological capabilities are accumulated and actions are implemented to manage a systematized, disciplined and continuous process.

Therefore, and assuming that innovation proposes to face challenges and risks, sometimes in contexts of great uncertainty, this research is concerned with exploring the implementation and management of innovation activities in industrial MSMEs in Córdoba during the period 2015-2020 as explanatory determinants of their innovative performance. The first challenge requires the design of a research instrument to investigate different innovation management activities and the results of the innovation process, and, based on the data obtained, to propose indicators that reflect the results achieved in a simple way, allowing the analysis of correlation between them.

This approach proposes to contrast, with an alternative approach to pre-existing studies, whether the implementation of systematized practices leading to the innovation process generates an impact on the innovative performance of the analyzed firms. Apparently, there are no studies of these characteristics in the region, so the results derived from this study are intended to be a contribution to the knowledge base applied to the design and execution of public policies and private strategies aimed at promoting the adoption and production of innovation that favor both the social and productive sectors.

Innovation

Numerous studies agree on the importance of innovation for the development of competitiveness in organizations. This is not a new concept; however, the different definitions of innovation that have been published at different times reveal how the concept has evolved. The latest editions of the Oslo Manual (OECD, 2005; OECD, 2018), are proof of this by incorporating to the technological innovations associated with products and processes, innovations of organizational and marketing type evidencing the dynamics and emphasis of their application.

Innovation is understood as a relevant component for economic and social progress, both at the level of organizations and nations. Its management is vital and forms part of the critical processes of any organization. According to Canizales Muñoz (2020), in contemporary trends framed in globalization, innovating is a daily task, which develops from a dynamic, continuous and non-seasonal process. It is an interactive process, the results of which depend on the relationships between different companies, organizations and sectors, as well as on institutional behaviors deeply rooted in each regional or national history (Johnson and Lundvall, 2003).

Thus, the innovation process can be analyzed as the result of collective learning, a consequence of collaborations within the company and between the company and other organizations (Cassiolato et al., 2014). Rojo-Gutiérrez et al. propose the same. (2019), considering that the view of innovation as a process highlights the role of the company, whether to deploy activities in the management of new ideas or in knowledge management, the focus of its importance is concentrated on the benefits it generates through its results.

Innovation management

Based on the definitions of the Virtual Observatory of Technology Transfer (OVTT) (n.d.), and Orozco Barrantes et al. (2017), we will say that it is the managerial capacity over economic and human resources, towards the creation of new ideas and knowledge that allow the development of new products, processes and services or the improvement of existing ones, and the transfer of those same ideas to the manufacturing, distribution and use phases. Several authors, from the most classical to contemporary, highlight the importance of managing innovation, mainly under the premise that order, discipline, monitoring and control in a complex and interactive process are key to obtaining the expected results (Drucker, 1985; Ponti and Ferras, 2008; Seclen Luna and Barrutia Güenaga, 2019; Tidd and Bessant, 2018).

The study of innovation and its management has been complemented with proposals for management models that formulate simplifications of reality in order to be applied and studied. Although they do not offer a universal solution, they facilitate the explanation of a complex reality and the transmission of experiences that can serve as a reference. As progress has been made in the learning and appropriation of the innovation process, models have tried to adapt to the needs and realities of organizations, contemplating their circumstances and singularities, going from being linear models to interactive and networked models, however, many focus on describing the process, rather than defining how to promote the development of the capabilities that the organization has to innovate (García Leonard and Sorhegui Rodríguez, 2020), since these arise from a gradual and cumulative learning process, which accompanies organizational maturity.

Supported by the paradigms proposed by the theory of innovation management models, there are several researches oriented to study and formulate practical models

(Cooper, 2005; Tidd, Bessant and Pavitt, 2005; Trías de Bes and Kotler, 2011; Güell, 2014; Comunidad Design Thinking en español, 2019; Tidd and Bessant, 2018; Chesbrough, 2020). In this research, it takes as reference the one proposed by Tidd and Bessant (2018), who present a simplified model of the innovation process divided into 4 stages: a). search for signals from the environment, b). selection of technological or market opportunities, c). implementation of the innovation, and d). capture of the benefits of innovation.

Figure 1. Innovation management model Source: Adapted from Tidd and Bessant (2018).

We highlight from this proposal the existence of an initial stage leading to the search for innovation opportunities, with the possibility of directing efforts to the open search in the internal and external environment of the organization, giving rise to the generation of ideas from creative processes and the detection of demands and opportunities gathered from the contact networks with other organizations in the environment. The contributions of Rojo-Gutiérrez and Padilla-Oviedo (2018) stand out here, by emphasizing the participation of the individual over the company; the latter being the source and generator of ideas through his creativity and restless attitude in bringing about change. Finally, the management model analyzed contemplates the delivery of value to the client, given that its last stage of value capture could be understood not only as the obtaining of a new product or service, but also with its delivery to the recipient and the appropriation of its results.

Despite the existence of different models, there is no consensus on a single and fully explanatory model of the process that an invention goes through from the time it is developed and brought to market, as suggested by different authors (Tidd et al., 2005; Du Preez and Louw, 2008; Seclen Luna and Barrutia Güenaga, 2019; García Leonard and Sorhegui Rodríguez, 2020), this due, among other factors, to the heterogeneity among companies, their different routines, competencies, capabilities and strategic objectives, however, a series of standard activities that could be applied in different companies stand out.

Innovative performance

We will refer to innovative performance as the result of the innovation process, being the determination of its measurement one of the main concerns of current business management (Arévalo Tomé et al., 2013). The challenge of measuring the impact of innovation activities, proposes to define indicators; in particular, a performance indicator is presented as an instrument for measuring the main variables associated with the fulfillment of objectives, being also a quantitative and/or qualitative expression of what is intended to be achieved (García Cediel and Castillo Bautista, 2016).

In order to design an indicator that reflects innovative performance, it should be mentioned that it can be oriented to different aspects and methodologies, according to the context in which it is to be implemented. Based on this, different works have been examined that expose different perspectives on how to approach the measurement of innovative performance, among which stand out those oriented towards the product (Córdoba Vega and Naranjo Valencia, 2017; Arias Pérez and Lozada, 2018; Coaquira Nina et al., 2019; Quinteros Camacho et al., 2019), from those that take other relevant dimensions such as process performance, capabilities, resources, and social and environmental responsibility (Gecheng et al., 2021salaiza et al., 2020; Shahla et al. 2020; Vega Sampayo et al., 2020; Valencia-Rodríguez, 2015; Garcia Velázquez et al. 2015, Arévalo Tomé et al., 2013; Canizales Muñoz, 2020).

Other recent studies, complementarily, emphasize the analysis of firms' innovative performance through the number of published patents (Chen, Chen and Vanhaverbeke, 2011; García et al., 2013; Sánchez Muñoz 2014) and on firms' linkage and cooperation processes with external organizations (Parrilli and Heras, 2016; Vélez et al., 2019; UNESCO, 2017; Radicic et al., 2019; Parrilli et al., 2020).

Method

A case study was chosen as the research methodology. The collection of data on the study variables is obtained from the design and application of a questionnaire that is chosen as an appropriate research instrument to contact the MSMEs that are key references. Subsequently, the method for systematizing the data is outlined, the most significant data are selected and a unit of measurement used to analyze the correlation of the variables chosen is designed.

Based on the correlation analysis, it is expected to provide an answer to the question: What are the innovation management activities implemented by industrial MSMEs in Córdoba, Argentina, and to what extent do they explain their innovative performance?

The research design presents a mixed, non-experimental and correlational-causal approach and is aimed at verifying the proposed hypothesis:

- H0: Innovative performance is not better among companies that implement innovation management activities in a systematized way.
- H1: Companies that implement innovation management activities in a systematized way obtain better results in their innovative performance than companies that do not

Case study

The study is conducted in companies classified as industrial MSMEs, according to Resolution 220/2019 (SECPYME, 2019), located in the province of Córdoba, Argentina. On the other hand, the companies that are active and registered in the Industrial Information System of Cordoba (SIIC, 2019), in the 2019 operating year, were considered. The selected companies are invited to participate in a questionnaire to collect information on the variables analyzed in the research. The results presented here are part of a pilot study on a sample of 90 companies from different sectors of activity and location in the province, which seeks to test the validity of the methods and procedures used.

Variables

The variables proposed for the study are: innovation management activities (independent variable of a qualitative nature) and innovation performance (dependent variable of a qualitative nature). Tables 1 and 2 specify the variables in order to identify the dimensions for their measurement.

Table 1

Variable operationalization matrix Innovation Management Activities

Variables	Conceptual Definition	Dimensions	Indicators Operational definition
INNOVATION MANAGEMENT ACTIVITIES Independent variable	Activities, methods or processes aimed at increasing the creation of new knowledge, generating ideas to develop new products, processes and services or improve existing ones, and the transfer of these same ideas to the manufacturing, distribution and use phases.	Search for innovation opportunities	Internal input of ideas.
			Contribution of external ideas.
			Evaluation of ideas.
			Application of ideas.
			Encouragement of creativity.
			Technology Watch
			Market research.
		Opportunity selection	Innovation strategy.
			Market validation.
			Formulation of innovation projects.
			R&D activities.
			Investment in Technology.
			Implementation or application of quality systems.
		Innovation implementation	Management of financial resources for innovation projects.
			Project management.
			Knowledge management.
			Relationship with universities, innovation centers, specialized consultants.
			Marketing strategy.
		Value capture	Internationalization.
			Intellectual property.
			Interaction with other companies.

			Post-launch innovation follow-up.

Note: The study variable Innovation Management Activities is conceptually and operationally defined based on Tidd and Bessant (2018). Source: Own elaboration based on Cohen and Gómez (2019).

Table 2
Operationalization matrix of variable Innovative performance

Variables	Conceptual Definition	Dimensions	Indicators Operational definition
INNOVATIVE PERFORMANCE *Dependent variable*	Results of the innovation process.	Product innovation	Market introduction of new product/service.
			Introduction to the market of significant improvements in existing products/services.
		Innovation in process	Introduction of new production method.
			Introduction of new distribution method.
			Significant improvement of processes related to the environment.
		Commercial innovation	Introduction of new marketing method.
			Introduction of new design or presentation of the product/service.
			Introduction of innovative pricing and promotional policies.
		Organizational innovation	Introduction of a new organizational method applied to business practices.
			Introduction of a new method of work organization.
			Introduction of external relations of the company.

Note: The study variable Innovative Performance is defined conceptually and operationally, based on the classification of innovation proposed in OECD (2018). Source: Own elaboration based on Cohen and Gómez (2019).

From the data obtained, we seek to establish the correlation between the variables. For the particular case, and under the assumption that the distribution is not normal, the Spearman's rank correlation coefficient (Rho) is determined, being a measure of

correlation for variables at an ordinal level of measurement, where individuals or sample units can be ordered by ranks (Hernández Sampieri et al., 2014).

Considering the most influential factors that emerge from the aforementioned correlation, a quantitative indicator is designed for each of the variables, called: Innovation Performance Index (IDI) and Innovation Management Activities Indicator (AGI). The construction of these indexes makes it possible to generate a *ranking* among the participating companies, to order them according to their innovative performance through IDI and to analyze their behavior.

Research instrument

To collect the required data, a specific instrument was designed, for which the background of previous studies provided relevant information on the methods and practices used. This is a questionnaire that is distributed among the selected MSMEs. For the design of the instrument, the proposal of agile and closed questions and statements was taken into account in order to facilitate participation. The questionnaire was structured in three sections: I- general data related to the company; II- implementation of innovation management activities; and III- innovative performance of the firm. Given the characteristics of the issues to be investigated, the instrument is oriented to the strategic level of the organization.

In order to determine the validity of the instrument, it was initially applied to a technology-based company with a recognized innovative trajectory, with the purpose of evaluating its applicability and functionality, as well as the opinions of experts. Likewise, Cronbach's alpha reliability statistic was used to determine internal consistency.

Parameterization of variables

In order to evaluate the independent variable, a Likert-type scale was applied, as a set of items presented in the form of statements that seek to measure the subject's reaction in categories (Hernández Sampieri et al., 2014). For the purpose of designing the aforementioned statements, the innovation management model proposed in Tidd and Bessant (2018) has been taken as a reference. A set of statements aimed at assessing the respondent's perceptions is formulated on a qualitative scale and then translated into a quantitative equivalence with possible values of: 1 to 5, with 1 being the minimum or null and 5 the maximum.

According to the stages proposed by the model, innovation management activities were classified as follows: I- Search for opportunities for innovation; II- Selection of opportunities for innovation, III- Implementation of innovation and IV- Capture of value from innovation. Based on this, a total of 22 assertions were made. The responses were oriented to assess the respondent's perceptions according to different criteria.

Table 3
Scale for measuring the qualitative variable AGI.

Appraisal criterion	1	2	3	4	5
Agree or disagree	Strongly disagree	Disagreeme nt	Undecided	Agreed	Totally agree
Frequency	Null	Download	Media	High	Very high
Importance	Unimportant	Minority	Moderately important	Important	Very important
Level or degree of valuation	Null	Download	Media	High	Very High

Note: Own elaboration based on Cohen and Gómez (2019).

Regarding the dependent variable, closed questions were proposed on aspects related to the outcome of the innovative process, taking into account the classification of innovation presented in the Oslo Manual (2018). This classification has been chosen because of its application in various studies and settings, with the understanding that it facilitates comparability between studies, as well as its applicability to other research.

Specifically, to study this variable, questions were designed and asked about the 4 categories of innovation, according to their classification as: I- Product innovation; II- Process innovation; III- Commercial innovation; and IV- Organizational innovation. On this basis, a total of 11 questions were posed. The possible answers were defined in a closed manner and are intended to eliminate or reduce the subjective perception of the respondent, so that the answer is conducive to defining the achievement, or not, of innovative results. The possible answers are: "Yes", "No", "In process". It is worth noting the mention of the response "In process", with the understanding that companies that did not achieve results, but are in the process of achieving them, require a differentiated valuation, in line with the definition of potentially innovative firms identified in the Bogota Manual (Jaramillo et al., 2001).

Table 4
Rating scale of the dependent variable

Factors	*Subfactors*	*Possible answers*	*Quantitative valuation*
F1: Product innovation	F1.1: New products	Yes	3
	F1.2: Significant improvements to existing products.	No	1
		In process	2
F2: Innovation in Process	F2.1: New processes.	Yes	3
	F2.2: Significant process improvements	No	1
	F2.3: Improvements to reduce environmental impact or working conditions	In process	2
F3: Commercial Innovation	F3.1: New marketing methods	Yes	3
	F3.2: Improvements in product design or presentation.	No	1
	F3.3: New pricing policies and promotions.	In process	2
F4: Organizational Innovation	F4.1: New organizational methods applied to business practices.	Yes	3
	F4.2: New methods of work organization.	No	1
	F4.3: External relations	In process	2

Note: Own elaboration based on Cohen and Gómez (2019).

In summary, among the 22 statements related to innovation management and the 11 questions related to innovative performance, 33 responses were obtained for each of the companies that participated in the study and, for each one, quantitative values were assigned as detailed in Tables 3 and 4, above.

Data analysis.

The data obtained in the defined collection process were coded and transferred to an error-free matrix for analysis. This required the application of *software* for statistical analysis, in this case the InfoStat program (InfoStat, 2020). Based on the most influential aspects of the variables under study provided by the correlation analysis, we proceeded to design a quantitative indicator representative of each of the variables quantitative indicator representative of each of the variables: Innovative Performance Index (IDI) and Innovation Management Activities Indicator (AGI), defined as follows:

$$AGI_i \equiv \sum_{j=1}^{4} \sum_{k_j=1}^{M_j} \left(g_j * w_{k_j} * X_{k_j,i} \right)$$

Where:
AGIi= Innovation Management Activities Indicator of company i;

j = 1: "A- Innovation opportunities," 2: "B- Selection of innovation opportunities", 3: "C- Implementation of innovation," 4: "D- Value capture of innovation."
kj = question number k of factor j;
Mj = total number of questions associated with factor j;
gj = weighting value of factor j in AGIi;
wkj = weighting value of question kj in relation to factor j;
$Xkj_{,\,i}$ = value of company i's response to question kj.
Then, the weights of each of the j factors being equivalent to each other:
$\sum_{j=1}^{4} g_j = 1$with: g1 = g2 = g3 = g4 = ¼,
the weightings of each question in relation to factor j are also equivalent to each other:
$\sum_{k_j=1}^{M_j} w_{k_j} = 1$; with: wkj = 1/Mj (∀j),
and defining:

$$x_{j,i} = \sum_{k_j=1}^{M_j} \left(\frac{X_{k_j,i}}{M_j} \right)$$

as the simple average of the values of company i's answers to the questions associated with factor j;
we can then express AGIi as:

Equation 1
Indicator of Innovation Management Activities - AGI

$$AGI_i = \frac{\sum_{j=1}^{4} (x_{j,i})}{4}$$

The results obtained for this indicator will be between 1 and 5, indicating its qualitative assessment and its quantitative correspondence, according to the following table:

Table 5
Quantitative equivalence of AGI

Qualitative assessment	Quantitative valuation
Very high	5
High	4
Moderate	3
Under	2
Very Low - Nil	1

Note: Own elaboration.

IDI Formula

$$IDI_i \equiv \sum_{p=1}^{4} \sum_{q_p=1}^{H_p} \left(d_p * w_{q_p} * Y_{q_p,i} \right)$$

Where:
IDIi= Innovative performance index of company i;

p = 1: "A- Product innovation", 2: "B-Innovation in process," 3: "C- Commercial innovation", 4: "D- Organizational innovation;
qp = question number q of factor p;
Hp = total number of questions of factor p;
dp = weighting value of factor p in the IDIi;
wqp = weighting value of question qp in relation to factor p;
Yqp, i = value of company i's response to question qp.
Therefore, the weights of each of the p factors being equivalent:
$\sum_{p=1}^{4} d_p = 1$with: d1 = d2 = d3 = d4 = ¼,
the weightings of each question in relation to factor j are also equivalent to each other:
$\sum_{q_p=1}^{H_p} w_{q_p} = 1$; with: wqp = 1/Hp (∀p),
and defining:

$$y_{p,i} = \sum_{q_p=1}^{H_p} \left(\frac{Y_{q_p,i}}{H_p} \right)$$

as the simple average of the values of company i's answers to the questions associated with factor p;
we can express the IDIi as:

Equation 2
Innovative Performance Index IDI

$$IDI_i = \frac{\sum_{p=1}^{4} (y_{p,i})}{4}$$

The results obtained for this indicator will be between 1 and 3, indicating its qualitative assessment and its quantitative correspondence, according to the following table:

Table 6
IDI quantitative equivalence

Qualitative assessment	Quantitative valuation
High	3
Medium	2
Null	1

Note: Own elaboration based on Cohen and Gómez (2019).

Results

The research instrument designed for the study is evaluated as reliable according to the internal consistency analysis obtained through the Cronbach's Alpha reliability statistic, which yields a value of 0.9473. After its application in 90 companies, a descriptive statistical analysis of each of the variables under study was carried out. Subsequently, an inferential statistical analysis was performed to determine the potential for a significant correlation between the two variables, inferring whether and to what extent the implementation of innovation management activities explains the results in innovation performance.

Descriptive statistical analysis

Innovation Management Activities

In order to describe the results obtained on the application of innovation management activities, an analysis of each of the stages of the process is presented.

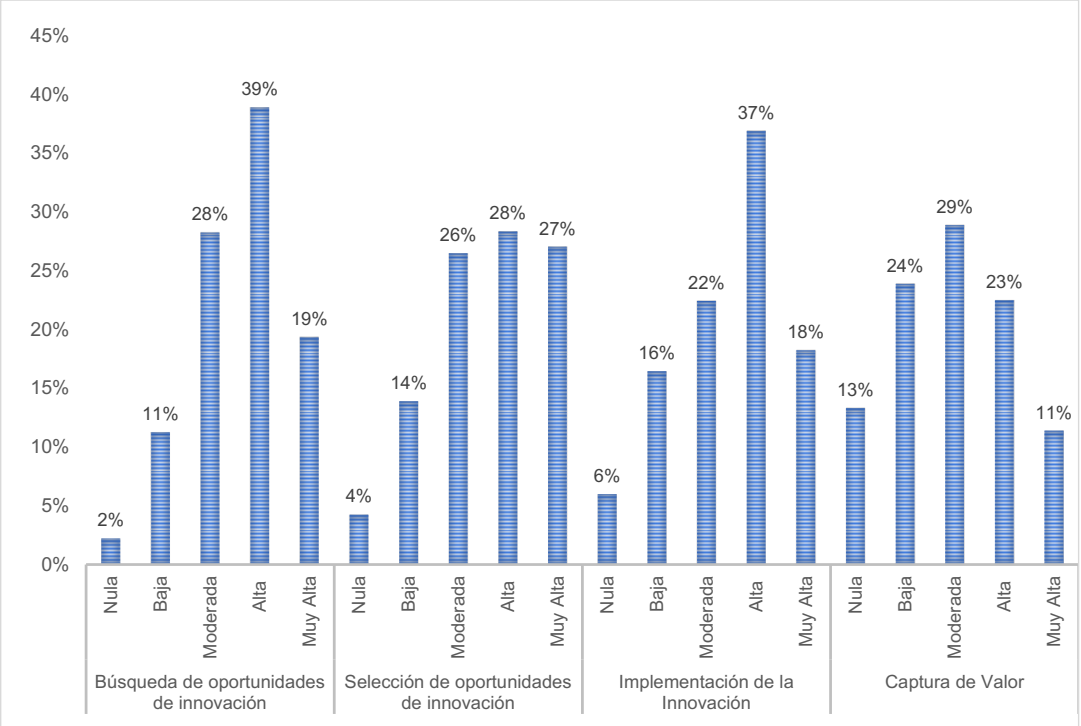

Figure 2. Descriptive analysis of IGAs

Highlighting the "high" and "very high" ratings for each of the aspects, it can be seen that, on average, the implementation of innovation management activities is uniformly applied among the companies analyzed. Actions related to the search for innovation opportunities are valued as the most frequent and important (58% of the companies analyzed), while the selection of innovation opportunities and implementation of innovation represent 55% in both cases, however, the actions of selection of opportunities are distinguished, since the "very high" valuation is higher in comparison with the implementation actions. Actions related to value capture are among the least valued and least frequent for this group of companies, with "high" and "very high" ratings occurring in only 34% of the cases, while 37% of the ratings are "null" and "low".

Indeed, it stands out, taking the "high" and "very high" ratings, that the importance and frequency in the implementation of actions related to innovation management is ordered as: 1- Search for Innovation Opportunities, 2- Selection of Innovation Opportunities, 3- Innovation Implementation and 4- Innovation Value Capture. The following graph shows more clearly the order of weightings referred to above.

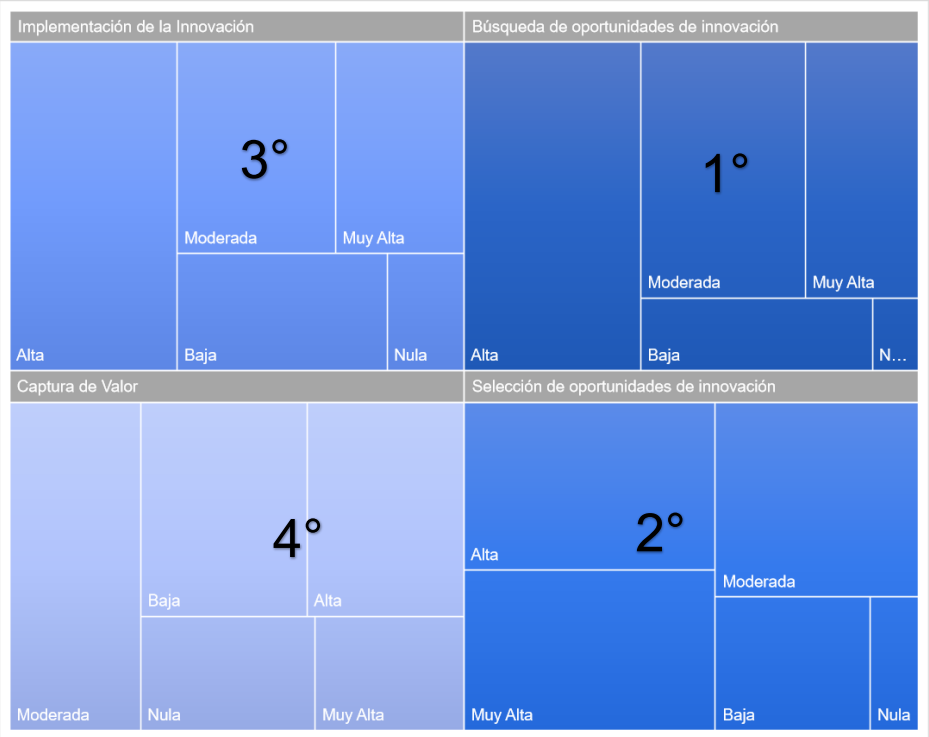

Figure 3. Order of relevance of the IGA valuation

Innovative performance outcome

In order to describe the results related to innovative performance for the 90 participating companies, the analysis by type of innovation proposed for the operationalization of this variable is presented.

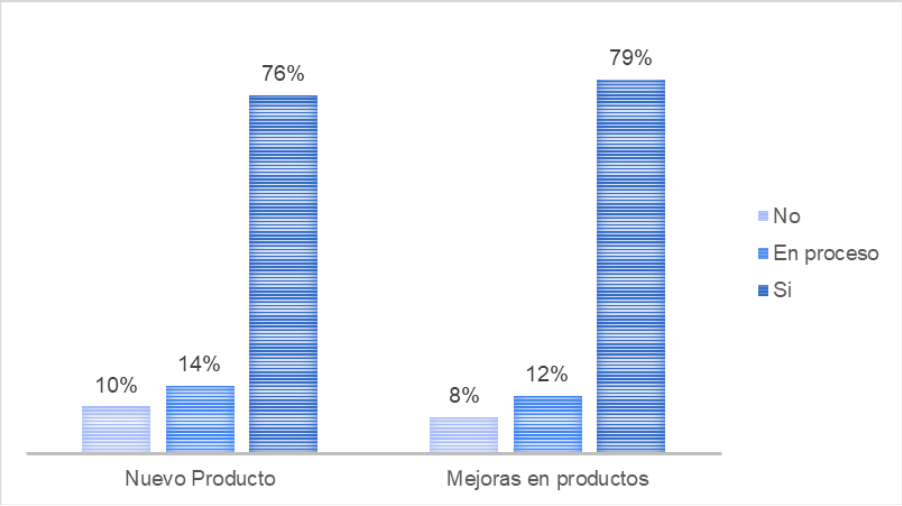

Figure 4. Product innovation

The results support a good innovative performance, with more than 90% of companies having implemented product innovations or being potentially innovative.

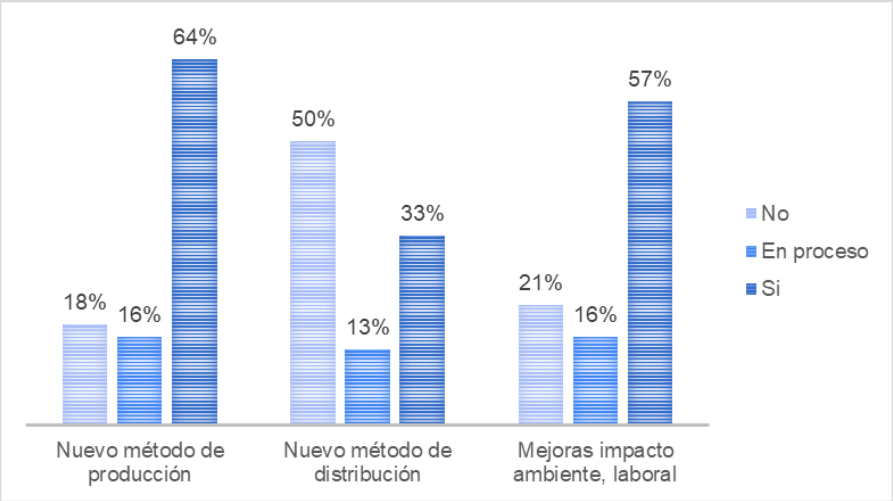

Figure 5. Process innovation

The information obtained shows a high percentage of companies that innovate in production methods and processes that result in better environmental and labor performance, or are in the process of doing so. The lesser focus on innovation in new distribution methods is significant.

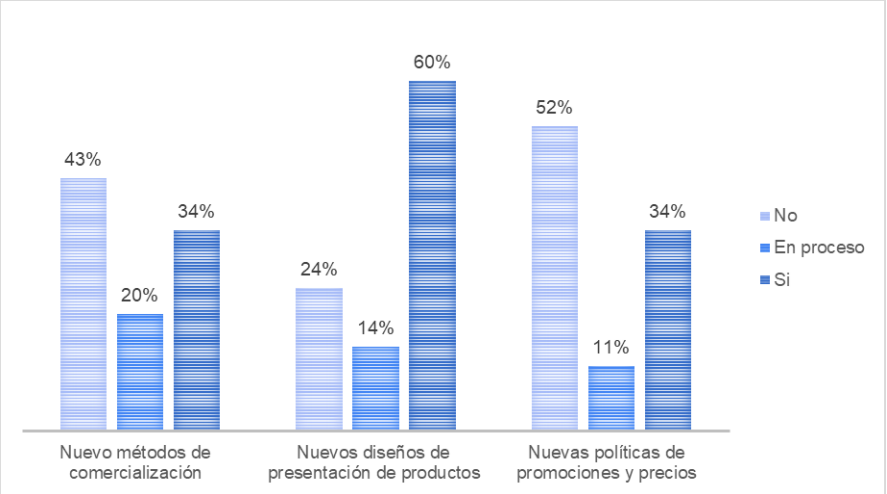

Figure 6. Commercial innovation

It is highlighted that, for commercial innovation, about half of the companies are innovative or potentially innovative and the other half have not achieved results in that aspect.

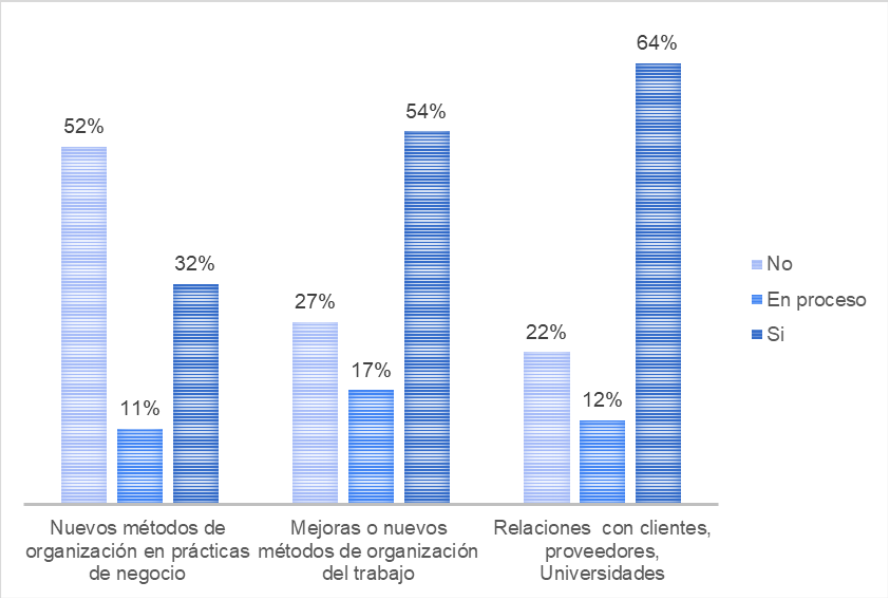

Figure 7. Organizational innovation

It is observed that organizational innovation is mostly oriented to the relationship with actors of the innovation system and to introduce improvements in work organization methods.

In order to obtain an overall view of the innovative performance variable and to highlight preliminary conclusions, a better innovative performance is observed in the following order: 1- Product innovation, 2- Process innovation, 3- Organizational innovation and 4- Commercial innovation, graphically represented below.

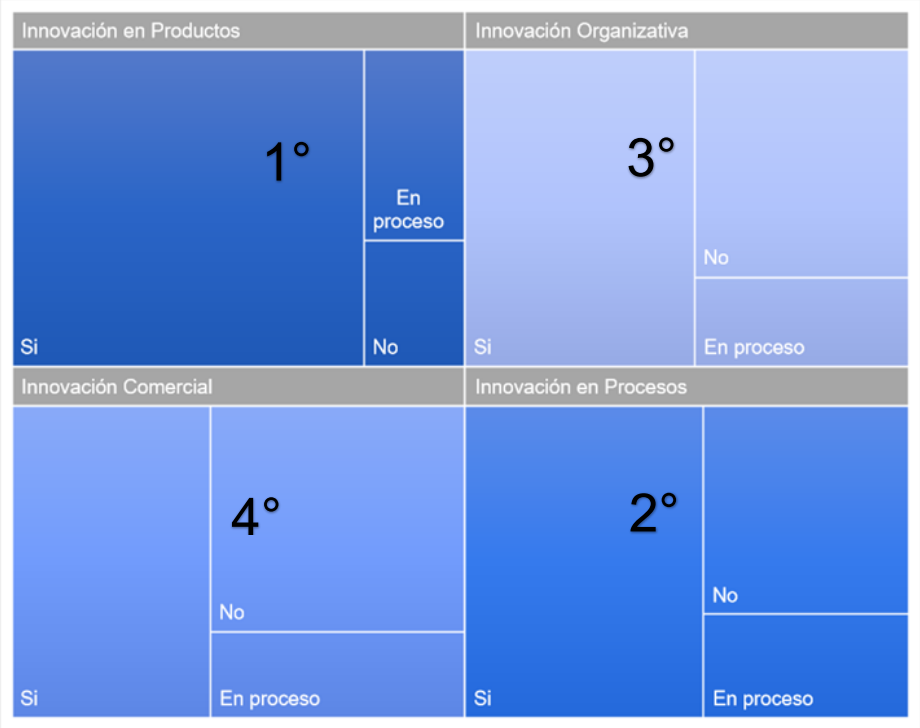

Figure 8. Ranking order of Innovative Performance by type of innovation

A first conclusion from the descriptive analysis suggests that, at the aggregate level, there is a relevant weighting of the different factors proposed to measure innovation

management activities, as well as innovative performance. In the analysis proposed below, we will seek to infer the correlation between the variables.

Inferential statistical analysis

Correlation coefficient

Having corroborated, through the Lilliefors test based on the Kolmogorov-Smirnov goodness-of-fit test , that the variables do not have a normal distribution, the Spearman correlation nonparametric statistical test was applied , obtaining a matrix of 242 data from the association of the 22 questions proposed for the independent variable and 11 for the dependent variable. On this basis, the most influential or significant relationships or associations were determined, using the critical Rho, which, for a sample size of 90 and a significance level of 0.05, is 0.207.

It is noted that, in most cases, there is a positive correlation; however, most of the associations are considered weak or statistically insignificant, with the value of the correlation coefficient below the critical coefficient. Of the 242 associations, 79 are above the critical Rho, i.e. 32.65%.

In order to reduce the information subject to analysis, the sub-factors of the independent variable considered irrelevant were eliminated from the original matrix, applying the criterion of discarding the sub-factors whose simple averages of their correlation coefficients are less than 0.207. Thus,a reduced correlation matrix is presented. Hereafter, this information will be used to advance the proposed inferential model.

Table 7
Reduced Correlation Matrix

	Independent Variable - Factors	**AGI A**	**AGI B**	**AGI C**	**AGI D**
Dependent Variable - Factors	**Sub-Factors**	Encouraging creativity	Innovation in business strategy	Marketing strategy	Internationalization.
Product Innovation	New products.	0.190	0.230	0.150	0.100
	Significant improvements to existing products.	0.150	0.300	-0.030	0.150
Innovation in Process	New processes.	0.250	0.300	0.060	0.320
	Significant process improvements.	0.240	0.180	0.310	0.360
	Improvements to reduce environmental impact or labor conditions.	0.230	0.180	0.190	0.150
Commercial Innovation	New marketing methods.	0.190	0.160	0.320	0.270
	Improvements in product design or presentation.	0.120	0.120	0.150	0.080
	New pricing policies and promotions.	0.180	0.260	0.380	0.130
Organizational Innovation	New organizational methods applied to business practices.	0.280	0.280	0.350	0.430
	New methods of work organization.	0.270	0.170	0.140	0.230
	External relations with clients, suppliers, universities, etc.	0.240	0.100	0.190	0.300

Note: Correlation between IDI and AGI of highest significance.

IDI and AGI indicators

Based on the application of the formulas developed for each variable (Equation 1 and Equation 2), the values of each indicator were calculated for each of the companies surveyed. The results obtained are presented graphically, ordered by company, according to their highest IDI and corresponding AGI.

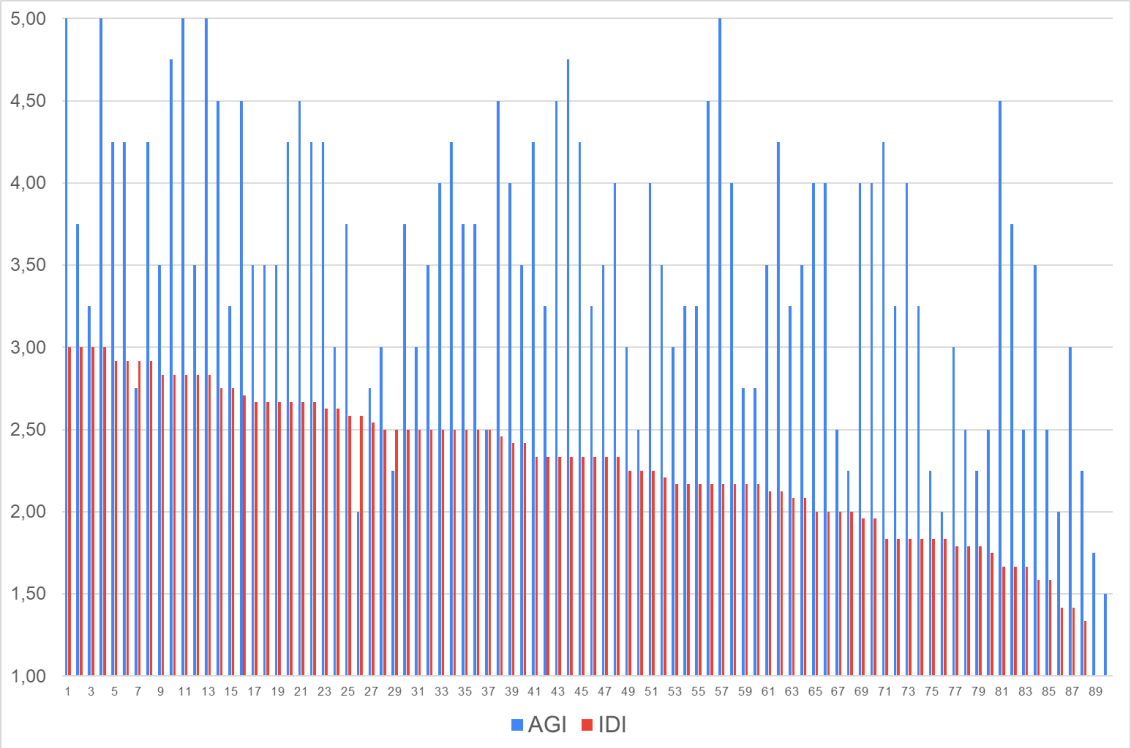

Figure 9. Ranking of companies according to IDI.

The information available makes it possible to explore, by using the statistical tool of linear regression analysis, whether the results obtained fit a linear equation, attempting to reflect the behavior of the companies in relation to the problem posed, contrasting the proposed hypothesis. These results are presented below.

Table 8
Linear regression analysis

Variable	N	R^2	R^2 Adj	ECMP	AIC	BIC
IDI	90	0.27	0.26	0.26	0.16	90.86	98.36

Coef	Est.	E.E.	LI(95%)	LS(95%)	T	p-value	CpMallows	VIF
const	1.29	0.18	0.94	1.64	7.26	<0.0001		
AGI	0.28	0.05	0.18	0.38	5.72	<0.0001	33.31	1.00

Note: Linear regression analysis using InfoStat, (2020).

Based on this information, it is possible to define the following equation:

Equation 3

$$\mathcal{Y} = 1{,}29 + 0{,}28 * x$$

Where:

$\mathcal{Y}$=IDI

x = AGI

It is observed that, although it is not a determining factor, it shows an explanatory tendency for the phenomenon studied. Graphically, from the visualization of the dispersion we obtain:

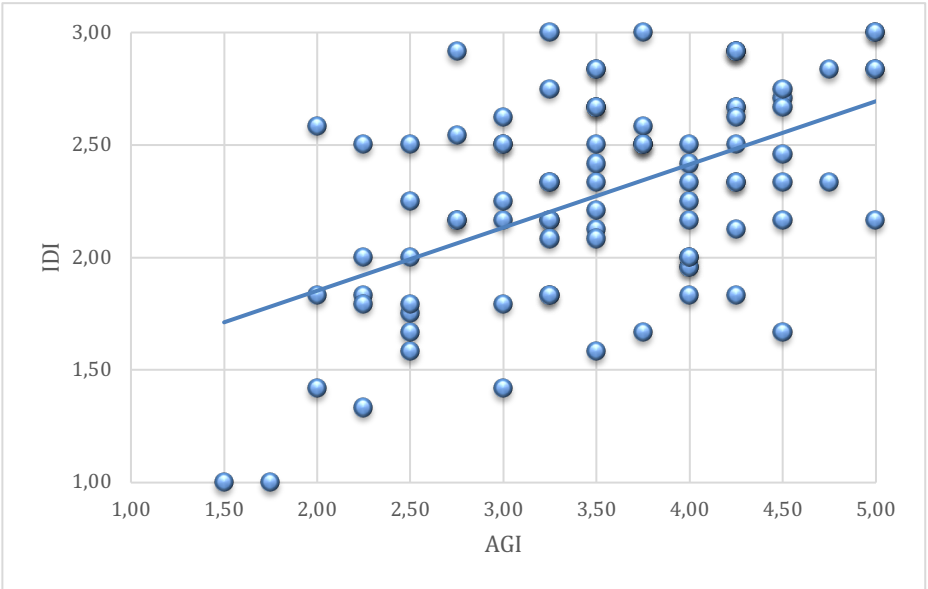

Figure 10. Scatter plot of the results. Linear regression analysis

Discussion and conclusions

The preliminary studies proposed for this research expose the relevance of accumulating scientific knowledge on innovation, particularly in its application and results. It is also necessary to consolidate regional studies that allow comparisons with other regions, assuming that different cultures, social realities, geographic and economic conditions may lead to dissimilar results, even in the face of equivalent strategies.

On the other hand, research oriented towards real cases contributes to the analysis of current dynamics and circumstances, while proposing a structured and rigorous knowledge base on which to base the design of innovation-oriented public policies, as well as business strategies, based on the study of their own realities rather than attempting to extrapolate actions and results derived from external experiences.

From the descriptive analysis of the study variables, it can be seen, on the one hand, a good assessment in the application of innovation management activities among the companies studied, highlighting the activities related to the search for innovation opportunities as those with the highest application, followed by those related to the selection of innovation opportunities, implementation and value capture. On the other hand, a relevant number of companies assume a good performance in their innovative performance, being product innovation and process innovation the most significant, followed by organizational and commercial innovation.

Returning to the research question, the pilot study presented here makes it possible to put the proposed methodology into practice and reach the first conclusions on the question formulated. It can be seen from the results obtained that the activities promoting creativity, prioritizing innovation in business strategy and designing a marketing strategy show a positive correlation in innovative performance, although it is low, while the activities related to internationalization in companies show a moderate positive correlation, although causality has not been demonstrated.

In the hypothesis test, the null hypothesis is rejected, since the results show an explanatory trend for the phenomenon studied, although it is not decisive. An analysis that underlies the above is based on considering the multiple factors that affect the

variables, being a much more complex process and strongly conditioned by the external and intrinsic context of the firms, concluding that the execution and management of innovative activities does not constitute, by itself, a causal factor of the innovation index achieved.

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ANALYSIS OF THE PERFORMANCE LEVEL OF MEGAPROJECTS IN CAMEROON: THE CASE OF THE SECOND WOURI BRIDGE CONSTRUCTION PROJECT

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Abstract. Many organizations and project management practitioners are focusing on project performance. In recent years, Cameroon has embarked on major construction projects that could potentially be considered mega-projects, such as the construction of the second bridge over the Wouri River. The general objective of this study was to analyze the level of performance of the second bridge construction project over the Wouri River. This research was developed from a qualitative and quantitative approach. This research chose the semi-structured interview through a questionnaire and the documentary research as instruments of data collection. The participants consisted of a representative of the contracting authority, a representative of the project owner, a representative of the head of the contracting department, a representative of the contracting engineer, a representative of the assistant to the project owner, and two representatives of the company carrying out the work. The data collected was analyzed using the data analysis software Statistical Package for the Social Sciences (SPSS) and EXCEL software. The results show that the deadlines and costs of execution were not respected but the level of quality initially planned was respected. The results of this research are similar to the findings of OPS (2011), Standish group (2018), and PMI (2015) regarding project performance research that has a high percentage of failure in megaprojects.

Keywords: Performance, megaproject, construction project.

ANÁLISIS DEL NIVEL DE RENDIMIENTO DE MEGAPROJETS EN CAMERÚN: CASO DEL PROYECTO DE CONSTRUCCIÓN DEL SEGUNDO PUENTE SOBRE EL WOURI

Resumen. Varias organizaciones y profesionales de la gestión de proyectos centran su atención en el desempeño en la realización de proyectos. Durante varios años, Camerún se ha dedicado a la realización de grandes proyectos

de construcción potencialmente comparables a megaproyectos, como el proyecto de construcción del segundo puente sobre el Wouri. El objetivo general de este estudio fue analizar el nivel de desempeño del proyecto para construir el segundo puente sobre el Wouri. Esta investigación se desarrolló a partir de un enfoque cualitativo por un lado y un enfoque cuantitativo por el otro. Esta investigación eligió la entrevista semiestructurada a través de un cuestionario y la investigación documental como instrumentos de recolección de datos. Los participantes estaban compuestos por un representante de la autoridad contratante, un representante del propietario del proyecto, un representante del jefe del servicio contratado, un representante del ingeniero contratado, un representante del asistente del propietario del proyecto y dos representantes de la empresa que realiza el trabajo. Los datos recopilados se analizaron utilizando el software de análisis de datos Statistical Package for the Social Sciences (SPSS) y el software EXCEL. Parece que no se cumplieron los plazos y costes de ejecución, pero se cumplió el nivel de calidad inicialmente previsto. Los resultados de esta investigación son similares a los hallazgos de OPS (2011), Standish group (2018) y PMI (2015) en cuanto a investigaciones sobre el desempeño de proyectos con alto porcentaje de fallas en megaproyectos.

Palabras clave: Rendimiento, megaproyecto, proyecto de construcción

Introduction

Performance in project delivery is the focus of attention in many organizations. Research on project performance shows a high percentage of failure in mega-projects (Strategic Projects Observatory, 2011; Standish group, 2018). Project performance or success can be seen as the ability to deliver projects on time, on budget and to the required technical specifications (Atkinson, 1999; Westerveld, 2003). In recent years, we have witnessed the realization of large construction sites in Cameroon that can potentially be assimilated to mega construction projects in accordance with the definition of COST (2011), which states that a mega-project is a structuring initiative with a very high financial envelope, a significant political interest, and a considerable impact on the environment and on communities.

Questioning and studying the performance of mega-projects in Cameroon is of paramount importance. This research analyzed the level of performance of construction mega-projects in Cameroon more specifically that of the second bridge construction project over the Wouri River. Thus, it was possible to verify the validity of the findings of OPS (2011) and Standish group (2018) about the performance of mega-projects in the Cameroonian context.

The performance of projects focuses on their ability to be executed on time and within cost, while respecting technical requirements (Atkinson, 1999; Westerveld, 2003). This study highlights the gaps between the time, cost and quality objectives initially projected by project stakeholders and what was achieved. The results of this analysis are intended to draw the attention of construction actors to their performance in the realization of mega-projects and to a possible reframing of their project management.

Research has shown that large engineering and construction projects are highly complex. These projects are characterized by large-scale construction works, many stakeholders and interfaces, complicated systems and a lack of standardization (An and Shuai, 2011; Russell, 2013). According to Atkinson (1999) and Westerveld (2003), a project is said to perform or succeed when it is delivered on time and within budget while meeting the defined quality level. Flyvbjerg (2014) presents the mega-projects with historical cost overruns around the world in Table 1.

Table 1
Megaprojects with historical cost overruns worldwide.

Projects	Cost overrun (%)
Suez Canal, Egypt	1 900
Scottish Parliament Building, Scotland	1 600
Sydney Opera House, Australia	1 400
Montreal Summer Olympics, Canada	1 300
Concorde Supersonic Aeroplane, UK, France	1 100
Troy and Grenfield Railroad, USA	900
Excalibur Smart Projectile, USA, Sweden	650
Canadian Firearms Registry, Canada	590
Lake Placid Winter Olympics, USA	560
Medicare transaction system, USA	560
Bank of Norway headquarters, Norway	440
Furka Base Tunnel, Switzerland	300
Verrazano Narrow Bridge, USA	280
Bostorn's Big Dig Artery/Tunnel project, USA	220
Denver International Airport, USA	200
Panama Canal, Panama	200
Minneapolis Hiawatha light rail line, USA	190
Humber Bridge, UK	180
Dublin Port Tunnel, Ireland	160
Montreal Metro Laval extension, Canada	160
Copenhagen Metro, Denmark	150
Boston-New York-Washington Railway, USA	130
Great Belt Rail Tunnel, Denmark	120
London Limehouse Road Tunnel, UK	110
Brooklyn Bridge, USA	100
Shinkansen Joetsu high-speed rail line, Japan	100
Channel Tunnel, UK, France	80
Karlsruhe-Bretten light rail, Germany	80
London Jubilee Line extension, UK	80
Bangkok Metro, Thailand	70
Mexico City Metroline, Mexico	60
High-speed Rail Line South, The Netherlands	60
Great Belt East Bridge, Denmark	50

Note: Taken from Flyvbjerg (2014).

Several organizations have addressed the issue of project performance, such as the Standish Group International, the Project Management Institute (PMI) and the Strategic Projects Observatory (SPO). The work of these organizations draws attention to the high percentage of project failures in general and mega-projects. The following paragraphs present empirical data from these different organizations on project performance.

Data from Standish Group International

In its 2019 report, Standish Group International has published the results of a survey of over 50,000 projects. According to the organization, only 16.2% of projects were deemed successful by being completed on time and on budget, with all the qualities promised. Most projects, 52.7%, were over cost, completed late or lacked the qualities promised. These results provide ample evidence that projects are struggling to achieve the desired performance. Table

2 shows the percentages of successful, unsuccessful, and troubled projects between 1994 and 2014 (Standish group, 2015).

Table 2
Percentage of successful, unsuccessful, and problematic projects

Year	Success	Difficulty	Failure
1994	16%	53%	31%
1996	27%	33%	40%
1998	26%	46%	28%
2000	28%	49%	23%
2002	34%	51%	15%
2006	29%	53%	18%
2009	32%	44%	24%
2010	37%	42%	21%
2012	39%	43%	18%
2014	28%	55%	17%

Note: Taken from Standish group (2015).

According to Table 2, on average 30% of the projects analyzed by Standish Group were successful and about 27% were unsuccessful. There is a high percentage of projects in difficulty with an average of 46%.

Data from Project Management Institute

A study was carried out in 2011 by the Project Management Institute (PMI) on nearly 1000 project management actors (Mahamoudou, 2016). According to the results of this work, projects that do not achieve the predefined objectives constitute about 36%. This shows that even organizations with a good command of project management find it difficult to achieve the objectives of time, quality, and cost simultaneously. PMI (2015) notes that companies lose an average of USD 109 million of every billion invested in their megaprojects as a result of managerial failures. As a result, only 52% of megaprojects stay within their initial budget.

According to the Project Management Institute's (PMI) Pulse of the profession 2018 survey of 5,402 companies, around 70% of projects tend to fail. Projects with a budget of more than $1 million are 50% more likely to fail than projects with a budget of less than $350,000. Only 2.5% of companies complete all their projects all the time (PMI, 2018).

Data from the Strategic Projects Observatory

Mahamadou (2016) points out that the Strategic Projects Observatory (SPO) studies on the level of performance of strategic projects in Europe showed that almost 47% of the managers interviewed stated that about 26% of their projects failed in terms of time, cost and quality. The study revealed that most managers surveyed felt that in more than 15% of cases projects were abandoned.

In view of the percentages of failure reported by organizations such as the PMI, the Standish Group and the Strategic Projects Observatory, it can be noted that in several countries around the world, mega-projects are struggling to achieve the performance targets set by the construction industry. This observation leads us to question the contextualization of this observation, particularly the case of Cameroon. For some years now, we have been witnessing the implementation of major construction projects in Cameroon that can potentially be assimilated to mega construction projects in accordance with the definition of COST (2011), following the example of the project to build the second bridge over the Wouri. The question then arises whether construction megaprojects in Cameroon achieve the desired levels of

performance from project inception. In other words, are mega construction projects successful in Cameroon?

To answer this question, a review was made of a particular case that refers to the Wouri bridge construction project. In this regard, what is the performance level of the second Wouri bridge construction project? It is very likely that the level of performance of the construction project of the second bridge over the river is low. To conduct this research, three specific hypotheses were stated. The first hypothesis stated that the execution deadlines were not respected in the construction of the second bridge over the Wouri. The second hypothesis supported the idea that the execution costs were not respected in the construction of the second bridge over the Wouri. The third hypothesis claimed that the quality level initially planned was not respected in the execution of the project to build the second bridge over the Wouri.

The general objective of this study was to analyze the performance level of the second bridge construction project over the Wouri River. This research had three specific objectives. Firstly, it was necessary to analyze the level of performance of the Wouri second bridge construction project from the point of view of respect of deadlines, secondly to evaluate the level of performance of the Wouri second bridge construction project from the point of view of respect of costs and finally to study the level of performance of the Wouri second bridge construction project from the point of view of respect of quality.

In view of the above objectives, and after having presented the method used to conduct this study, this research was first applied to carry out an evaluation of the level of performance of the construction project of the second bridge over the Wouri from the point of view of respect of deadlines. Secondly, it analyzed the level of performance of the construction project of the second bridge over the Wouri from the point of view of the respect of costs. Finally, it analyzed the level of performance of the construction project of the second bridge over the Wouri from the point of view of respect for quality.

Method

Design

This research was developed from a qualitative and quantitative approach. A review of the literature on the performance of megaprojects was conducted in order to connect to previous research on the subject. The use of a data collection device allowed for efficient data collection in the field. Analysis of the data using data analysis software allowed for scientific interpretation of the results.

Participants

This study concerned mega construction projects in Cameroon, particularly the project for the construction of the second bridge over the Wouri River, and the population was made up of the actors of this project. The participants in this study included a representative of the contracting authority, a representative of the project owner, a representative of the head of the contracting department, a representative of the contracting engineer, a representative of the assistant to the project owner, and two representatives of the company carrying out the work (a member of the project management and a person in charge of the project quality department). Table 3 specifies the roles of each actor in the project.

Table 3
Roles of actors in the construction project of second bridge over the Wouri River

Actors	Role in the project
Contracting authority	He is the signatory of the contract and ensures its proper functioning. He also ensures the control of the effectiveness of the services during the execution through the General Directorate of Controls of Public Contracts.
Project owner	He represents the beneficiary administration of the services
Head of Contract Department	He ensures compliance with the administrative, technical and financial clauses at the stage of definition, preparation, execution and acceptance of the services covered by the contract. He represents the project owner in the relevant bodies and reports to them.
Contract Engineer	He is responsible for the technical and financial monitoring of the contract. He reports to the Contract Manager.
Assistant to the Contracting Authority	He is responsible for defending the project owner's interests at the stage of the definition, preparation, execution and acceptance of the services covered by the contract.
Contractor performing the services	*He is responsible for the design and implementation of the project.*

Note: Taken from this research.

Data collection instrument

This research chose the semi-structured interview as the data collection instrument. The interview evoked a structured research technique such as questionnaires. It should be noted that literature research also provided a solid basis for the collection of information in this study. Indeed, studies by Myers (1997) suggest that interviews and literature should be used primarily as a source of data.

Semi-structured interviews

The objective of these semi-structured interviews was to collect data about the performance of the second Wouri bridge construction project. The interview can be seen as an exchange with the purpose of the study (Gavard-Perret, Gotteland, Haon and Jolibert, 2012). According to these authors, the data collected during an interview is a production of both the interviewee and the interviewer. Thus, to produce the information necessary to achieve the study objectives, this research collected data through interactions with the construction actors involved in the project. The information was collected by answering the questionnaire proposed and validated by Ika (2011) about the key success factors of development aid projects. The participant had to provide information about the delay, cost and quality of the project. Each participant had to choose the means of data collection with which he or she felt comfortable to provide the maximum amount of information,

The various actors in the mega-projects selected for this study were contacted by e-mail, by phone call or in person. The location of the interview was agreed with the participant and was adapted to their schedule. The interviews were conducted in a relaxed and unpressured manner to allow the participants to open and offer objective data that is important for the research.

Literature review

The literature review was a very important and crucial step in carrying out this research. Thus, a first literature review was related to general readings about the research. This literature review targeted scientific and professional writings related to the problematic of the study. This literature review was open throughout the research.

As the research progressed, the readings became more and more focused. Contracts and meeting reports were of paramount importance. These documents provided an insight into the megaproject, tracking its progress from inception to assess its performance. Reading about megaprojects around the world and the performance of construction projects in general has been a focus of this research. The various research studies on the performance of mega-projects have identified the views of different researchers and practitioners in project management.

With the advent of new information and communication technologies, the Internet has proven to be a very useful tool in the data collection process. However, the use of webography has been done with great caution and common sense. Although not a traditional method of documentary analysis, this technique of information gathering had an important place in the conduct of this study.

Data analysis

This study used content analysis. The processing consisted in extracting useful and usable elements from the collected data, capable of defining the level of performance of the second bridge construction project on the Wouri. Data analysis recommends proper processing and interpretation of the data collected. The data was therefore analyzed and interpreted to bring out all its subtleties to draw reliable conclusions.

During this phase, the data collected during the data collection phase was coded manually to make it processable by data analysis software. In this work, data analysis was carried out using data analysis software. Microsoft Excel was also used to tabulate the numerical data.

The information was collected with the consent of the participants. The data collected was coded to be treated confidentially. The data was only used for the purpose of this research and the anonymity of the participant was respected.

Results

This section analyses the performance level of the second Wouri bridge construction project in terms of timeliness, cost, and quality.

Presentation of the data

The questionnaire proposed by Ika (2011) with questions on project success criteria was submitted to the various project stakeholders. Each stakeholder interviewed gave their views on a scale of 1 to 7. Table 4 shows what the different values on this scale represent.

Table 4
Value of the measurement range

Value of the sample	Correspondence
1	Disagree completely
2	Somewhat disagree
4	Neither agree nor disagree
7	Agree completely

Note: Taken from Ika (2011).

The data collected was analyzed using Statistical Package for the Social Sciences (SPSS) and EXCEL data analysis software. Table 5 presents the minimum, maximum and average values as well as the standard deviation of the scores attributed to each success criterion by the stakeholders of the second Wouri bridge construction project.

Table 5
Value of the measurement range

Code	Project Success Criteria	Min	Max	Avg	Standard deviation
CPT	Completion Of The Project Within The Timeframe	1	6	3,43	1,90
AIIO	Achievement Of The Initially Identified Objectives	5	7	5,71	0,76
DPROQS	Delivery Of The Project To The Required Quality And Standards	4	7	5,29	0,95
GBM	*Good Budget Management*	*5*	*7*	*6,14*	*0,69*

Note: Taken from this research.

Analysis of the level of performance of the second Wouri bridge construction project in terms of meeting deadlines

The main contract N°306/M/MINTP/CCPM-AI/2013 relating to the construction works of the second bridge over the Wouri was notified on 04 March 2013. This contract had a global execution period of forty-four (44) months for all the services (design and execution). This period was divided into two parts, the design part being eight (08) months and the execution part being thirty-six (36) months. By Service Order N°0306/OS/MINMAP/SG/DGMI/DMTR/CE2/2013 notified on 15 March 2013, the project owner prescribed the start of the services. Thus, the project end date initially planned was 15 November 2016 (AMO Final Report, February 2019).

On 06 February 2015, the project owner notified a Service Order N°0272/OS/MINTP/SG/DGTI/DOA/DOA20 extending by three (03) months the execution period of the design phase. This was followed by Amendment 1 notified on 13 January 2016 bringing the design phase deadline to eleven (11) months, but the duration of the execution phase was maintained at thirty-six (36) months. It should be noted that this extension of the design phase did not impact the overall duration of the project (AMO Final Report, February 2019).

On 20 January 2015, a dredging boat hit the deck of the jetty, causing severe damage to the structure, and preventing work from continuing for three (03) weeks (AMO Final Report, February 2019). After the restarting of the works of the implementation phase, the appearance of new constraints related to the management of traffic in the port area following the commissioning of a new cement plant located in the right-of-way of the project led the project owner to take several decisions relating to the scope of the project. These decisions were regularized by Amendment 2 and thus brought the end of the works to 19 September 2018.

Following the commissioning of this new cement plant within the project's right-of-way, the project owner decided to undertake several actions. This led to the signing of contract N°426/M/MINMAP/CCPM-TR/2015, notified on 14 December 2015. This contract concerned the realization of the additional installations of the project of Design / Realization of the second bridge on the Wouri for a global execution time of the whole of the services studies and works

of twenty-eight (28) months. This period comprised two parts, namely one (1) month for the design phase and twenty-seven (27) months for the execution phase. The timetable and phasing of the works was compromised due to certain constraints on the release of rights of way. This led to the signing of amendment 1 to the supplementary contract bringing the end of the work to 19 September 2018.

New constraints relating to the disturbances recorded in the exploitation of the quarry, whose aggregates were used to make the foundation and asphalt layers, led to another change in the schedule. This change was confirmed by the project owner through Service Order N°1421/OS/MINTP/SG/DGTI/DOA/DOA20/DOA22 notified on 28 September 2018. Thus, the end of the works for the execution of the two contracts (main contract and supplementary contract) was set at 15 December 2018. Table 6 shows the time consumption and progress of the works for the period January 2018 to February 2019. In this table, the consumption of time has been calculated from the notification of the service order prescribing the start of the services.

Table 6
Consumption of time versus progress of the construction of the second bridge over the Wouri from January 2018 to February 2019

PERIOD	MAIN CONTRACTS		COMPLEMENTARY CONTRACTS	
	Time consumption	Progress of work	Time consumption	Progress of work
Jan-18	131,8%	96,24%	89,29%	75,11%
Mar-18	136,36%	97,36%	96,43%	80,20%
Apr-18	138,64%	97,36%	100%	82,18%
Jul-18	145,45%	97,57%	110,71%	87,13%
Sep-18	150,00%	98,80%	117,86%	90,10%
Oct-18	152,27%	98,90%	121,43%	95,00%
Dec-18	156,82%	99,98%	128,57%	99,90%
Jan -19	159,09%	99,99%	132,14%	99,99%
Feb -19	161,36%	100%	135,71%	100%

Note: taken from PW2 project activity report summaries (January 2018 to February 2019).

Figures 1 and 2 show the work progress and time consumption curves for the period January 2018 to February 2019 for the execution of the main contract and the supplementary contract respectively.

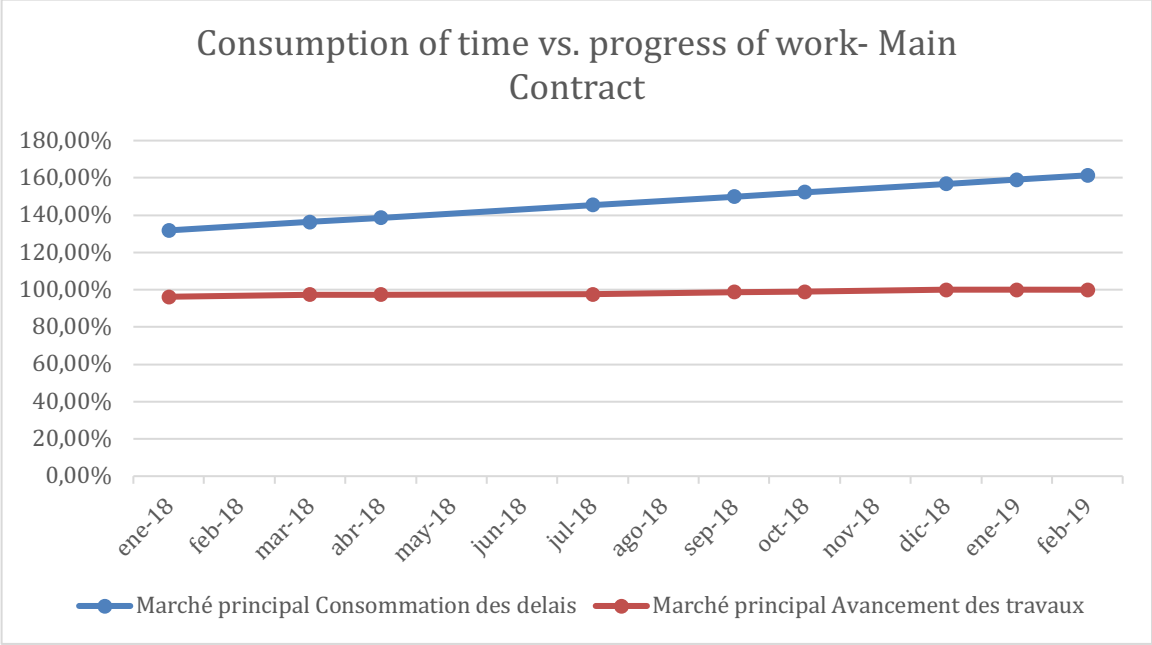

Figure 1. Time consumption vs. work progress - Main Contract. Note: taken from PW2 project activity reports (January 2018 to February 2019).

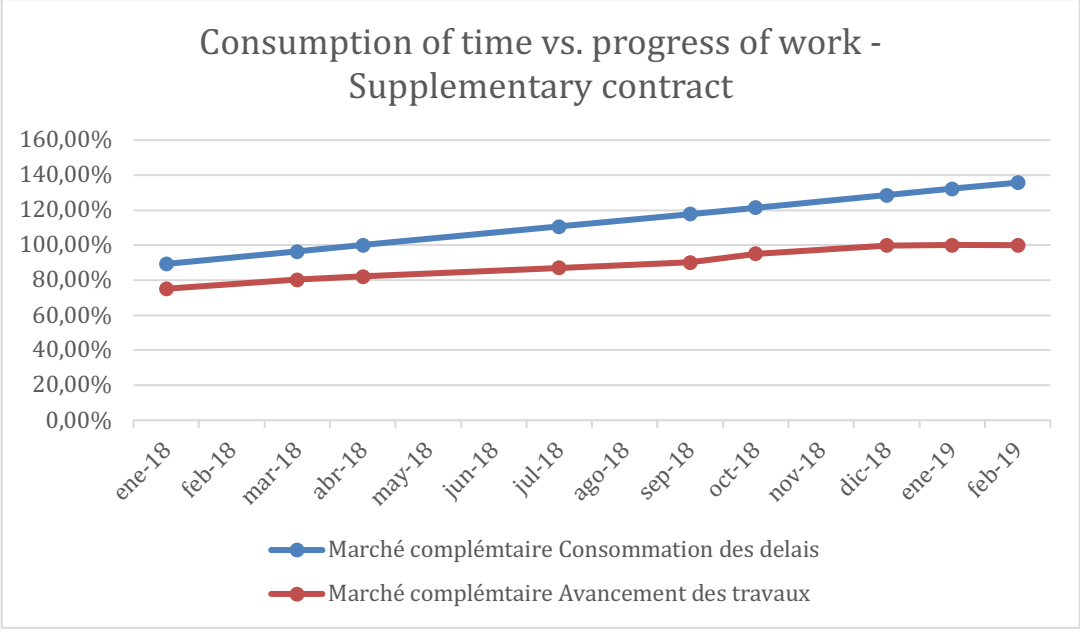

Figure 2. Time consumption vs. work progress - Supplementary contract. Note: taken from PW2 project activity reports (January 2018 to February 2019).

Figures 1 and 2 show that over the period from January 2018 to February 2019, the work progress curves have been below the time consumption curves. This means that the project has been behind schedule. The provisional general acceptance without reservation of the two contracts (base contract and supplementary contract) was pronounced on 15 February 2019. Table 7 shows the differences between the planned and the actual deadlines.

Table 7
Differences between the planned and actual timeframes for the construction of the second bridge over the Wouri River

Contracts	Start date	Expected end date	Actual end date	Expected completion time	Actual implementation time	Gap	
Main contract	15 March 2013	15 November 2013	15 February 2019	44 months	71 months	27 months	61,36 %
Supplementary contract	14 December 2015	14 April 2018	15 February 2019	28 months	38 months	10 months	35,71 %

Note: taken from inspired by the final AMO report of the PW2 project (February 2019)

Table 7 shows a 27-month and 10-month difference between the initially planned end date and the actual completion date for the main and supplementary contracts respectively. Thus, there was a 61.36% delay in delivery for the main contract and a 35.71% delay in delivery for the supplementary contract.

Analysis of the performance level of the second Wouri bridge construction project in terms of cost compliance

The main contract N°306/M/MINTP/CCPM-AI/2013 relating to the construction works of the second bridge over the Wouri and notified on 04 March 2013 was for a total amount of 180.31 million dollars (100.87 billion CFA francs). On January 13, 2016, Amendment 1 N°000298/AV/MINTP/CCPM-AI/2015 was signed by the project owner, the purpose of which was to extend the execution time and modify some provisions of the contract. But this Amendment 1 had no impact on the amount.

On October 3, 2017, Amendment 2 N°000242/AV/MINMAP/CCPM-AI/2017 was notified. This Amendment concerned the modification of certain provisions of the main contract, the early commissioning of certain parts of the work, the modification of the execution period and the modification of the amount of the provision for the relocation of the networks. The amount of this amendment was USD 3.84 million (CFA 2.15 billion).

Following the commissioning of this new cement plant in the project area, the project owner decided to undertake several actions. This led to the signature of contract N°426/M/MINMAP/CCPM-TR/2015, notified on 14 December 2015. This contract concerned the realization of the additional installations of the project of Design / Realization of the second bridge on the Wouri for a global amount of execution of the whole of the services studies and works of 60,57 million dollars (33,88 billion CFA francs).

An amendment to the contract for the additional works was notified on 03 October 2017. This Amendment 1 N°000241/AV/MINMAP/CCPM-AI/2017 concerned the modification of certain provisions of the complementary contract, the validation of certain new prices, the modification of certain quantities and the modification of the amount of the provision for the relocation of networks. The amount of this amendment was USD 7.75 million (CFA 4.33 billion). Table 8 shows the differences between the amounts initially planned and the amounts consumed in the execution of the contracts for the construction of the second bridge over the Wouri.

Table 8
Differences between the amounts planned and the amounts consumed in the execution of the project for the construction of the second bridge over the Wouri

Contracts	Amount originally planned (in dollars)	Amount consumed (in dollars)	Differences	
			In dollars	As a % of
Main contract	180 313 659	184 150 600	3 836 941	2,13%
Supplementary contract	60 566 052	68 313 399	7 747 346	12,79%

Note: taken from inspired by the final AMO report of the PW2 project (February 2019).

Table 8 shows differences of USD 3.84 million and USD 7.75 million respectively between the amount initially planned and the amount actually used in the execution of the main contract and the supplementary contract. Thus, there was a budget overrun of 2.13% in the execution of the main contract and a budget overrun of 12.79% in the execution of the additional contract.

Analysis of the performance level of the second Wouri bridge construction project in terms of compliance with quality requirements

Within the framework of the execution of the project for the construction of the second bridge over the Wouri, quality control was carried out at several levels.

Internal quality control, based on the principle of double control, consisted of internal and external control. The internal control was a quality control Organization attached to the Works Directorate. This control was therefore carried out by the workers and was exercised at all levels of the production department hierarchy. The external control had the task of ensuring the effectiveness of the internal control. This control was attached to the person in charge of the external quality of the site, who sometimes relied on design offices or external organizations.

External quality control was carried out by the Project Owner. In carrying out this control, the latter was assisted by two entities. The Technical Assistance to the project owner and the Geotechnical Assistance to the project owner.

According to the final report of the Assistant to the Contracting Authority, only materials approved by the internal and external inspection were used for the construction of the works (Final report AMO, February 2019). For the Assistant to the Project Owner, the implementation was generally done in compliance with the specifications. Thus, he considers that the supplies and execution procedures adopted for the implementation of the Work are compliant.

On the environmental and social level, according to the final environmental and social activity report, the level of compliance by the builders with the requirements of the Environmental and Social Management Plan (ESMP) resulting from the Environmental and Social Impact Assessment is 95.83%. For the Assistant to the Project Owner, most of the environmental and safety measures provided for in the various project documents have been satisfactorily implemented by the contractors.

Discussion and conclusions

The general objective of this study was to analyze the performance level of the second bridge construction project over the Wouri River. This research had three specific objectives. Firstly, it was necessary to analyze the level of performance of the Wouri second bridge construction project from the point of view of respect of deadlines, secondly to evaluate the

level of performance of the Wouri second bridge construction project from the point of view of respect of costs and finally to study the level of performance of the Wouri second bridge construction project from the point of view of respect of quality.

In relation to these study objectives, three hypotheses were stated. The first hypothesis stated that the execution deadlines were not respected in the construction of the second bridge over the Wouri. The second hypothesis supported the idea that the execution costs were not respected in the construction of the second bridge over the Wouri. The third hypothesis claimed that the quality level initially planned was not respected in the execution of the project to build the second bridge over the Wouri.

The data collected from the stakeholders of the second bridge construction project over the Wouri River indicate an average of 3.43 out of 7, or 49%, for the criterion "timely completion of the project". Analysis of the project documents shows a gap of 27 months and 10 months respectively between the initially planned end date and the date on which the project was completed for the main contract and the supplementary contract. Thus, there was a 61.36% delay in delivery for the main contract and a 35.71% delay in delivery for the supplementary contract. These results show that the execution deadlines were not respected in the construction of the second bridge over the Wouri. These results are in line with the findings of Standish Group (2019), PMI (2018) and OPS (2011), which state that most mega-projects have difficulty meeting deadlines. From the above, it can be said that the first hypothesis which stated that the execution deadlines were not respected in the construction of the second bridge over the Wouri was validated.

The stakeholders of the second Wouri bridge construction project awarded an average of 6.14 out of 7, i.e., 87.71%, for the criterion "good budget management". Analysis of the project documents shows discrepancies of USD 3.84 million and USD 7.75 million respectively between the amount initially planned and the amount used in the execution of the main contract and the supplementary contract. Thus, there was a budget overrun of 2.13% in the execution of the main contract and a budget overrun of 12.79% in the execution of the additional contract. This result shows that the execution costs were not respected in the framework of the construction of the second bridge over the Wouri. Compared to the findings of PMI studies (2015) which reveal that companies lose an average of USD 109 million out of every billion invested in their mega-projects as a result of managerial failures, i.e. about 10.90%, by assigning an average of 6.14 out of 7, the stakeholders of this project find the results obtained from the point of view of respecting costs (2.13% of cost overruns) satisfactory as regards the execution of the main contract, representing about 74.85% of the overall services. Although the actors were satisfied with the management of the project costs, the results of this study show that the second hypothesis which supported the idea that the execution costs were not respected in the framework of the construction of the second bridge over the Wouri was validated.

The data collected from the actors in the Wouri secondary construction project indicate an average of 5.71 out of 7, i.e., 81.57%, and 5.29 out of 7, i.e., 75.57%, respectively, for the criteria "achievement of the initially identified objectives" and "completion of the project in accordance with the required quality and standards". These results are in line with the analysis of the project documents, which indicate that only materials approved by the internal and external auditors were used for the construction of the works (Final AMO Report, February 2019). For the Assistant to the Contracting Authority, the implementation was generally done in compliance with the specifications. Thus, he considers that the supplies and execution procedures adopted for the implementation of the Work are compliant. Also, on the environmental and social level, according to the final environmental and social activity report, the level of compliance by the builders with the requirements of the Environmental and Social

Management Plan (ESMP) resulting from the Environmental and Social Impact Assessment is 95.83%. For the Assistant to the Project Owner, most of the environmental and safety measures provided for in the various project documents were implemented satisfactorily by the contractors. These results show that the level of quality initially planned was respected in the execution of the construction project of the second bridge over the Wouri River. From the above, it can be said that the third hypothesis which claimed that the quality level initially planned was not respected in the framework of the execution of the project for the construction of the second bridge over the Wouri River was not validated.

In short, this study analyzed the level of performance of the second bridge construction project over the Wouri River. The results show that the deadlines and costs of execution were not met, but the quality level initially planned was respected. The results of this research are similar to the findings of OPS (2011), Standish group (2018) and PMI (2015) on project performance research with a high percentage of failure in mega projects.

Although this study was conducted on a single project, it presents interesting results. However, the question arises as to what the performance of other mega-projects in Cameroon is like? The analysis of the performance of other mega-projects in Cameroon and Africa could thus be the subject of further research and contribute to the generalization of the findings of this study.

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MANAGEMENT OF BUSINESS INTELLIGENCE TOOLS FOR THE DIAGNOSIS OF THE FOOD SAFETY CATEGORY IN AN ECUADORIAN BUSINESS ENVIRONMENT

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Summary. This research describes the management of Business Intelligence tools to evaluate the productive environment of an industrial trading company in Ecuador, specifically within the category of food safety. The study was descriptive and evaluative with a non-experimental and longitudinal design. From a census sample of 24 individuals (business advisors, technicians and managers), data was obtained through direct observation and the application of a survey of closed-ended dichotomous questions, with content validity through expert judgment and a good level of reliability ($\alpha = 0.91$; $p < 0.05$).the survey had content validity through expert judgment and a good level of reliability ($\alpha = 0.91$; $p < 0.05$), whose general analysis was carried out using the hypothetico-deductive method. The results showed that only 58% of the commercial intentions resulted in successful sales and, of the latter, 70% required at least two visits to the customer's premises. In addition, only 11% of the complaints corresponded to the areas evaluated (logistics). Through Business Intelligence it was possible to diagnose that the main non-conformities denoted interruptions in the company's transversal activities, due to the lack of established processes, management and performance indicators, as well as the lack of adequate technological tools. It was concluded that the company deserves a system oriented towards the optimization of the food safety category, administrative, commercial and continuous improvement processes, in order to guarantee greater economic sustainability.

Key words: business intelligence, quality tools, key performance indicators, continuous improvement, safety.

GESTIÓN DE HERRAMIENTAS DE INTELIGENCIA DE NEGOCIOS PARA EL DIAGNÓSTICO DE LA CATEGORÍA COMERCIAL DE INOCUIDAD EN UN ENTORNO EMPRESARIAL ECUATORIANO

Resumen. Esta investigación describe la gestión de herramientas de Inteligencia de Negocios para evaluar el entorno productivo de una empresa comercializadora industrial de Ecuador, en específico, dentro de la categoría de inocuidad. El estudio fue de tipo descriptivo y evaluativo con la presentación de un diseño no-experimental y de corte longitudinal. De una muestra censal de 24 individuos (asesores comerciales, técnicos y directivos), se obtuvo una data mediante la observación directa y la aplicación de una encuesta de preguntas cerradas tipo dicotómicas, con validez de contenido mediante juicio de expertos y registro de buen nivel de confiabilidad ($\alpha = 0{,}91$; $p < 0{,}05$), cuyo análisis general se ejecutó mediante el método hipotético-deductivo. Los resultados reflejaron que solo el 58% de las intenciones comerciales se concretaron en ventas exitosas y, de estas últimas, el 70% precisó al menos de dos visitas a las instalaciones de clientes. Adicionalmente, solo el 11% de los reclamos correspondieron a las áreas evaluadas (logística). Por la Inteligencia de Negocios pudo diagnosticarse que las no conformidades principales denotaron interrupciones en las actividades transversales de la compañía, producto de la falta de procesos establecidos, indicadores de gestión y desempeño, igualmente por la carencia de herramientas tecnológicas adecuadas. Se concluyó que la empresa amerita de un sistema orientado hacia la optimización de la categoría de inocuidad, los procesos administrativos, comerciales y de mejora continua, con el fin de garantizar una mayor sostenibilidad económica.

Palabras clave: inteligencia de negocios, herramientas de calidad, indicadores claves de desempeño, mejora continua, inocuidad.

Introduction

The speed at which market demands evolve means that organizations must continuously keep themselves informed about the production, marketing and service environments they provide to their customer base. In addition to this reality, the current technological changes are accelerated and stand out as tools that make it possible to cope with economic fluctuations and limited resources. Companies have an imperative need to control the resources involved in their productive operations, whether they are manufacturing, services or mixed. The competitive advantages of a company are those that can be sustained by minimizing costs and resources negligently used (Project Management Institute, 2013).

In the particular context of companies in Ecuador, there are insufficient combined applications of agile project methodologies aimed at improvements in the commercial, input and safety categories. Verbigracia, extended and combined applications of methods, techniques and systems such as Six Sigma, Kanban, Lean and Business Intelligence are scarce within Ecuador's business environments. To date, the number of Ecuadorian mixed companies in the commercialization of goods and services that implement methodologies oriented towards continuous improvement continues to be modest.

This study focuses on the profile on the management of Business Intelligence tools, taking as a scenario for its application to the safety category of an industrial trading company in Ecuador. The intended business intelligence project for the company would aim to provide an organization with all the necessary planning mechanisms in order to obtain the information required to make decisions on the sustainability of the food safety category.

Company under analysis

The object of study is an industrial trading company located in Quito, Ecuador (it explicitly requested anonymity). The company has forty employees on its active payroll and ten external collaborators. The areas of the company are: commercial/technical, logistics, accounting and purchasing. Each of the departments has a director, who is a management representative.

The company started operations more than twenty-five years ago, its operational activity is the commercialization of industrial inputs in four product categories: packaging, ingredients, machinery and food safety. However, safety is the last to be implemented in the commercial offer, reaching seven years of sales availability. Despite this period, the company has not been able to consolidate commercial plans and business strategies that would allow the competitive positioning of the category within the market. The average total annual turnover for the last few years has reached thirteen million US dollars (USD), while sales of the food safety line for the same period are approximately USD 200,000. There has been no increase in the annual amount of this category in the last five years, despite the fact that the company indicates an annual growth of at least 5% in the last five fiscal periods (Quality and Safety Department [DCI], 2021).

Business Intelligence and its technology solutions

Business Intelligence is understood as the various structured practices that can be applied for better decision making within the business. This set of tools allows to combine information for the identification and resolution of problems. After these evaluations, it is possible to identify opportunities for business growth in organizations, in which trends and major events are timely addressed and corrected (Rio, 2006).

The relevance of Business Intelligence is philosophically supported by the well-known phrase of W. Edward Deming (1900-1993): "You cannot improve what you do not control; you cannot control what you do not measure; you cannot measure what you do not define" (ISOTools, 2020, p.1). This is a critical reason why the tool promotes planning, the precise measurement of the results obtained from the commercial exercise, a verification and study of the variable nature of such results and an updated guide for timely decision making, both preventive and corrective.

Companies with a successful track record are those that, in their historical trajectory, have achieved a compatible and solid combination of decision-making within the framework of their general management and significant changes in management and supervision systems. In this way, the principles, values and organizational culture of companies are aligned, through Business Intelligence, with their own strategic operations, business ventures and technological adaptations in times of crisis and economic boom (López, 2015; Socconini, 2019). Today, a key strategy for companies is digital transformation. This is applied through innovation in technological tools, which allow us to take full advantage of the data obtained from operational management. (Chaudhuri et al., 2011).

There is a wide range of technological solutions that are an essential part of Business Intelligence, those selected should respond to the specific and contextual needs of each economic and social entity, but, in general, these alternatives seek to contribute to the sustainable and competitive improvement of the organization by making the best possible decisions, based on goals and key performance indicators (Curto, 2010). Due to

the nature of the company under study, the following solutions are especially considered for diagnostic purposes:

- Business rules
- Balanced scorecard
- Knowledge management
- Data integration
- Control panels
- Enterprise Resource Planning (ERP) system
- Customer Relationship Management (CRM)

The business rules notably define the policy and operational management of the business entity, while the balanced scorecard represents a resource for charting objectives according to specific areas. Knowledge management enables problem solving by leveraging the experience and training of organizational members, while data integration combines information from diverse sources to transform it into useful data (Muñoz et al., 2016). Dashboards contribute to the detailed monitoring of situational indicators and performance ratios (their role is discussed below). The enterprise resource planning system involves a global management that unifies and marks traceability in all processes in the search for better optimization, planning and automation of the company's resources and areas (Chiesa, 2004). Finally, customer relationship management aims at an administrative organization of the company's contact portfolios, through which it is possible to condense all relevant data about consumers, as well as performance statistics on customer satisfaction (Montoya and Boyero, 2013).

Continuous improvement

Continuous improvement constitutes the segment of management focused on boosting greater positive indicators of effectiveness and efficiency within the company, which is generated by adjusting specific activities that require optimization (Aguirre, 2014). The projects that a company conceptualizes must be based on customer demands, supplier expectations, market fit, and correlated with time, product quality and financial return. This is why it is required that projects have a coordinated management in which the continuous improvement cycle is complied with: plan, do, check and act (PHVA). It starts with planning, execution, verification and action, which translates into the application of quality techniques and tools, the last ones allowing to settle these previous ones and turn them into phases applicable to the organization (Pineda and Cárdenas, 2021).

In order for this progress to be monitored as continuous improvement, it is essential to have indicators that allow both the reporting of activities and their evaluation through metrics. These indicators must be monitored, so companies must implement systems that allow them to make timely and accurate decisions regarding their operational outlook (Montero et al., 2015).

In the industrial trading company in this study, for example, growth is measured by the increase in monetary units received over a defined period of time. Reporting to senior management is presented in billings of the category's products in US dollars (USD) per month (DCI, 2021). Expenses per salesperson, logistics costs and other values are recorded at the accounting level, but the efficiency of the category is not evaluated, and no commercial objectives or projects derived from them are established to guarantee the sustainability of the business.

At the time of the diagnosis, the company had electronic invoicing platforms that controlled inventories and sales at a monetary level. For the evaluation of data that would allow the integral governance of the organization, the application of Business Intelligence tools was proposed. In this way, it is expected to forge a continuous improvement sustained over time, i.e., a stable optimization of the quality of processes, products and services together with a reduction of production costs, already obtaining a potential and better quality of product and/or service (Escuela de Organización Industrial [EOI], 2021).

The Company and the safety category

The safety category is understood in the organization as the segment of products and services that guarantee the safety of the facilities, equipment and utensils, as well as the inclusion of operators of the client companies that are mainly engaged in the manufacture of food and cosmetic products. Safety is also accepted as the guarantee that a food, medicine and cosmetic, when ingested, will not cause harm, as long as the intended use is respected, i.e. the recommendations for preservation, preparation, consumption and final disposal provided by the manufacturer (Pan American Health Organization [PAHO], 2021).

The company under review is recognized as a supplier of industrial supplies in Ecuador's agribusiness sector. The food safety category markets the following products in its active catalog: chemical supplies, utensils and sanitary implements. In addition, we provide technical advice on cleaning and disinfection protocols and preventive plans derived from the operational needs of our customers. The line of food safety inputs is the most recently implemented in the sales catalog, so it is considered that it has yet to complete the market positioning cycle. A product positioned in the market must comply with the marketing life cycle: growth, maturity and decline (Loaiza, 2018).

Within companies engaged in the service sector, it is essential to understand that this cycle of goods is accompanied by stages of productive operations, which focus on the following aspects: a) implementation of technological tools, b) data collection and transformation, and c) application of business intelligence. The three phases lead sequentially to organizations being able to enter into the implementation of computer systems, data collection and implementation of previously established designs, based on the development of applications to meet the needs of business users, who are mainly customers, but not the only ones (Godás, 2006). Within the category of safety, the role of all stakeholders such as suppliers, regulatory bodies, end consumers, among others, is also relevant.

The company's business goal is to generate profitability, so providing the necessary information is substantial, since it allows the internal evaluation in terms of efficiency and effectiveness, prior to the technological planning of dispositions. Business Intelligence tools can be applied at different levels of the organization, from operational indicators to strategic results(Ríos-Carrión et al., 2021). All successful organizations, regardless of the industry they operate in, implement measurements as part of their daily activities, as they provide the necessary objective information for decision making (Gholami and Hign, 2010) (Gholami and Hign, 2010).

The Company, key performance indicators and dashboards

Key performance indicators are understood as measurements that provide the organization with the skills to manage and control projects. There are different ways to determine what to measure in the organization, the most efficient ones serve the business objectives and the information needs for decision making (Kenett and Baker, 2010). In

the midst of such a process, control panels are also indispensable. These are graphic tools that enable constant monitoring of the company's operating efficiency, in a simple format that combines the elements analyzed and compared at different times of the business activity (Molina et al., 2020).

Measuring the organization's performance begins with the implementation of data collection and follow-up instruments. This instrumentation provides the company and its senior management with the data required to execute, in a timely manner, the changes that will consolidate a more profitable position. The indicators are presented as dashboards that constitute strategic tools, easily manageable and for monitoring in incipient businesses of a mixed nature, i.e., commercial ventures that combine services and products (Cordero, 2017). In this way, a control panel allows the regulation of processes, resource management, products and overall corporate performance.

Method

Design

The research was descriptive and evaluative, corresponding to a non-experimental field design, with a longitudinal cut and a mixed degree of data structuring (qualitative and quantitative). Descriptive hypotheses were considered for the following variables: 1) operational and logistical performance processes, 2) safety category, 3) management of business intelligence tools, and 4) continuous improvement of the company. Table 1 shows the process of operationalization of the research variables.

Table 1
Table of operationalization of variables

Variables	Conceptual definition	Operational definition	Dimensions	Indicator 1	Indicator 2
Operational and logistical performance processes	Benefits provided by the processes of an organization's operational and logistic areas	Changes in the areas that allow standardization, implementation and improvement of processes	Process performance	Standardized processes/ processes carried out	Delays due to logistical processes
Safety category	Commercial category grouping together products that ensure food safety in client companies	Chemicals, implements and technical advice for intended use	Products of the category	Product Portfolio	Technical advisory services
Management of Business Intelligence tools	Tools that enable data to be turned into knowledge so that organizations can make better decisions	Dashboards, ERP, CRM and others that allow to analyze the information obtained in the company and make decisions in the commercial category	Business Intelligence Tools	Successful sales/ total sales	Number of visits to consolidate sales
Continuous improvement	Approach to process improvement based on the need to continuously review defects detected in operations and propose solutions to prevent errors from recurring	Strategy of planning, doing, verifying and acting to detect problems in the company and propose definitive solutions	Customer satisfaction	Claims by product	Service claims

The main hypothetical outline of the study is as follows the diagnosis of the productive performance and performance level of the company's food safety category will be established with greater technical criteria and precision, through the use of Business Intelligence tools. Through the hypothetical-hermeneutic method, the dimensions, sub-dimensions and indicators of the research variables could be established (Hernández et al., 2014).

Direct observation was used as the main data collection technique. The research began in August 2020, with monthly and preliminary data collection during the second half of this year. The application of the main primary data collection instrument was carried out from January to September 2021 (a total of nine records). A nine-month period was chosen for this process, since this is the annual cycle in which adjustments can be made to improve the company's business indicators. In the last quarter of the year, customers only make repurchases or replacements, since the food industry is at its

production peak, so that proposals and product suitability tests can rarely be carried out in the final months of the year (they do not represent the bulk of commercial advances in the food safety category).

Participants

We worked with the totality of study units of the population involved in the line and safety category, as it was considered a manageable number of individuals (Moreno, 2017). The census sample consisted of 24 individuals, of whom twelve were commercial and technical advisors, eight were employees in the logistics area and four were representatives of the company's senior management.

As for sociodemographic data, 70.83% of the respondents were male and the remaining 29.17% were female. Of the respondents, 54.17% were in the 30-39 age range, followed by 20.83% in the 40-49 age range, 16.67% in the 50+ age range, and the remaining 8.33% in the 20-29 age range. On the other hand, 33.33% had a college degree in their academic training, another 33.33% as technologists, 25% with a master's degree and 8.33% with an engineering degree.

In descending order, 66.67% of the respondents reported 1 to 10 years of permanence in the company, followed by 20.83% who reported 21 to 30 years and about 12.50% who reported 11 to 20 years of permanence. Most of the respondents are located in the logistics area (37.50%), followed by positions in the commercial area (33.33%), then in the technical area (25%) and finally in the administrative area (4.17%). With regard to the modality of work, 37.50% is office-based management, followed by 33.33% located in warehouses, 12.50% in the form of visits to customers, another 12.50% in a hybrid position (office and visits) and, finally, the remaining 4.17% in the form of teleworking. While 79.17% of those consulted attended to all types of clients, the remaining 20.83% only did so with the company's strategic clients.

Instruments

The census sample was first asked an initial round of ten open-ended questions by means of an unstructured interview, in order to explore and identify the company's problems. Other data from direct observation were recorded by means of anecdotal records *in situ* at the point of sale on the following events: Technical-commercial visits with advisors and discussions with senior management.

The main data collection instrument included its identification, brief introduction, purpose and instructions for completion. The instrument was designed as a diagnostic survey of continuous improvement and processes of the commercial enterprise, with dichotomous closed questions (Yes/No), whose content validity was determined by expert judgment and the level of reliability obtained was acceptable internal consistency ($\alpha = 0.91$; $p < 0.05$). The instrument is made up of three main sections and a total of 60 items: a) administrative aspects (20 items), b) operational aspects (20 items) and c) continuous improvement aspects (20 items). The survey was applied in person and directly with each individual.

Regarding the operational aspects surveyed, the review indicators were aligned with the logistical levels of product shortages in the safety category, delays in product dispatch, distribution and reception times, and the recording of complaints due to confusion in the dispatch of the product. The technological solutions incorporated were business rules, knowledge management, ERP, CRM and control panels, already composing Stages 1 and 2 of the diagnosis.

With regard to administrative aspects, the indicators associated with the safety category were the monthly records of commercial attempts, coverage and customer service rates, products sold in terms of the resources invested to achieve these sales, as well as the final balance of successful sales. The technological solutions implemented in

this opportunity were ERP, CRM, dashboards and data integration, as part of Stage 3 of the diagnosis.

The aspects of continuous improvement consulted revolve around product return records, the creation of credit notes and invoice cancellations. The technological solutions applied in these cases were ERP, data integration and balanced scorecard, already corresponding to Stage 4 of the diagnosis.

Data analysis

The processing of the data obtained from the survey was carried out with the support of the SPSS software, version 25, establishing as a general diagnosis that the company was oriented towards increasing sales of its different commercial categories, but nevertheless there are no business plans implemented in the food safety line. Based on the perception of the respondents, a total of ten (10) central processes were identified for subsequent evaluation with Business Intelligence tools, namely: a) four (04) of administrative order in accounting and purchasing activities, b) three (03) of technical order in consulting activities, c) two (02) of logistical order in dispatch activities and, d) one (01) of commercial order in sales activities. Figure 1 shows a synthesis of the flow carried out as a result of the diagnosis for the control panels.

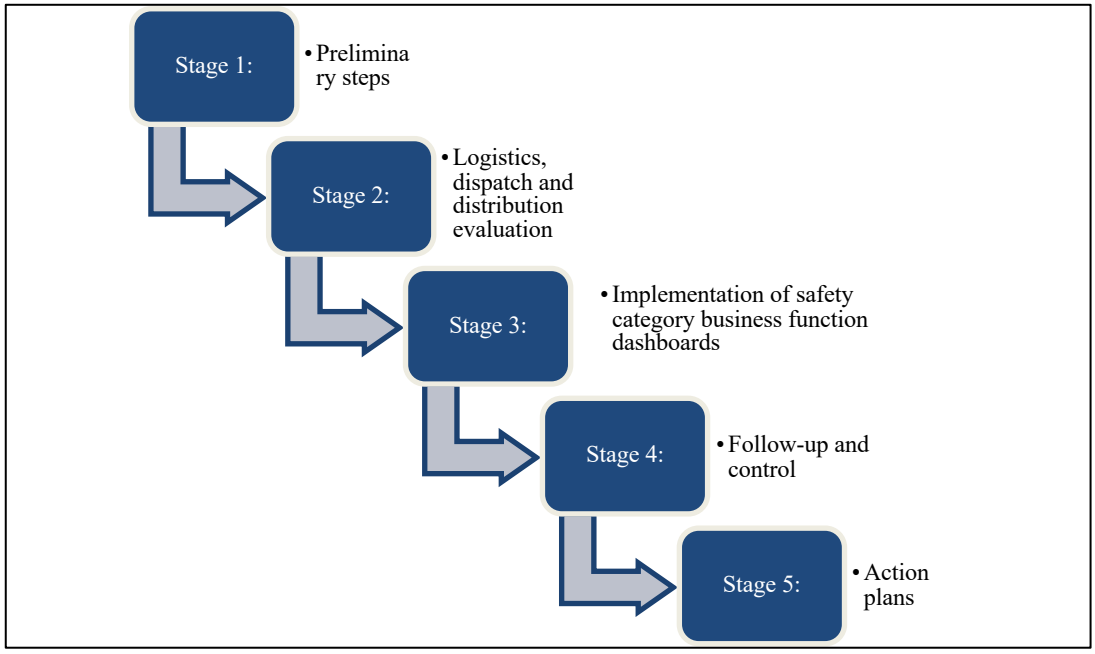

Figure 1. Design, construction and monitoring stages of control panels
Note: Source: Own elaboration (2021).

In Stage 1, the specific objectives of the model were established: 1) to achieve profitability and, 2) to ensure the sustainability of the safety category. A data model was structured and conceptualized with the construction of dashboards. These measures aimed at obtaining complete and quickly accessible data. The diagnosis determined that the information available was not objective, lacked usefulness, and did not allow for an in-depth analysis. In addition, it became evident that the *software* that the company maintained at the time was not aligned with the company's strategic, commercial or administrative plan.

In order to gather the data that would allow the application of the proposed tools, business indicators were established that were in line with the company's strategic plans and senior management. Based on these goals, the planned commercial dashboards were built, creating data that provides real information for closing sales of the food safety line,

predicting patterns of habitual customer behavior, market variations, payment model and portfolio recovery. In this way, organizational policies are aligned with the company's business purpose. Figure 2 summarizes the sequence of activities applied in this stage.

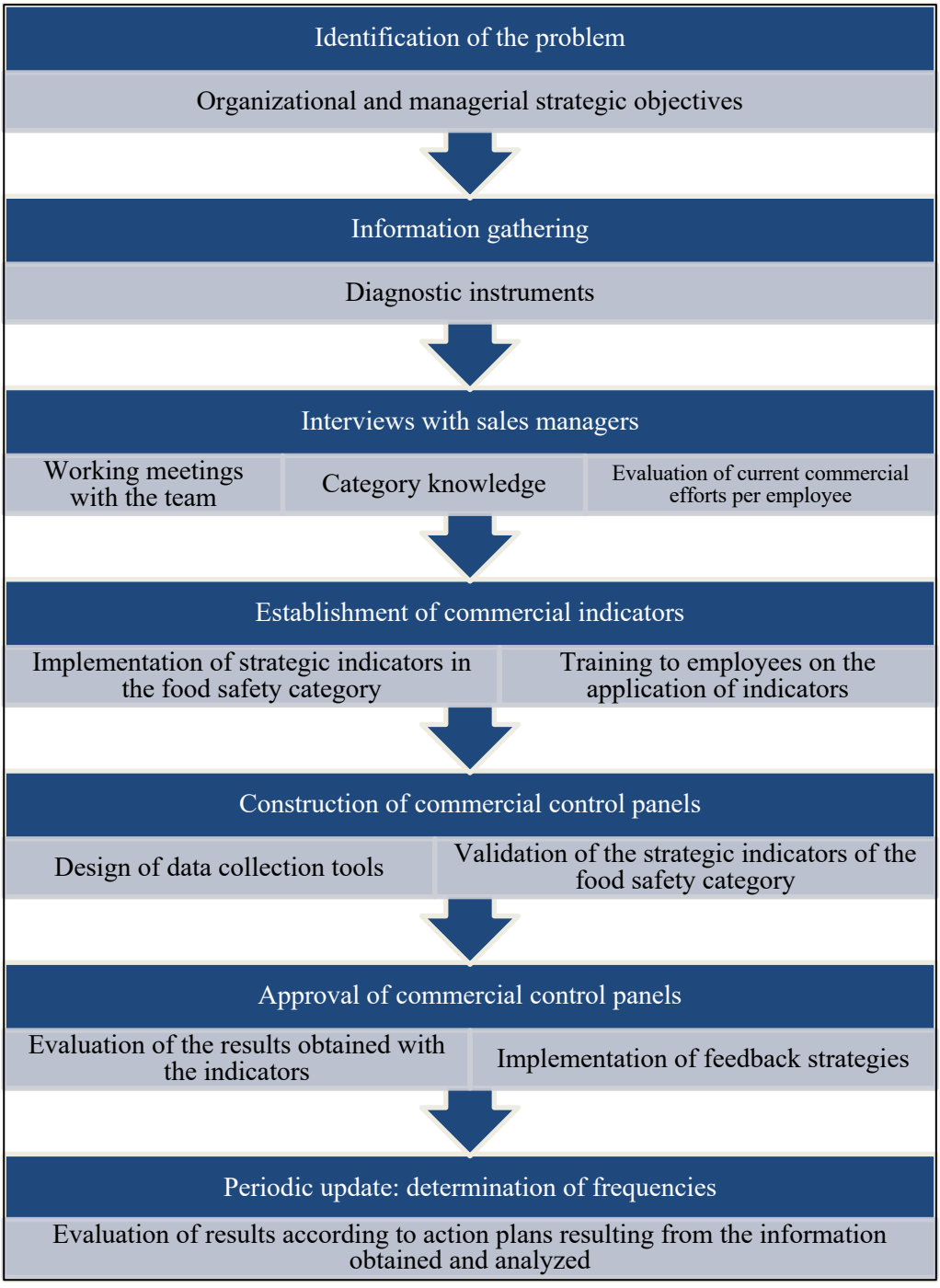

Figure 2. Preliminary steps for the development of control panels

Stage 2 involved a diagnostic assessment of the current state of the underlying and supporting processes, including logistics, dispatch and distribution. The department in charge of product packaging activities also applies safety programs, which include control elements at reception, both at the documentary and physical levels. For this stage, the cycle described in Figure 3 was followed.

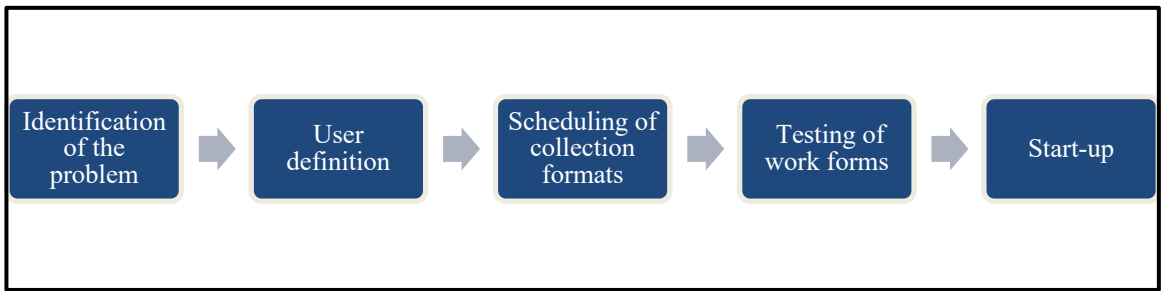

Figure 3. Process followed for the logistics area

Table 2 shows the main drawbacks of the safety category diagnosed with the application of the survey.

Table 2
Main drawbacks in the support activities associated with the safety category

Inconvenience recorded	Committed team	Resources used	Customer complaint record
Shortage of products in the food safety category	Shopping Logistics Business leader in the food safety category	Money Staff time	Claims to commercial advisors for supply chain disruption
Delays in product reception times	Logistics Shopping	Products of the category Staff time	Delays in product stowage
Delays in dispatch and distribution	Logistics: dispatch and distribution	Products of the category Staff time External freight payments	Delays in product deliveries to customers
Confusion of product to be shipped	Logistics Business advisors in the food safety category	Products of the category Staff time Customer payment commitment	Complaints on product deliveries. Product returns Creation of credit notes or cancellation of invoices

Once the problems had been defined, the users who should have access to fill in the information were identified. The area manager, warehouse assistants and the inventory manager were included. Collection forms were programmed, for which the pertinent information to be filled out was determined. Once the tools were established, the working form tests were conducted. Finally, the instruments were put into operation. After the creation of the control panels, the next step was the drafting of reports, which made it possible to draw up action plans according to the teams: customer service, commercial, technical and logistics teams.

During Stage 3, commercial control panels were incorporated into the safety category. Table ~~2~~ 3 shows the model of the logbook of visits to customers, which constitutes an information base that made it possible to generate the data for present and future follow-ups of the line's commercial opportunities.

Table 3
Commercial activities control panel

Company name	Customer contact	Commercial interest	Work performed by commercial/technical agent	Visit/call activities	Pending from commercial/technical agent	Resources	Remarks

In Table 4, the visit log control chart model was outlined, which will be one of the *datadashboards (control charts)* that will be monitored by Senior Management and will allow generating commercial business plans in the short (monthly), medium (quarterly) and long term (one year).

Table 4
Visit log control chart

Indicator	Description
Commercial/technical agent	
Month of coverage	
Immediate commercial commitments	
Medium-term pending (more than one month)	
Visit number to define the purchase	
Customer's reasons for purchase	
Place from which the transmission is made	

Table 5 describes those elements that were included in the monitoring instruments.

Table 5
Proposed indicators and variables for commercial dashboards

Proposed indicator	Work area	Place of work	Number of reports transmitted per month	Average monthly transmissions	Tool productivity	Successful sales per month
Collaborator 1						
Collaborator 2						
Collaborator 3						

These indicators considered the employee, area, number of reports transmitted per month and place of work. These translate into the number of customer services that lead to successful sales. As part of the information to be monitored, it was considered important to establish a trend for each vendor, so an average number of monthly transmissions was recorded. In case of less than the average, the employee must indicate the reasons for the drop in sales, to be adjusted in the action plans for the new period. Finally, the productivity of the tool was highlighted as relevant, which is understood as the use of the registration forms in relation to the sales made and confirmed by each person. In this way, it was possible to monitor the commercial performance of each employee in the sales area of the food safety category with simple meters. The successful results of this sales event are perceived through effective sales with turnover achieved from commercial approaches of the line's sales force.

The update of dashboards and their follow-up was carried out on a quarterly basis. As a result of this evaluation and data collection, the need to generate new marketing channels for the food safety category was identified. The particularity of the reports

chosen was that their reporting format allowed for an agile interpretation of the information, as well as a comprehensive review of the organizational landscape. The tabulated presentation of the data allowed the system to be defined as a support to be implemented in the company, giving a real production phase prior to the stabilization of the new Business Intelligence system.

Stage 4 consisted of an evaluation of the indicators, as well as individual follow-up with the commercial advisors. Within these boards, the different scopes that a figure has for the areas of the company were defined. For example, it was identified that monthly sales for the technical-sales team of the category represented the entire effort of orders generated and invoiced, while, for the financial management, only the amount covered in the credit portfolio approved for the tax year period was considered.

Complaints generated in the logistics area were recorded on nonconformity forms, which included the information gathered during the preliminary steps. This information comes from customers and internal logistics service users, such as commercial and technical advisors who consolidate category sales and who must deliver the product (added value for the company). These items are recorded as model nonconformities in Table 6.

Table 6
Non-conformities of products in the food safety category received by the logistics area

Non-conformity	Description	Person who generates/receives the complaint	Estimated time to resolve the nonconformity by logistics
Claims to commercial advisors for supply chain disruption			
Delays in product stowage			
Delays in product deliveries to customers			
Product returns			
Creation of credit notes or cancellation of invoices			

These are focused on the collaborators of the different areas that make up the company and its commercial aspect. These elements of timely decision making are part of the feedback and corrective actions that the company must implement to ensure category profitability.

During Stage 5, action plans were generated for each area analyzed. Firstly, the plans corresponding to the commercial/technical team: a pair that performs the functions of approaching customers on their premises, detecting their needs and contributing to the mixed component of management, by offering products and advising on their intended use. Secondly, there are the plans corresponding to the logistics team: as a missionary activity of the organization, logistics plays the role of complying with the physical supply chain of the inputs of the food safety line, so minimizing non-conformities and errors derived from its operations are fundamental provisions for business continuity.

Results

The use of commercial dashboards, as part of Business Intelligence, was carried out over a period of nine months, after which information from the proposed dashboards was obtained from the commercial and technical advisors. Initially, there was no way to

evaluate the commercial performance of employees, as they had not been structured or applied in the company. The data obtained showed that, considering the twelve commercial advisors evaluated who carry out commercial activities in the category, only 58% have successful sales 58% had successful sales during the period in question.

It was established as was established as a successful sale to that commercial process that began with a visit or approach with the customer (through different telematic communication channels due to the COVID-19 pandemic). Figure 4 shows this distribution in the sales classification of the food safety category, considered in the period from January to September 2021.

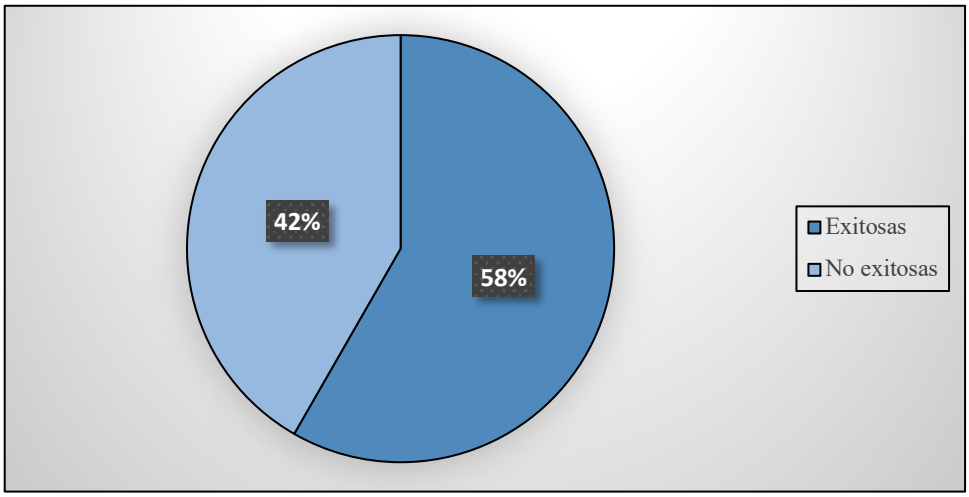

Figure 4. Safety category sales classification: January to September 2021

Figure 5 shows the results obtained for the number of visits necessary to achieve an effective purchase by customers.

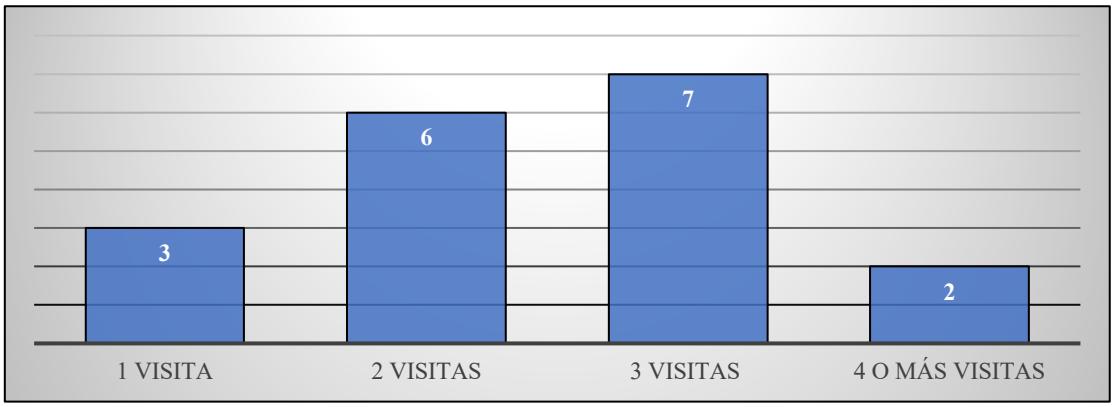

Figure 5. Number of commercial visits and techniques necessary to consolidate a successful sale.

The monthly average of successful sales in the category is eighteen (18). These are carried out by the twelve commercial and technical advisors. It is worth noting that, of these successful commercial efforts, more than 70% require two or three visits, which implies costs attributed to the category, which directly impacts the category's profitability. Figure 6 shows that only 17% of sales are successful with one visit, while more than 70%

require two or three visits by commercial and technical advisors. Finally, it is evident that 11% of successful sales require four or more visits to consolidate.

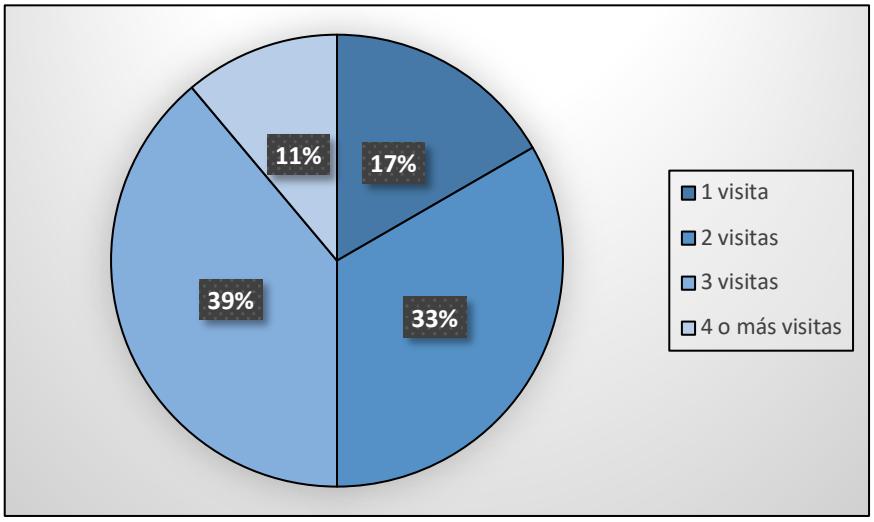

Figure 6. Representation of number of visits required for a successful sale

Figure 7 shows that 82% of the category's successful sales were made at the customer's premises, i.e. after an *on-site*visit. 11% of successful sales are executed at the company's point of sale, i.e. in the organization's demo room. Only 7% of invoices are issued after telematic interactions.

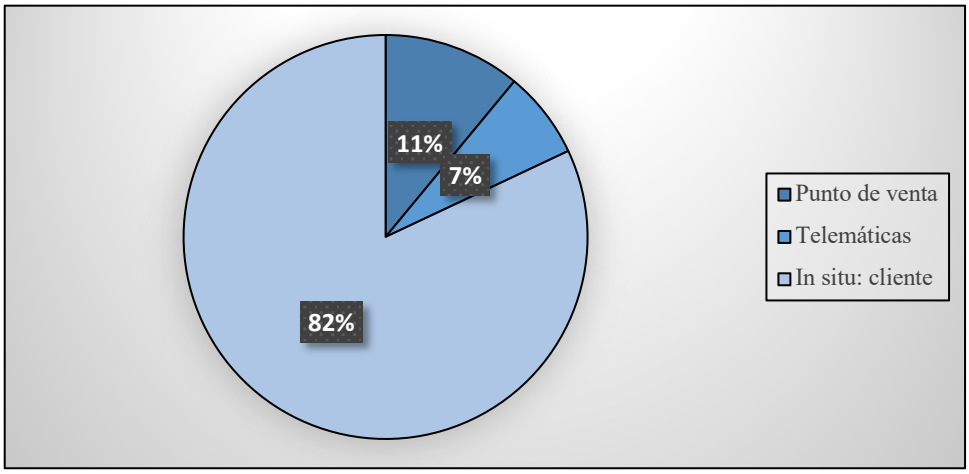

Figure 7. Place of attention of the effective sale.

From the data obtained from the diagnostic record, it can be deduced that delays in the delivery of products to customers and product returns were the most frequent nonconformities in the logistics area. These correspond to 65% of the total complaints received by the department, as shown in Table 6.

Table 6
Registration of non-conformities and complaints in the logistics area

Non-conformity	Claim frequency	Person receives the claim	Estimated time to resolve the nonconformity by logistics
Claims to commercial advisors for supply chain disruption	5	Commercial/technical advisor	Variable according to supplier availability
Delays in product stowage	3	Logistics	Variable according to the availability of logistics personnel
Delays in product deliveries to customers	28	Commercial/technical advisor	24 to 72 hours, depending on delivery point nationwide
Product returns	19	Logistics	24 to 72 hours, depending on point of departure nationwide
Creation of credit notes or cancellation of invoices	17	Logistics	Less than 24 hours after financial department approval

Documentary tax issues account for 26% of customer complaints, while supply chain disruption and logistics delays account for 11% of complaints, as shown in Figure 8 as shown in Figure 8.

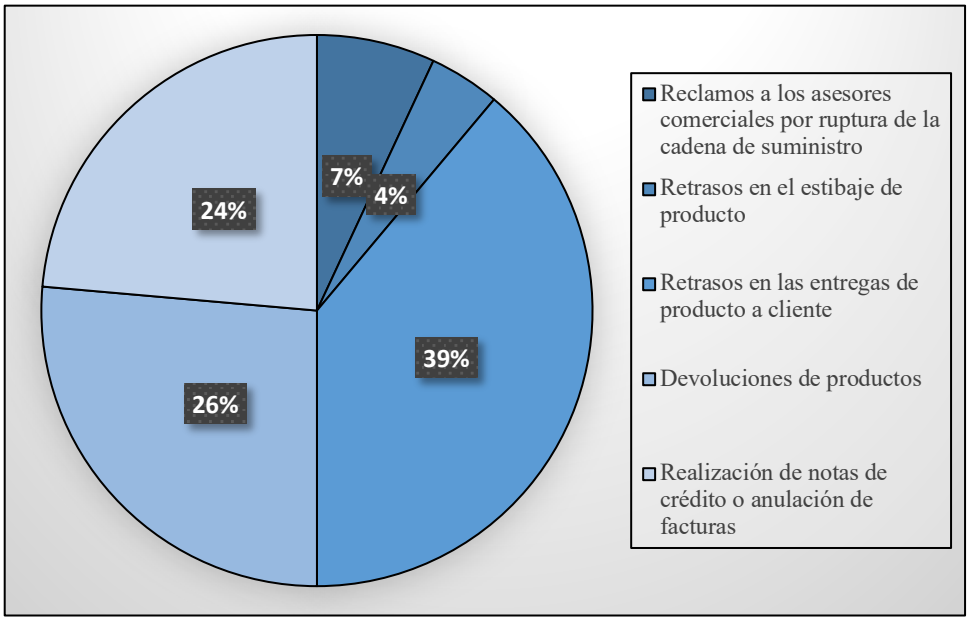

Figure 8. Proportion of safety category claims registered by the logistics area in the period January-September 2021.

It is worth mentioning that the claim resolution time is variable. The results show that the time to close the nonconformity will depend on aspects such as the place where the product must be shipped and delivered again or where it comes from in the case of a return. In addition, the tax documentation aspects require a different treatment since they depend on strategic departments such as financial management.

In summary, the technological solutions proposed made it possible, in the first place, to define the company's policy and guiding processes with respect to its food safety category. Secondly, performance indicators were constructed for this category and other key areas of the company. Thirdly, it was possible to draw a preliminary and unified line of processes associated with the category with planning criteria. In fourth and last place, the management of consumer profiles and their relationships with the company was also better achieved. In this way, the corroboration of the hypothesis regarding the diagnosis of the food safety category is established, through a better technical value and precision derived from the business intelligence tools.

Discussion and conclusions

Successful sales in the food safety category accounted for 58% of the commercial approaches of the company's sales force. This is attributable to the fact that there was no monitoring during the period analyzed and only referred to commercial and strategic information gathering. It is expected that by performing the relevant feedback with the frequency proposed in each indicator, despite market limitations, substantial improvements in the success rate of the commercial line through Business Intelligence will be achieved.

Successful sales require a high commercial effort, which directly impacts category costs. This translates into low efficiency of commercial efforts, which must be reiterative in order to achieve category turnover. The technical and commercial viability of the line is undermined by the opportunity cost of a positive result. It is necessary to generate an action plan to improve these commercial indicators.

It is important to emphasize that only 11% of the sales were consolidated at the company's point of sale, resulting in the fact that the line's demonstration room does not generate an important contribution at the moment to the turnover. Only 7% of sales were made through telematic contacts, which means that this method is not very effective for sales of products and services of this nature. 82% of successful sales were achieved through on-site visits. This was because the inputs had to be tested on the surfaces to be applied. In addition, the service must be complemented with the direct users of inputs and utilities, so it is remarkable that it must be carried out at the place where the final consumers of the products are located, who must be trained in the intended use of the goods.

As for the non-conformities received by the logistics area, these were based on internal aspects of the department, such as delays in product deliveries to customers and returns, as well as agents external to operations (supplier shortages), lack of logistics personnel (the responsibility of human resources) and tax documents (the responsibility of the finance department). From this we can conclude that logistics personnel go through several processes that need to be optimized, so that some claims and their respective closures can be expedited. In addition, it is presumed that product returns are due to confusion in nomenclature and intended use, and therefore the possibility of training internal personnel on the products marketed by the category is being considered.

Based on the results obtained after the design and application of Business Intelligence tools in the food safety category of a trading company, it can be concluded that the organization requires the immediate development of management indicators, both at the commercial level and in the support operations that make possible the sales activities of the food safety line. The results of the research revealed shortcomings in the area of personnel training, as well as low efficiency in the sales effort. Their success lies in the turnover achieved after a commercial approach. However, without considering sales amounts in monetary units, it is possible to visualize that several visits are required to formalize an effective sale. It is necessary to generate an indicator of costs attributed to these commercial target shifts.

It is important to note that sales in the food safety category are mainly made at the customers' facilities. This is due to the fact that the products must be applied and tested on food contact surfaces, being these agro-industrial manufacturing companies the main customer of the industrial trading company. Such a fact becomes indispensable, since the technical advice of intended use must be oriented to the users of the products *on site*, which is why the combination of technical and commercial approach together is justified in order to position the line and build customer loyalty.

The complaints received by the logistics department indicate transversal causes in the organization, which not only depend on the aforementioned area, but also integrate responses from other collaborators and hierarchical levels. This reality proves that an action plan oriented towards the speedy resolution of conflicts and the closure of non-conformities is essential, with the goal of optimizing the commercial situation of the food safety category.

The current processes operated in the company require diagnostic and optimization tools, not only in the construction of data collection instruments, but also systems that allow the automation of the information obtained in real time. In terms of business development trends, the permanent adoption of systems that allow planning the resources of the food safety line, such as an *Enterprise Resource Planning* (ERP), a planning system that allows companies, through modular insertions, to control accounting, human resources, logistics and supply chain, projects, inventories, document management, sales and commercial management, quality management, foreign trade, among others, is relevant.

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ANALYSIS AND BEST DESIGN PRACTICES OF A HYDROELECTRIC CIVIL WORKS IN HONDURAS

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Summary. Currently, project management has many tools and methodologies that seek to develop successful projects, but it is not always possible to meet the objectives set from their conception. A large portion of construction projects are executed without being properly evaluated and documented throughout their life cycle, increasing the likelihood of being a failed project and not meeting the expected profitability or use. The case study is about a hydroelectric project that was initiated with a private Honduran company's own personnel (EPH)[1], which soon began to present a series of problems that generated cost and time delays. When 85% of the original budget estimate had been used and less than 50% of the work had been completed, EPH decided to hire an external supervisory company (ESE) to monitor the project, review the project design and ensure that the project was completed. The project was completed with an additional year and eight months of construction and the final total cost was US$7.5 million over the original budget. The main objective of this research is to analyze the efficiency and sustainability of the project in order to obtain lessons that make it possible to identify the failures and successes in the deviations achieved throughout the project and, based on them, to generate recommendations that will allow the organization to correct and improve its current methodology for its future projects.

Key words: Lessons learned from civil projects, ex post project evaluation, project success, project planning, project efficiency.

[1] At the express request of the company and due to the sensitive nature of the information, it was decided to keep it anonymous.

ANÁLISIS Y MEJORES PRÁCTICAS PROYECTUALES DE UNA OBRA CIVIL HIDROELÉCTRICA DE HONDURAS

Resumen. Actualmente la gestión de proyectos cuenta con muchas herramientas y metodologías que buscan desarrollar proyectos exitosos, no siempre es posible cumplir con los objetivos fijados desde su concepción. Una gran parte de los proyectos de construcción son ejecutados sin ser evaluados y documentados adecuadamente a lo largo de su ciclo de vida, aumentando las probabilidades de ser un proyecto fallido y de no cumplir con la rentabilidad o uso esperado. El caso de estudio es sobre un proyecto hidroeléctrico que fue iniciado con personal propio de una empresa privada hondureña (EPH)[2], que al poco tiempo empezó a presentar una serie de inconvenientes que generaron desfases en costos y en tiempo. Cuando se había utilizado el 85% del presupuesto original estimado y se observa un avance de obra menor al 50%, la EPH decidió contratar a una empresa supervisora externa (ESE) para darle seguimiento al proyecto, revisar el diseño del mismo y que se asegurara que el proyecto fuera culminado. El proyecto fue culminado con un año y ocho meses adicionales de construcción y el costo del total final superó en 7.5 millones de dólares americanos del presupuesto original. El objetivo principal de esta investigación es la de analizar la eficiencia y sostenibilidad del proyecto para obtener lecciones que posibiliten la identificación de las fallas y aciertos en los desvíos alcanzados a lo largo del mismo y, a partir de ellos, generar recomendaciones que le permitan a la organización corregir y mejorar su actual metodología para sus futuros proyectos.

Palabras clave: Lecciones aprendidas de proyectos civiles, evaluación proyectual ex post, éxito de proyectos, planificación del proyecto, eficiencia del proyecto.

Introduction

The development of this research arose from the need and importance of implementing a formal evaluation procedure at the end of each EPH project to validate the achievement of the project's products and detect the causes of any deviations in costs, scope and execution time that may have occurred, and to propose evaluation criteria to be applied in future projects.

This work will show that the evaluations are a valuable source of information and that, based on the data collected throughout the evaluations, they demonstrate the accuracy of the company's projection and formulation of projects, the convenience of using the same suppliers or materials for future projects, and would allow for corrections or adjustments to internal procedures if necessary, among others.

The goal of this research is not the comparative analysis between different companies in the sector, but to generate for itself a project learning from the lessons learned in the case study. This is why the analysis is focused in-house so that the organization can know its strengths and weaknesses in the design and management of projects.

Efficiency evaluation is defined as "a comparative analysis between the components that were planned to be executed according to the pre-investment study that led to declaring the project as viable and the components actually executed" (JICA and MEF, 2012, p.195), analyzing various factors such as the achievement of the outputs obtained, execution time, costs, overall efficiency and ex post project sustainability.

[2] Por pedido expreso de la empresa y debido al tipo de información sensible, se decidió mantener el anonimato de la misma.

Method

The work was developed through the use of a non-experimental research design of the projective type with a mixed approach from the collection of information whose data collection instruments consisted of in-depth interviews conducted with key project personnel along with documentary review.

These instruments were validated based on expert judgment to ensure their suitability.

In order to evaluate the project, use was made of the completion evaluation included in the ex post evaluation methodology proposed by the Japan International Cooperation Agency and the Ministry of Economy and Finance of Peru (JICA and MEF, 2012, p.196), which analyzes the efficiency and sustainability of the project. In addition, lessons learned can be obtained to subsequently generate action plans for corrections or improvements, and subsequent follow-ups and measurements are suggested to analyze the project's performance in the medium term and confirm the achievement of the project objectives established in the early stages of the project.

Results

The results and justifications obtained for the Efficiency Evaluation concept will be presented below:

The PH under study has been divided into six main components. These components were evaluated individually to corroborate whether they had been fully completed or not, and to confirm whether they provide the service for which they were built.

Analysis of project deliverables

Table 1

Quantitative comparison of the main outputs of the project

Main project components	Component unit	Quantity (Number, physical dimension, etc.)		
		Preview	**Current**	**execution % (Actual/ Planned)**
DAM AND INTAKE WORKS				
Dam and intake works	global	1	1	100%
3000 PSI concrete and 15 kg/cm2 cyclopean concrete	m3	907	1,452.09	160%
CONDUCTION PIPE				
Conduction piping	global	1	1	100%
Total length	m	2,872.00	3,215.90	112%
PRESSURE TANK OR LOADING CHAMBER				
Pressure tank or loading chamber	global	1	1	100%
Concrete 280 kg/cm2	m3	515.	514.	100%
PRESSURE PIPE				
Pressure piping	global	1	1	100%
Total length	m	654	654	100%
POWERHOUSE				
Powerhouse	global	1	1	100%
Construction area	m2	330.91	455.	138%
LIFTING SUBSTATION				
Lift substation	global	1	1	100%

$$\textbf{Nivel de ejecución de componentes} = \frac{\text{Componentes Ejecutados (indicador)}}{\text{Componentes Previstos (indicador)}}$$

$$\textbf{Nivel de ejecución de componentes} = \frac{1+1+1+1+1+1}{1+1+1+1+1+1}$$

$$\textbf{Nivel de ejecución de componentes} = \mathbf{1.00}$$

Note. Adapted from JICA and Ministry of Economy and Finance of Peru. (2012)

Table 1

Analysis of implemented project components

Main project components	execution % Execution % Execution % Execution % Execution % Execution % Execution	Information extracted from interviews
Dam and intake works	160%	Additional dam placement, requiring an increase in the volume of cyclopean concrete and 3000 PSI concrete of approximately 550m3.
Conduction piping	112%	During the execution of the works, it was necessary to go around obstacles, which led to an increase in the length of the pipeline. In addition, it was necessary to use a considerably higher amount of blasting than estimated because the soil found on site had different characteristics than expected. There is a lack of an adequate geological study.
Pressure tank or loading chamber	100%	The design was slightly modified.
Pressure piping	100%	It was carried out as planned.
Powerhouse	138%	The powerhouse was redesigned to house an additional turbine, requiring an increase in area, and the construction method of part of the powerhouse was also modified to minimize the impact on the budget.
Lift substation	100%	The use of a transformer bank was required to reduce the unbalance between the phases of the National Interconnected System circuit that hindered the synchronization of the plant and put the plant's equipment at risk.

Analysis of the time efficiency of the project

JICA and MEF (2012) indicate that project time efficiency is obtained by making a comparative analysis between the execution time foreseen in the pre-investment study with which the project was approved and the time it actually took for the project to be completed. For this section, the project was divided into seven main components. The data were obtained from the schedule presented in the feasibility study and the final construction schedule provided by the PH supervising company.

Table 2

Comparison of Planned and Actual Execution Time

	Scheduled			Current			Expected / Actual Ratio	Degree of efficiency
	Home	**End**	**Period (months)**	**Home**	**End**	**Period (months)**		
Overall execution time	01/11/2017	31/03/2019	17.	10/12/2017	15/01/2021	37.	**0.46**	**Inefficient**
Execution time by main activities								
Preliminary activities	01/11/2017	30/04/2018	6.00	10/12/2017	09/04/2018	4.	**1.**	Very Efficient
Dam and intake works	01/02/2018	30/09/2018	8.	01/02/2018	30/03/2020	25.00	**0.**	Inefficient
Conduction piping	15/01/2018	31/01/2019	12.	10/12/2017	20/05/2020	29.	**0.43**	Inefficient
Pressure tank or loading chamber	01/05/2018	31/07/2018	3.	09/11/2018	30/03/2020	16.	**0.**	Inefficient
Pressure piping	01/06/2018	28/02/2019	9.	09/04/2018	13/06/2020	26.	**0.**	Inefficient
Powerhouse, Overhead crane, Turbines and generators	01/03/2018	31/03/2019	13.	07/07/2018	23/09/2020	26.	**0.**	Inefficient
Transmission line, Lift substation and Electrical and control system	01/07/2018	31/10/2018	4.	10/02/2020	15/01/2021	11.	**0.**	Inefficient

$$\text{Eficiencia en el tiempo} = \text{Nivel de Ejecución de Componentes} \times \frac{\text{Tiempo Previsto}}{\text{Tiempo Actual}}$$

$$\text{Eficiencia en el tiempo} = 1.00 \times \frac{17.00}{37.00}$$

$$\text{Eficiencia en el tiempo} = \mathbf{0.46}$$

Note. Adapted from JICA and Ministry of Economy and Finance of Peru. (2012)

Project cost efficiency analysis

According to JICA and MEF (2012), project cost efficiency is the:

> Comparative analysis between the total investment cost of the project foreseen in the pre-investment study with which it was declared viable and the total cost of the project in its execution, at the level of each product, component or package of contracts. (p.73)

Table 0

Comparison of Expected and Actual Cost

	Preinvestment Study (Thousands of USD)	Amount Executed (Thousands of USD)	Expected/ Actual Ratio	Degree of efficiency
Overall Cost of Execution	10,944	18,481	**0.**	**Inefficient**
		Cost per product (Components)		
Pre-investment, land purchase and construction administration	515	1,349	0.	Inefficient
Indirect costs (revolving fund, financial and legal expenses)	877	3,265	0.	Inefficient
Development costs, preliminary activities, temporary activities, access and miscellaneous works	534	988	0.	Inefficient
Dam and intake works	1,129	1,509	0.	Inefficient
Conduction piping	4,326	5,515	0.	Inefficient
Pressure tank or loading chamber	204	623	0.	Inefficient
Pressure piping	866	1,296	0.	Inefficient
Powerhouse, Overhead crane, Turbines and generators	1,999	3,426	0.58	Inefficient
Transmission line, Lift substation and Electrical and control system	495	511	0.	Inefficient

Eficiencia en el costo =	**Nivel de Ejecución de Componentes**		x	**Costo Previsto**	
				Costo Actual	
Eficiencia en el costo =	1.00	x	10,944		
			18,481		
Eficiencia en el costo =	**0.59**				

Note. Adapted from JICA and Ministry of Economy and Finance of Peru. (2012)

Analysis of overall project efficiency

This analysis of the overall efficiency of the project is based on the level of achievement of the outputs, on the time required to execute it and on the investment costs required to complete it.

Eficiencia global =	Nivel de Ejecución de	x	Período previsto / Período actual	x	Costo previsto / Costo actual	
Eficiencia global =	1.00	x	17.00 / 37.00	x	10,944 / 18,481	
Eficiencia global =	**0.27**					

Figure 1. Calculation of Overall PH Efficiency

Sustainability analysis

According to JICA and MEF (2012), the action is defined as:

> Evaluate the factors indicated in the pre-investment study that declared the project's feasibility, which guarantee that the project will generate the expected benefits and results throughout its useful life, and analyze whether and to what extent these factors are maintained or vary. Of special interest is the identification of problems that occurred during the execution period, as well as the possible risks in operation and maintenance. (p. 76)

This evaluation was divided into 3 main dimensions, namely:

Financial Sustainability

The purpose of this section is to evaluate, first of all, the accuracy of the O&M, administrative and financial costs and expenses foreseen in the feasibility study against those actually incurred during the operation period up to the preparation of this report.

Table 3

Comparison of projected and actual O&M, Administrative and Financial costs from December 2020 to August 2021

	Planned (USD)	Real (USD)	Planned/Actual Ratio	Degree of efficiency
Projected Operating & Maintenance and Financial Costs and Expenses for Dec - 2020 and Jan - Aug - 2021	1,034,333.33	775,490.12	**1.**	Overall, the costs and expenses **are** within the budget estimated in the feasibility study.
Breakdown of costs and expenses				
Projected operating, maintenance and administrative costs and expenses for Dec - 2020 and Jan - Aug - 2021	635,000.00	203,512.34	3.	These costs and expenses **DO** fall within the budget estimated for this purpose in the feasibility study.
Projected financial expenses for Dec - 2020 and Jan - Aug - 2021	399,333.33	571,977.78	0.	These costs and expenses are **NOT** within the budget estimated for this purpose in the feasibility study.

Secondly, to make an initial assessment to confirm whether the costs of all operations, maintenance and administration are being covered by the income received from the operation of the plant.

Table 4

*Verification of the coverage of costs and expenses for the production to be invoiced**

Amount to be Invoiced* (USD)	**O&M, Administrative and Financial Costs and Expenses (USD)**	**Invoicing/Cost & Expense Ratio**	**Remarks**
794,488.19	775,490.12	**1.**	Costs and expenses to produce and cover financial commitments are covered with a reduced margin of slack.

Note. *This column shows the sum of the amounts to be billed between December 2020 and August 2021. It is worth mentioning that this amount does not necessarily coincide with the actual invoicing, nor with the payments received from the client.

Operational Sustainability

The purpose of this dimension is to confirm whether the components are capable of providing the service or function for which they were built, thus asserting the operational sustainability of the executed project. Data were acquired through structured interviews and documentary analysis.

Table 5

Operability of delivered components

Component	Expected function or service	% of compliance with the objective (0% to 100%)	is it possible to improve the function or services currently provided by the delivered components?		Proposals for improvement	Additional remarks or comments by the Plant Operations Manager
			Yes	**No**		
Dam and intake works	Accumulate water in the riverbed and divert part of the water to the pipeline.	**80%**	X		**Construction of a sand trap. Raise the height of the dam to increase the pressure at the penstock inlet.**	**The desander is missing in the dam. The river's flow is not being used.**
Pipeline	Gravity conveyance of water from the dam and intake works to the loading chamber.	**80%**	X		**Improve pipe supports. Internal painting of piping.**	**Settlements of up to 25 cm in sections of the pipeline. Small reverse slope sections. There is more friction than estimated. It recommends painting the inside of the pipeline to protect it from corrosion, improve internal friction and prevent the release of rust particles that could affect the turbines in the long term.**
Pressure tank or loading chamber	Stabilize the water level before entering the pressure pipe. It allows managing load oscillations during operation and controlled	**100%**	X		**Verify if there is a way to improve the operation of the desander.**	**The desander is not working satisfactorily.**

	overflow of water during load stops or load rejections by means of an overflow controlled by a side spillway.					
Pressure piping	Convey the operating flow at the pressure required for the operation of the powerhouse turbogenerator units.	**100%**	X		**Access for inspection required (Manhole)**	**It works satisfactorily.**
Powerhouse	To protect the turbines, generators and regulation and control elements of the power plant.	**100%**		X		**It works satisfactorily.**
Turbines and generators	Transform the kinetic energy of a stream of water into mechanical energy and subsequently transform the mechanical energy into electrical energy.	**100%**	X		**Modification of Unit 1, pressure release was performed on the rear part of the turbine shell to normalize the pressure that the water exerted on the bearings. (Factory defect)**	**Bearing wear caused the turbine to be used at only 60% of its capacity, wasting water resources during the rainy months and thus affecting production. Not yet received.**
Lift substation	Raise the required voltage level before delivering power to the transmission grid.	**100%**		X		**It works satisfactorily.**

Table 9 shows the detail of the net energy expected to be produced according to the modeling of the hydrological study used as reference in the feasibility study and the net energy that the plant is actually producing and its respective ratio.

Table 6

Net energy production (kWh) actual versus forecast

Month - Year	Production - Net energy (kWh)		Actual/ Planned Ratio	Degree of efficiency
	Scheduled	**Real**		
Production from Dec -2020 to Aug -2021	**10,088,657.00**	**7,107,263.53**	**0.**	Inefficient
Production breakdown				
December -2020	993,657.00	653,400.86	0.	Inefficient
January - 2021	791,000.00	805,133.87	1.	Very Efficient
February - 2021	515,000.00	491,089.04	0.95	Inefficient
March - 2021	437,000.00	387,696.57	0.	Inefficient
April - 2021	302,000.00	451,171.42	1.	Very Efficient
May - 2021	195,000.00	614,664.00	3.	Very Efficient
June - 2021	2,302,000.00	1,255,254.42	0.	Inefficient
July - 2021	2,498,000.00	1,006,072.83	0.	Inefficient
August - 2021	2,055,000.00	1,442,780.52	0.	Inefficient

Note: Prepared by the authors.

Table 10 seeks to confirm the existence of a general maintenance plan and verify whether it is adequate to extend the useful life of the dam components and thus ensure its operational sustainability.

Table 7

Analysis of existing maintenance plans

Area/Component	is there a maintenance plan for this area or component?		If there is a maintenance plan, is it effective?			If there is NO maintenance plan, is work currently underway to develop a maintenance plan?		Mention the challenges faced by not having a maintenance plan
	YES	**NO**	**YES**	**NO**	**Explain**	**YES**	**NO**	
Electromechanical Equipment (Turbines, generators, traveling crane, etc.)	**X**		**X**		If they have details of the routine inspections to be carried out and the periodicity of revision of the components.			
Civil works of the hydroelectric dam (dam, conduction and pressure lines, load chamber, powerhouse)		**X**				**X**		Measurements are taken on a daily basis. We are working under a corrective rather than preventive maintenance modality.

Table 11 below analyzes the quality of the transfer of the project to the operator by analyzing the products delivered and the training provided to the end users. This allows verifying whether the operators were provided with the information required to become familiar with the final product and whether they were provided with adequate training to ensure that they have the knowledge required to correctly operate the hydroelectric plant to ensure that its operational sustainability is achieved.

Table 8

Project transfer analysis and training of operating personnel

Delivered products	YES	NO	Rate the products delivered at the time of transfer and/or training received			Additional comments or observations
			GOOD	**REGULAR**	**MALO**	
was an inventory of equipment delivered?	X		X			An inventory of spare parts and installed equipment was provided.
were the warranties for the different equipment or components delivered and their completion dates?	X					The immediate supervisor was provided with it.
were as-built drawings, quality controls and tests provided during execution?	X		X			The operations manager does not have the hydrological studies to make energy production comparisons.
were the activities and responsibilities of each member of the team that would manage the hydroelectric plant provided?	X		X			The employment contract stipulates the obligations.
Qualify the transfer of the project to the end user.			X			
Rate the training received at the time of the project transfer			X			Some of the personnel operating the plant were in charge of electromechanical assembly and had previous experience in similar projects; training was

				provided during commissioning.
how do you consider the follow-up and monitoring after the training was adequate?		X		24/7 advice is available from suppliers.
was an operating manual for the plant components provided? (Dam, pressure and conduction lines, loading chamber, powerhouse). Please rate this manual.	X		X	They were only provided with a general manual, the detailed manual is being prepared by the personnel currently operating the dam.
was an operating manual for the electromechanical equipment provided? (Turbines, generators, traveling crane, plant management software, etc.) Please rate the manual.	X	X		From the technical point of view it is adequate, it would be advisable that it be in Spanish with friendlier terms.

Risks

Table 12 shows the possible socio-environmental risks that could compromise the operation of the plant and that must be taken into consideration in order not to lose continuity of operation as a result of conflicts of this nature.

Table 9

Socio-environmental risk analysis

Potential socio-environmental risks	Yes	No	Additional comments
was there a process of free, prior and informed consultation with the surrounding community prior to the approval of the project and submission for state approval?	X		There is documentation that supports the rapprochement with the population from the beginning of the project through open meetings.
have the company's commitments to the population been fulfilled, for example, aid projects of some kind, such as reforestation, irrigation systems, access road improvement, etc.	X		Little by little, the agreements are being fulfilled.
is there acceptance of the plant operation by the community surrounding the project?	X		In general, yes, regardless, there is always slight disagreement from the population because they seek to take advantage of the hydroelectric plant for personal benefits.
has the monitoring of water quality in the river in winter and summer season and conducting of aquatic fauna inventory of the river, by specialist in the subject, once a year suggested by the Environmental Measures Compliance Report (ICMA) (2018, p.52) been carried out?		X	He is not aware of any such action to be taken.
is river flow monitored downstream of the dam and downstream of the final discharge? (The guideline value should be that of the ecological flow of the river, ICMA, 2018, p.53)?	X		Ecological flow monitoring is performed daily.
is there an indigenous population that could be affected by the operation of the dam?	X		Yes, there have already been approaches with the Maya-Chortí ethnic group. There are employees of this ethnic group.
do they have conflict resolution and preventive conflict management strategies?		X	It is convenient to define action plans in the event of demonstrations or conflictive approaches so as not to be surprised.
has the environment surrounding the hydroelectric plant been affected in an unforeseen way?		X	
does the plant have an Occupational Health and Safety Plan?	X		

Mention any additional risks that may currently be present.	Due to lack of knowledge of the operation of the hydroelectric plant by the population, conflicts may arise. The operations manager suggests inviting the population to learn about the power generation process to validate that it is a clean and environmentally friendly way of generating electricity.

Discussion and conclusions

This section presents the interpretation of the results previously presented, mentioning the possible causes that led to these results and a comparison is made with the findings of publications on evaluations of related topics. The lessons learned are also listed, consisting of

both the successes and failures identified. Finally, proposals are provided to solve the problems that caused the gaps.

Efficiency**:** This criterion was evaluated in four dimensions: product achievement, project execution time efficiency, project cost efficiency and overall efficiency.

With respect to the *achievement of outputs*, it can be seen that all the components planned to be built were 100% completed, reaching a level of execution of components equal to **1** according to the calculations shown in Table 1. However, despite the fact that all the components were completed, three of them showed considerable deviations in their expected dimensions, as shown in Table 2. The dam, the pipeline and the powerhouse were the components that suffered the aforementioned differences. These differences had a negative impact on the project, as they were the source of the project's cost and execution time lags.

When analyzing the *time efficiency of the project* (see Table 3), it was observed that the approved feasibility study considered that the expected execution time of the project would be 17 months; however, the project was executed in 37 months in total, therefore, an efficiency of 0.46 was observed, which qualifies it as Inefficient. Referring to the table in question, it can be seen that almost all the main activities of the project required more time than programmed to be executed.

For the calculation of *cost efficiency*, the prefeasibility study indicated that US$10,944,000 was required to execute the project; however, US$18,481,134.69 was required, resulting in a cost efficiency of 0.59, which is classified as inefficient. Table 4 shows that all components suffered cost overruns and specifies the formula used to obtain the cost efficiency. It can be seen that the components that underwent changes were those that had the greatest impact on the final cost of the project.

The overall efficiency was calculated with a value of 0.27, which is catalogued by Montero et al. (2013) as inefficient, concluding that the overall efficiency was not adequate.

The implementation problems identified through the analysis of the documentation submitted and the interviews conducted with key personnel are summarized below:

- Vague feasibility study. The budget presented in the feasibility study, on which the decision to execute the project was based, was practically an order of magnitude estimate, as it appears to have been calculated without precise engineering data. Additionally, it was not based on a reliable geological and geotechnical study.
- Inadequate component designs for actual conditions. The fact of not having adequate technical information (information that is used as a basis for the design of the structures), led to assume different scenarios to those faced in the field, causing considerable changes in the first components executed.
- Poor planning. There was no detailed implementation program from the outset. During implementation, many unplanned activities occurred that prolonged the duration of the project due to designs based on incorrect studies and assumptions.
- Monitoring and control of passive work. At the beginning of the project, despite being aware that the project was experiencing considerable delays and changes, no decisive or effective action plans were made to help reduce the delays. It can be seen that reactive, not proactive, management was exercised.
- Absence of a technical file or definitive study at the beginning of the project. The project was initiated without having: technical specifications, accurate construction execution drawings, accurate quantity quantifications, detailed base budget, detailed execution schedule, and accurate geological and geotechnical studies.

- Inadequate risk management. Each risk entails a cost, the risk study identifies those that are most likely to materialize and a risk response plan is established to reduce the chances of their occurrence. This is evidenced by the inadequate identification of risks when undertaking a project of this magnitude, with general information and with personnel with insufficient skills to plan and lead it.
- Inadequate cost management. The budget lacked: adequate determination of the activities necessary to carry out the project, proper definition of unit prices for the activities, accurate quantification of the quantities of works in key activities and, last but not least, inadequate monitoring and control of costs, since it is not apparent that in the first year of project execution adequate corrective actions were taken when budget slippages occurred.
- Poor procurement management. First of all, not having an accurate schedule directly affects procurement planning, as errors are made in knowing what and when to procure. Secondly, the lack of a supplier selection process, both for services and supplies, does not necessarily allow for the selection of the most favorable offer in the market, and limits the customer's price negotiating power and does not allow him to compare services with companies that perform similar activities.
- Insufficient competence of key personnel involved in planning and design. The experience that the personnel may possess to manage the work is a very important point, since a competent person knows the procedures to follow to obtain adequate results and increases the probabilities of meeting the objectives. This does not mean that new personnel should not be hired, but rather that it is imperative that the people who are going to lead a project have the minimum competencies required to ensure compliance with the pre-established goals.
- Inadequate initial quality management. The EU did not have an adequate quality plan until the supervising company started its quality controls parallel to those of the contractors to validate results.
- Ineffective communications management. Personnel interviewed indicated that at the beginning there was no efficient coordination and communication to achieve synergy between the different contractors. Effective communication is a key factor for the proper performance of the work.

Ruíz's (2005) research, entitled *Determining Project Success*. The*case study*indicates that among the most common problems that arise in projects and that affect the achievement of their objectives are: poor planning, poor communication, improper monitoring of progress, incompetent project manager, among others.

> Cruz (2003), in his research entitled *Metodología a seguir para la planificación de un proyecto hidroeléctrico antes de su implementación en Guatemala (Methodology to follow for the planning of a hydroelectric project before its implementation in Guatemala*) indicates that:
>
> > The scope and details of engineering studies, geological explorations, designs and cost assessments in connection with feasibility investigations would have to be sufficient to ensure the reliability of the project plan and to guarantee that the project can be carried out at the anticipated cost. (p. 90)

ILPES (1997) indicates that the feasibility study should provide as precisely as possible the benefits and costs of the project and deepen the analysis of those variables that affect the project.

Ríos and Medina (2020), that it is necessary to adequately address risk management, since the materialization of one or more unforeseen risks can cause considerable impacts on the

other areas of the project, usually the most affected being cost management, work scheduling, resources and procurement.

Sustainability**:** As mentioned, sustainability can be assessed under the probability that the components are likely to be operated and used and achieve their ultimate purpose during their useful life. Under this statement, we proceeded to validate the existence or absence of the same in the project under investigation. The valuation was made by analyzing the financial and operational sustainability and the risks under the present socio-environmental context.

With respect to *financial sustainability*, Table 6 shows that the maintenance costs and expenses projected in the feasibility study for the period during which the plant has operated are higher than those actually used once it is in operation. This indicates that the original projection was adequate and does not jeopardize the sustainability of the project. It is only important to mention that, as expected, financial expenses exceeded projected financial expenses due to the fact that loans for the execution of works were higher than estimated. This was offset by the fact that the expected operating, maintenance and administrative costs and expenses have turned out to be much lower than expected, and these savings have served as a "financial cushion". Another parameter evaluated in terms of financial sustainability was the coverage of costs and expenses for the production that has been invoiced, as shown in Table 7. This parameter shows a small gap between both elements, which indicates that the company may have difficulties to cover its fixed and financial costs if production declines, which places it in a latent financial risk. Currently, there is a divergence between the production invoiced and the payments received from the client, which makes the project financially unsustainable.

In assessing *operational sustainability,* the ability of the components to provide the intended service was addressed in the first instance. It was found that all the components are functioning, but that there are some of them that are not fully providing the service they should and preventing the maximum use of the available water resources. The above is reflected in Table 8. In addition, the adequate design of the hydroelectric plant is questionable, as there are deficiencies in the overall operation of the plant. Another factor analyzed in the context of operational sustainability was the comparison between the planned operation and the one actually produced. In order to evaluate this parameter, net energy production was used as a reference, the values obtained are shown in Table 9, in this table. an efficiency equal to 0.70, which results in a degree of efficiency classified as inefficient according to Montero et al. (2013), as only 70% of what was planned has been produced. This production percentage was affected both by deficiencies in the design of the plant, which as mentioned above, do not allow the best use of available resources, and by factory problems in one of the installed turbines. Another point considered relevant to assess in order to confirm the operational sustainability of the project was the analysis of the existing maintenance plans. Table 10 shows that the maintenance plan provided for the installed electromechanical equipment, such as turbines, generators and traveling cranes, is in place and considered effective. However, there is no maintenance plan for civil works and the operating personnel are currently working on developing one, and for now corrective rather than preventive maintenance is being carried out in certain situations. To conclude the evaluation of operational sustainability, the quality of the process of transferring the project to the end user and the training provided to operational personnel were analyzed. Under this criterion, according to Table 11, there is a general good transfer and training of personnel, with only the operating manual for non-electromechanical components being rated as regular. Based on the above, it can be concluded that the PH is currently operationally sustainable; however, it is necessary to adjust some of its components and formally prepare the civil works maintenance manual to ensure its long-term operability.

The last aspect evaluated in the sustainability criterion was that of risks related to socio-environmental conflicts. This aspect is of utmost importance because its mismanagement can lead to the temporary or permanent closure of a project of this nature. As shown in Table 12 in the social part, it can be generally seen that there has been a rapprochement with the population and that they have shown acceptance of the project, however, there are always specific situations of disagreement. It is important that the company complies with its commitments to the population to avoid confrontations. In the environmental aspect, the company is complying with the ecological flow quota and other tasks required by the environmental regulatory entity, and it is only necessary for the company to validate the need to monitor water quality and the inventory of aquatic fauna in the river, which seems sensible to do to confirm that no negative impact is being made on the tributary. Based on the above, it can be concluded that there are currently no socio-environmental risks that could compromise the operation of the plant.

The sustainability issues identified through the analysis of the documentation submitted and the interviews conducted with key personnel are listed below:

- Billing mismatch. Invoicing to the customer is differentiated from production. It is advisable to minimize the gap between the reading of the metering instruments and the issuance of the invoice to reduce the financial impact. Attempt to comply with the seventeenth registration, billing and payment clause of the contract.
- Lack of a civil works maintenance manual. In order to extend the useful life of the project and ensure the recovery of the investment, it is necessary to have a manual that indicates the actions to be carried out in an orderly, planned and permanent manner and also indicates the frequency with which these tasks must be performed.
- Deficiencies in the overall hydroelectric plant design. In general, it can be seen that the plant has deficiencies that do not allow the full use of the water resources of the area and it is necessary to make adjustments to the components built to maximize the use of the flow identified in the area.
- In the socio-environmental aspect, there is a lack of conflict resolution strategies.

With respect to social conflicts, Gamboa and Cueto (2012), in their Policy Paper entitled "Hydroelectric plants and social conflicts: recommendations for better environmental management", identify the following direct causes for the generation of social conflicts: the failure to communicate prior and timely the realization of the hydroelectric project, low quality of the Environmental Impact Studies, distrust between the local population and the operator/concessionaire of the hydroelectric project, absence of conflict resolution strategies and preventive conflict management, lack of prior, free and informed consultation with the affected indigenous peoples, etc.

Lessons learned: Based on the above findings, the following is a list of the most important lessons learned from the project under study:

1) Improve the quality of pre-investment studies. It is imperative that decisions be made based on reliable documents, which is why it is necessary to allocate a greater amount of economic resources and sufficient time to carry out the necessary studies that will reliably demonstrate the advantages and disadvantages of the project being evaluated.
2) Creation of a technical dossier. Once a project has been approved by means of an accurate feasibility study, it is imperative to allocate the time required for the preparation of a complete technical file that includes the following aspects: descriptive report, final studies and designs, final drawings, technical specifications that will govern the project, quality specifications, quantification of work quantities, preparation of a base budget with a precision that is within a range of ±5 to ±10 of the expected amount, cost sheets or analysis of unit prices or direct costs, analysis of general expenses and profit or indirect costs, a

base chronogram. It is highly recommended that the personnel performing the above activities be part of the staff that will execute the project since they will have full knowledge of the project from its conception.

3) Seek advice from companies or personnel with proven experience when entering an unknown market. Experience is an added value that must be taken into consideration when undertaking a project, especially when it is the first time that a project is to be developed outside the market in which the company has previously worked. Usually, experienced companies already have and know the procedures, formats and guidelines necessary to manage, as far as possible, situations that may be out of control.

4) Perform effective project management. Effective project management allows the development of a project management plan that effectively integrates the following aspects:

- *Scope*, establish all the work that needs to be done to successfully complete the project and define a scope baseline to validate that the defined deliverables are being met;
- *Time*, establish a baseline of execution time to monitor and control during the execution of the work;
- *Costs*, establish a cost baseline to monitor and control during the execution of the work;
- *Quality*, establish the quality standards required for the project to be executed, perform quality assurance and quality control;
- *Human resources*, identify the personnel needed to carry out a project and when such personnel are required. In addition, define the skills and competencies that such personnel must possess. Subsequently, acquire the required personnel, improve their skills, evaluate, provide feedback and carry out conflict resolution.
- *Communication*, define how communications with the different stakeholders will be carried out and validate that the communication is effective;
- *Risks*, a preliminary study of the possible risks that could occur, defining their probability of occurrence, establishing the impact they would generate and defining whether the risk is assumed, eliminated or transferred;
- *Procurement*, establishment of processes for the acquisition of materials and contracting of services. These procedures must define the specifications of the materials, the minimum quality required, evaluation of the supplier in terms of compliance with contracts and finally define the selection criteria, whether based on quality or price;
- *Project stakeholders*, it is necessary to identify stakeholders, whether they are sponsors, users, affected people, customers, etc., in order to establish strategies for effective stakeholder involvement.

5) Creation of a database of contractors and professional service providers. It is advisable to initiate the creation of a database of contractors, consultants and companies that provide professional services for hydrological, geological, geotechnical, topographical, structural design, etc. studies. In addition, record their experience, references to validate their performance in previous works, contacts and any other information considered relevant.

6) Development of a digital repository**.** It is important and convenient for the company to have a digital platform or shared digital folders. These folders provide access to various technical information resources, lessons learned or relevant information to be taken into account by key personnel for the performance of their functions, or for the same personnel to gradually add the information they generate, so that it is available to other colleagues

and forms part of the company's intangible capital. Access restrictions can be made as deemed appropriate.

7) Validation of hydrological modeling. The work was approved through the use of hydrologic modeling due to the lack of site-specific data. Given that the hydroelectric plant is in operation, it is considered a good practice to compare the actual observed versus modeled data to, firstly, certify the degree of reliability of the base modeling and simultaneously confirm whether the productions foreseen in the feasibility study will be achieved and, secondly, adequately study the area to assess whether it offers new business opportunities.
8) Bechmarking. In order to ensure the sustainability and useful life of the project, an evaluation and analysis of the processes (e.g., operation and maintenance), products and/or services of companies or firms with extensive experience in hydroelectric power generation and that demonstrate "best practices" is proposed. The purpose is to compare the processes of the reference or benchmark company with the processes currently being executed and to confirm if there are opportunities for improvement and implement the changes considered appropriate. It is suggested to pay special attention to operation and maintenance practices, personnel training and socio-environmental risks. The aim is to learn from the experience of others in order to improve one's own performance.
9) Preparation of a socio-environmental risk analysis. A detailed analysis of possible risks, both favorable and adverse, is important in order to establish action plans to prevent negative risks from materializing and to enhance those with a positive impact.

The general objective of this research is to analyze the causes that generated considerable deviations in costs, project execution times and the uncertainty of obtaining the expected energy production once the hydroelectric dam is put into operation. Based on the above, it can be concluded that:

- It is considered that the research has achieved its main purpose by identifying through the use of the evaluation at completion, which is the first of the evaluations stipulated within the ex post methodology, that: the inaccuracy of the technical studies used for the project design, the lack of a definitive study or technical file before starting the project, the lack of an effective project management plan, the planning and initial management of the project by personnel with limited experience, have been the origin of the main causes of the time and cost delays that have arisen.
- It has been possible to confirm that the dam has weaknesses in its design, which do not allow it to make full use of the available water resources and obtain the expected energy production. It is necessary to make adjustments to certain components to maximize their use.
- An ex-post follow-up evaluation is required within one year to verify the sustainability of the project. This sustainability will be evaluated based on operation and maintenance.
- It is important to insist on the need to document the lessons learned and proceed immediately to their dissemination for application to the project under study and to future projects to be executed.

To close this section, some recommendations for the future are proposed.

- Continue with the next stage of the Ex Post evaluation, i.e. ex post monitoring, to validate sustainability oriented to operation and maintenance within one year.
- Review of the overall design of the dam, by personnel or companies with the appropriate skills, to identify the necessary adjustments to be made in order to get the most out of it.

- Once the design review has been carried out, invest in an adequate planning for the execution of the design, establishing from the beginning baselines for comparison of scope, budget and work scheduling.
- Evaluate the operation of the sand trap built in the loading chamber since it is not working effectively.
- Continue to compile lessons learned and disseminate them to company personnel so that they can be taken into account in the planning and execution of future projects.
- Identify, as a team, the risks that threaten the project, which may have a positive or negative impact, in order to establish action plans to maximize or minimize them or eliminate them respectively.
- To reduce the financial risk of the project during its operation stage, there must be adequate coordination between the operating and administrative teams to ensure that invoicing and collections are not delayed, since there is no slack between the amount invoiced and the operating, maintenance, administrative and financial costs and expenses.
- To ensure that there are no interruptions in operations for socio-environmental reasons, bear in mind the Compensation Measures contracted with the neighboring community set out in the Qualitative Environmental Diagnosis (DAC) 2007 and the duties acquired in the Environmental Measures Compliance Report (ICMA), 2018, and validate the need to carry out the environmental control measures number 53 and 55 of said report.
- Analyze the feasibility of performing preventive maintenance to extend the useful life of the metallic pipe by using coatings that protect the pipe both externally and internally from rust and corrosion.

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STANDARDIZED MODEL FOR PROJECT IMPLEMENTATION PLANNING TO IMPROVE THE PERFORMANCE OF NONPROFIT ORGANIZATIONS

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Summary. In this work, the instruments within the processes used for planning the execution of projects in nonprofit organizations, NPOs, were identified: Scope, Time and Costs, as well as their impact on the performance of the projects and their improvement through the proposed model, which rescues the best practices of the world of the same entities, and at the same time, the practices of the business world that can be adapted to a greater or lesser degree were identified. For the management of the implementation, 18 instruments were found, most of them proposed and rescued from the business world; 10 of them were adapted for the ENL without problems in 100%; 4 of them for 36% of the ENL; while only 28% of the instruments from the business world could be adapted for the ENL. In general, it was possible to identify from the results that the NLAs do not have a functional structure that facilitates the formulation and execution of projects, since decisions are made at high corporate levels, which sometimes, together with the lack of experience, makes it difficult to apply the use of the tools and delays the attainment and attraction of resources through the projects. Finally, the model represents an initial proposal that can be analyzed, modified and is subject to continuous improvement.

Key words: Execution phase, Non-profit entities, Efficiency, Effectiveness, Standardized model.

MODELO ESTANDARIZADO PARA LA PLANIFICACIÓN EN LA EJECUCIÓN DE PROYECTOS QUE PERMITA MEJORAR EL DESEMPEÑO DE LAS ENTIDADES NO LUCRATIVAS

Resumen. En este trabajo fueron identificados los instrumentos dentro de los procesos utilizados para la planeación de la ejecución de proyectos de las organizaciones sin fines de lucro, ENL: el Alcance, Tiempo y Costos, así como su impacto en el desempeño de los proyectos y su mejora a través del modelo propuesto, que rescata las mejores prácticas del mundo de las mismas entidades, al mismo tiempo fueron identificadas cuales fueron las prácticas del mundo empresarial que pueden ser adaptadas en mayor o menor grado. Para la gestión de la implementación se encontraron 18 instrumentos en su mayoría propuestos y rescatados del mundo empresarial entre ellos; 10 de ellos fueron adaptados para las ENL sin problemas en un 100%; 4 de ellos para el 36% de las ENL; mientras que de los instrumentos propios del mundo empresarial sólo un 28% pudieron ser adaptados para la ENL. En general, se pudo identificar a partir de los resultados que la ENLs no cuentan con una estructura funcional que facilite la formulación y ejecución de proyectos, ya que las decisiones se toman en altos niveles empresariales, lo que a veces unido a la falta de experiencia dificulta la aplicación del uso de las herramientas, y retrasa la consecución y captación de recursos a través de los proyectos. Finalmente, el modelo representa una propuesta inicial que puede ser analizada, modificada y está sujeto a la mejora continua.

Palabras clave: Fase de ejecución, Entidades no lucrativas, Eficiencia, Eficacia, Modelo estandarizado.

Introduction

In the course of history, a number of social and economic organizations have emerged, created with the aim of responding to the needs of certain groups in society, which due to their specificities do not belong to the public or private capitalist sectors in which economic entities are traditionally classified, giving rise to the residual field known as the "third sector". The third sector has gaps that have not yet been filled, since it is presented with two approaches: the first is the European social economy, of French origin, which identifies the non-profit sector. The second approach, called Anglo-Saxon, conceives the nonprofit sector as equivalent to the third sector, thus identifying it with nonprofit entities characterized by the application of the principle of non-distribution of benefits, including both entities (Ruíz, 2001).

The Non-Profit Entities, NPEs, also known as social economies, third sector, solidarity economy, participatory economy, among others, also known as social economies, third sector, solidarity economy, participatory economy, among others. They consider NLEs as a sub-sector of the economy, where their main characteristic, compared to companies and public entities, is related to the primacy of man and the social purpose over capital. Its main services are not intended for exchange through price and satisfy its target audience, which is found in different fields of action, such as: rural development, culture, education, health, adults, children, among others (Radrigan and Peniglalia, 2012).

In the legal and administrative sphere, NLEs differ from for-profit entities, EL, as those whose purpose is different, generally of a social nature, since they do not respond to administrative hierarchies subject to the law (Raffino, 2020). Many organizations, whether EL or ENL of companies or institutions, where tasks/activities are often confused with projects, due to the fact that both have similar characteristics: they are executed by people, they are limited by time and resources, they require planning, to be executed, supervised and controlled in order to achieve specific objectives and the success or failure of the organization depends on the focus of the results. The main difference lies in the fact that projects are temporary and have a defined end, while activities/tasks are continuous and repetitive and sustain the organization over time, produce goods and

services, and do not end when they reach their objectives. (Lledó and Rivarola, 2007; Gardilcic, 2016). According to their nature there are multiple types of projects, but in this case we will only address the classification of projects according to their nature or the entity that promotes them, these can be: public or social and private (Meza, 2010).

Projects in ENL non-profit organizations consist of 3 phases: formulation, implementation and evaluation. The formulation and evaluation of projects in these entities have standardized models that are applied, resulting in projects that are very well formulated and in line with the reality in which they operate. However, the execution phase has very dispersed, non-standardized and difficult to apply instruments, which affect project performance. Project management boasts an abundant literature in relation to the application of instruments generated in for-profit companies (Siles, Mondelo, 2018). On the other hand, this is not the case for NPOs due to their essential characteristic, that of not producing monetary surpluses, which makes their performance difficult since they cannot be evaluated with objective criteria, as is the case of for-profit entities. Along with this, there are the purposes that NLEs follow, which are difficult to quantify, which makes it necessary to look for new ways to propose planning practices for project execution in order to improve performance.

The current importance of non-profit entities is due to the role of the actors both inside and outside the institutions, who demand clarity and effectiveness in the management to improve their performance; since it is clear that the success of these entities is given by the success in their planning processes for the execution of their actions, satisfying the demands of their target population (Navas, Breijo, 2020).

Some nonprofit entities will incorporate practices in the formulation and implementation of planning mechanisms to improve their performance. Although these practices have been beneficial, they have not been analyzed in detail to know their degree of diffusion and use, since the studies reach a very incipient level, despite the fact that in the business field they are giving good results (Mason, 2020).

The management approach in general, and planning in particular, is an aspect that is being addressed by two disciplines, economics and sociology. However, none of this knowledge has satisfied all the demands for information that needs to be systematized and despite their socioeconomic relevance in the nonprofit field there is insufficient consistency in data processing and inventory of these entities, at the same time, an incipient qualitative research and identification of facts is observed, especially in matters of management of the execution of activities (Helming, Jegers and Lapsley, 2004; Radrigan, Dávila and Penaglia, 2012).

The execution or implementation of projects in NLEs has very little relation with existing research in the environment, thus, there is a fragmentation of knowledge (Mason 2020). The use of project execution instruments in public institutions is a recurring requirement, but this does not ensure the success of their performance, so it is necessary to take into account other aspects such as: the intrinsic nature of these entities, the importance of human resources and the knowledge of the different actors and their roles (Andalaf. 2006). The planning of project implementation was based on instruments such as participatory observation, in-depth interviews, surveys and the review of the current legal framework, and its results were aimed at projects of a public nature, thus breaking down a methodological proposal with its corresponding instruments, aimed at projects for undeveloped countries (Da-Fonseca, Hernández-Nariño, Medina-León, Nogueira-Rivera, 2014).

As can be seen, the efforts for the use of planning instruments in NLEs have been continuous, however, there are still pending issues such as the effectiveness in their performance, which opens the doors to a range of future research (Moreno, Carrillo,

Roldán, Parrado 2018), aimed at achieving an improvement in the management of project execution, a key aspect of performance (Mason, 2020). From this aspect of analysis, a key element to take into account will be the different actors that have a transcendental role in the management of this type of organizations (Aragoneses, 2017), this emphasizes the importance of strategic planning of human resources as another tool that enables the improvement in the overall performance of NLEs (Guo, Brown, Ashcraft, Yashioca, 2011).

Research on the studies carried out in non-profit entities show that they are very incipient with respect to the execution phase of projects, making it difficult to contribute to their performance. Therefore, due to the absence of instruments and practices, the market and the dynamics are analyzed to facilitate the performance of activities for the benefit of the population involved in the projects. At the same time, management improvement is sought to be implemented with the identification of tools, techniques and methods within the business sector or adapted to the characteristics of the non-profit sector (Leguizamón, Castillo, 2011).

This work identified the instruments used for project execution planning in NLEs, specifically the instruments for Scope, Time and Costs, as well as the impact on the performance of the projects, by proposing a model that rescued the best practices from the world of NLEs and at the same time identified practices from the business world that can be adapted to a greater or lesser degree.

Method

Design

The research had a mixed level (exploratory and descriptive). At the exploratory level, it uses two types of research: literary research, which makes it possible to resort to statistical references of non-profit entities, data and analysis. This made it possible to obtain specialized information in the area of nonprofit management. The descriptive research made it possible to answer questions such as: what causes, what problems, how they are used, when, where and by whom, methods, techniques and tools for planning the execution of NLA actions.

Population

The main characteristic to determine the sample was to identify projects in development based on integral actions that are dedicated to improving the living conditions of the population and the most vulnerable sectors. The sample was "non-probabilistic" because of the use of criterion sampling by means of clusters: Group one conducted in-depth interviews with 5 non-governmental organization directors and 20 foundation directors. The second group applied a questionnaire to 5 technicians responsible for the execution of projects of non-governmental entities from 20 foundations.

Techniques

The technique applied was the *unstructured observation* used under natural conditions in the different circumstances and spaces where the population under study interacts. The *structured interview* was carried out by means of a questionnaire previously prepared and evaluated by experts in the area in order to gather information from primary sources at the time of the interview process and, finally, the *closed survey,* this technique was based on the recording of opinions and thoughts of project directors and technicians of nonprofit organizations.

Validation of Research Instruments instruments

The validation of the research instruments was carried out in three steps: first, an interview guide with a series of questions focused on the object of study was developed. Next, a questionnaire was formulated with a series of questions related to the variables of the object of study. Finally, the questionnaire was structured with 6 sections: a) Information on non-profit entities. b) Information on the knowledge of tools for project implementation. c). Information on the use of tools for the execution of projects. d) Information on problems in the use of tools. e). Information about the adaptability of tools. e) Observation guide. The research questions were categorized, designed, evaluated and validated by experts in the field.

Statistical Analysis

For the analysis of the data, an inventory of qualitative and quantitative aspects was made, following the following steps such as: Careful**reading** of texts related to the tools and techniques used by nonprofit and for-profit entities. **Categorization** based on questions such as: what are the causes and problems encountered in the management of nonprofit organizations? Also, which instruments are used and which can be adapted, taking as a basis the Delphi method for a better adaptation to the object of study. **Grouping and regrouping.** Through the regrouping and conformation of analyzed documents taking into account: the syntactic, semantic, pragmatic levels and the objectives to which the research is intended to respond as established in the literature (Gil, Conti, Pulido and Prieto, 2002).

Database Construction

With the research data, a database is created in an excel file parameterizing the responses of the entities taken. The focus of the study is defined by each of the research questions, the data generated through descriptive statistics will generate graphs that allow us to interpret and obtain the first answers to the research questions. The detailed analysis answers preliminary conclusions and finally interprets and answers the objectives, the research problem, designing an effective communication process in the final document.

Database analysis criteria

First the statistical data were recorded: the amount (number), the sum, the mean, the maximum and minimum values, the standard deviation, the quantity according to the values, the percentages according to the values, and the total percentages, the increasing and decreasing values. Multiple response data were coded to facilitate statistical treatment; choice data such as "Yes, No, Maybe" were also coded for statistical treatment.

The open-ended questions, strictly qualitative, underwent a first phase of homogenization, to group answers coherent with the feeling of the questions, interpreted with a high level of alertness to verify the degree of coherence both internally and with other groups of answers. Some of the answers were linked to each other, which made it necessary to correlate the results. Also, in the analysis of the open-ended questions with more than one answer option, the following points were taken into account for a proper statistical analysis: 1) In some observations, the percentage of responses may make sense out of the total number of responses, giving a result of 100. 2) In other observations, the percentage of responses will make sense over the total number of entities surveyed. The sum should add up to 100. 3) In other cases, the % of responses will make sense over the total number of entities surveyed, and may exceed 100 if an entity participates in more than one option.

Results

For the empirical verification of the stated objective, several questions were asked, such as:*Which phase do you consider the most important of the project*? The answer to this question gave a glimpse of which phase of the project is given the greatest importance by the NPOs and was considered the one to which they dedicate the most time and resources; in this case the most important phase was project formulation, where approximately half of the nonprofit entities (48%) assign it as a priority, this is due to the requirement of the cooperation entities, since they ensure the target groups and that the project is viable. It was also possible to observe that only one third of the NLA budget is allocated to the project implementation phase (28%) and 24% to the evaluation phase, which was the least prioritized in terms of importance, despite the fact that it is a tool for verifying the achievement of objectives and scopes and, at the same time, proposes adjustment and correction mechanisms for future actions.

When asked the question " *Why do nonprofit organizations assign greater importance to the Formulation phase?*they stated that it is because at this stage of project generation, problems and needs are identified that give the projects their raison d'être, and that the entities that prioritize project evaluation consider that this phase is the one that allows for feedback and allows for correcting deviations and errors. While the entities that opted to give greater allocation to Execution argued that this phase embodies the reality of the project, it also ensures its successful implementation. See Figure 1.

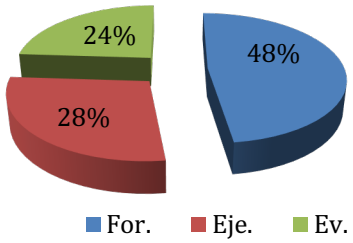

Figure 1. Importance of the phases of a project.

In response to the question "*What instruments are used for planning the implementation of the Scope*, the NLA, it was observed, as shown in Figure 2, that of the 4 instruments proposed (Analysis of Alternatives, Needs Matrix, Logical Framework and Programmatic Matrix), all four instruments were usedlogical Framework and Programmatic Matrix), priority is given to the logical framework, where -absolutely all of them- considered it to be the best known instrument in the NLAs and the cooperation entities. Unfortunately, they are not used to their true potential, because the entities only apply them in the project identification and formulation phase, and not for execution.

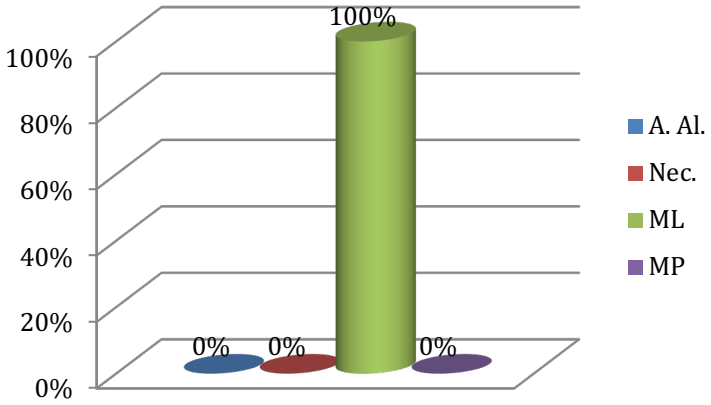

Figure 2. Use of project scoping tools

Now, consulting*What instruments are used to a greater extent for the chronogram*, it was identified that the use of the instruments specified above shows aspects related to the use in the NLEs. Of the instruments known by the LNAs, although to varying degrees, the one most commonly used is the logical framework (100%), which is not a specific instrument for planning the execution of activities, since it does not allow sequencing, establishing milestones, defining total and partial times for the project as a whole. On the other hand, although GANTT is known by some of the NLEs (20% of them), it is not used by any of them, which corroborates the lack of knowledge of its true potential. Similarly for instruments such as CPM and PERT are not used and are not taken into account for their applicability, since they would allow an optimal improvement in the execution planning for the project, thus ensuring time efficiency to achieve success in the projects, see Figure 3.

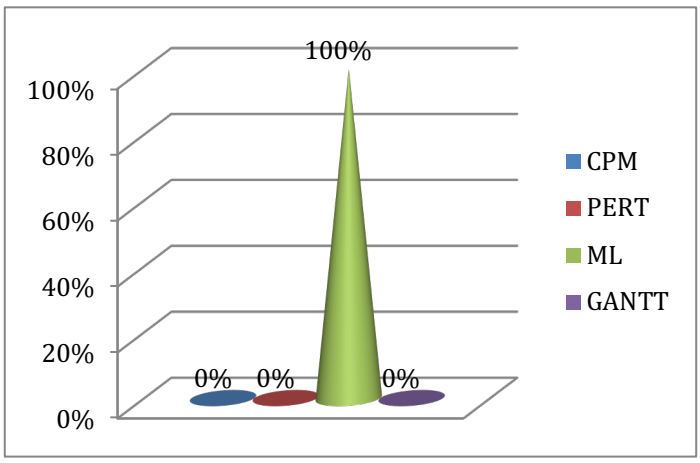

Figure 3. Use of tools for project scheduling

With respect to the question "*Which instruments are used to a greater extent for costs*", it was found that the budget instrument is the one most used for planning the execution of project costs in the NLEs (this is shown in Figure 4). Cost estimates as a tool are not used in any of the cases studied. Therefore, it can be deduced that budgets are not prepared efficiently by the NLA, since the second instrument is a necessary complement to the planning of cost execution in the project. This cost situation that has been presented, is one of the concerns when referring to the complementation not only of cost techniques, but also the interrelation with other processes such as time and scope of the project (Siles, Mondelo, 2018).

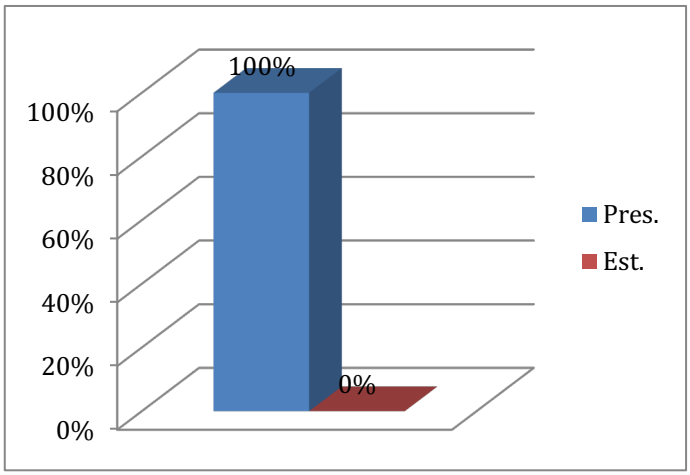

Figure 4. Use of instruments for project costs.

For the question*"How does the degree of use of instruments for project scoping affect*the degree of use of instruments for project scoping", it was observed that the causes of the degree of use of instruments for project scoping have little effect on the performance of projects in the NLEs (68%). Despite the fact that several instruments are not used for scoping, the Logical Framework is still the most used, it is very complete and adequate for this type of organizations, it was also observed that the degree of use of instruments for scoping affects the performance of a third of the NLS (32%) since they state that it is important to diversify the use of instruments for this process or phase (see Figure 5.).

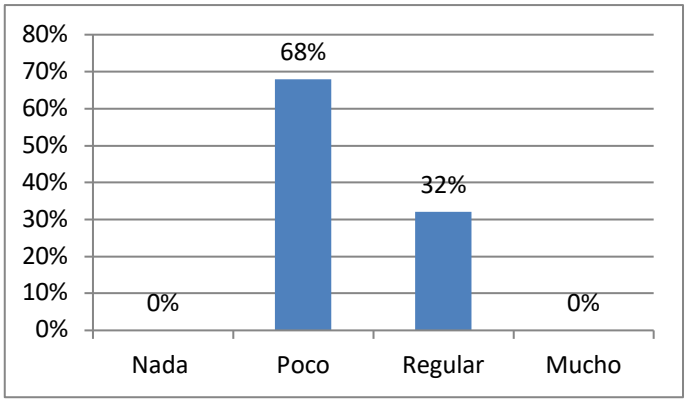

Figure 5. How it affects the degree of utilization of instruments for outreach.

Figure 6. shows*how the degree of use of planning instruments for the project schedule affects the degree of use of planning instruments for the project schedule*, as the planning of the execution of schedules is related to the activities and times of the project in the NLSs that use the Logical Framework to a greater extent; however, despite the importance of this technique, it is not exclusive, nor is it adequate for the planning of the schedule. With the application of this tool, non-governmental entities only list activities directed according to objectives, they do not have logical sequences, nor the establishment of fundamental milestones to optimize project times. The exclusive and reduced use of scheduling instruments affects project performance to a regular extent for more than half of the NLS (56%), while almost the other 44% stated that they affect project performance to a greater extent. This means that the NLEs do not have the

necessary instruments to optimize project times, compromising the degree of project efficiency.

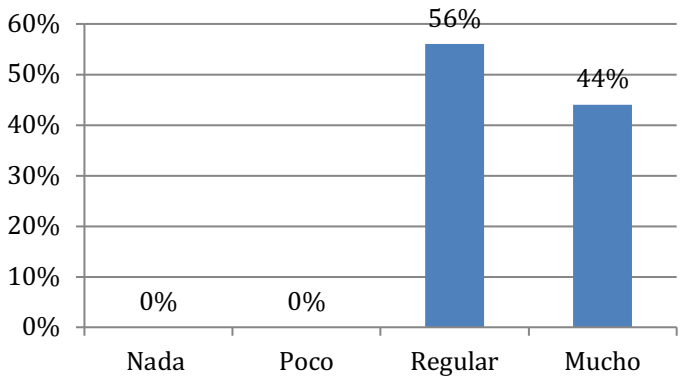

Figure 6. How it affects the degree of utilization of instruments for the schedule.

Figure 7 shows how NFEs are affected in their performance through the question*"How does the degree of use of instruments for planning the execution of costs affect*the quality and quantity, process of the costs of the instruments for planning the execution on the performance of the NFEs", it is observed that 64% are regularly affected, while more than one third (36%) indicate that if the costs are not adequately managed, they will directly affect the performance.

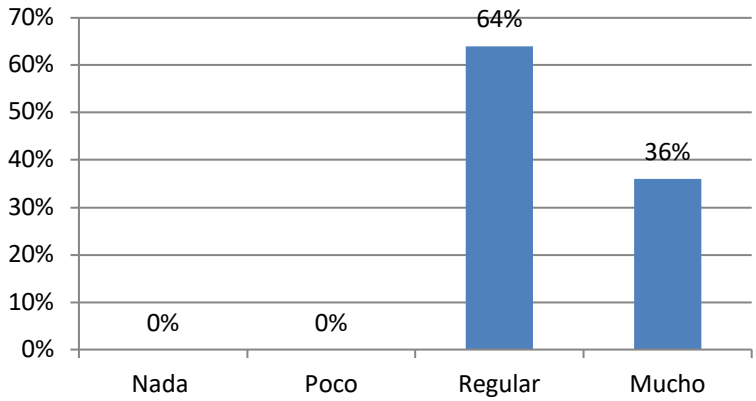

Figure 7. How the degree of utilization of techniques and tools affects costs.

To find out *which instruments used by private companies with the PMBOCK approach can be used or adapted in the NBS,* technicians were consulted on the basis of the diagnosis and real capacities, which make it possible to use and adapt the dynamics of nongovernmental entities to improve their performance. The technicians identified that the instruments can be used and adapted to their dynamics, among them are: Analysis of Alternatives, Needs Matrix, Programmatic Matrix, Logical Framework (specific to the NLAs), Budgets, Quotation Tables, Supplier Selection, Hierarchical Diagrams, Expert Judgment, Responsibility Matrix, which are 100% used and adapted without problems in the non-governmental entities. While instruments such as Market Research, Estimation by Analogy, Parametric Estimation, Estimation by Alternatives, can only be used and adapted without problem in 36% of the non-profit entities.

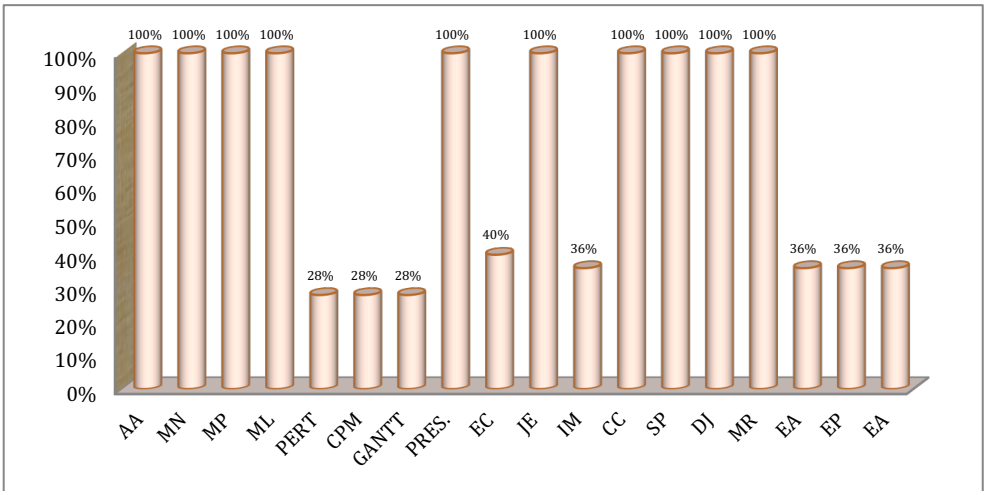

Figure 8. Techniques and tools that can be adapted.

It was also observed that instruments such as: PERT, CPM, GANTT, are usable and adaptable, only for 28% of the NLEs, where almost 2/3 of them manifest themselves as instruments that are strictly quantitative and do not take into account the qualitative aspects in the processes implemented by the nonprofit organizations. Also, it could be determined that the Cost Estimation instrument, can be used and adapted without problems in 40% of the NLEs (see Figure 8.), these results give support to those found in the results as mentioned in the literature (Siles and Mondelo, 2018).

Figure 9 below shows the instruments that are inserted in the proposed model. These adapted instruments are for both the business sector and the NLA, which rescues and adapts good practices that complement their application in the planning of project execution, thus improving efficiency, effectiveness and performance impact in the NLA.

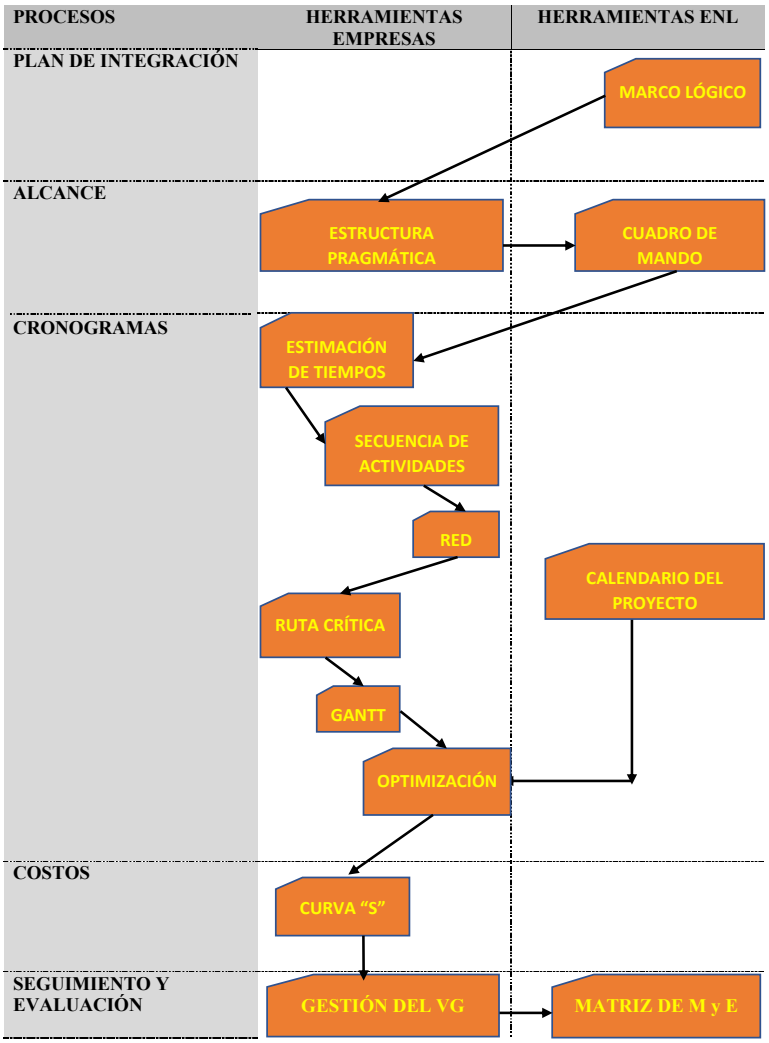

Figure 9. Execution planning model.

For the Scope instrument, the *Logical Framework* in the NLA *follows*a cause-effect or means-ends "logic" to relate all the elements of an intervention. This methodology covers 3 areas: the analysis of the context of the intervention, the ordering and structuring of ideas and the presentation of the project in a clear and standardized way as shown in Figure 10.

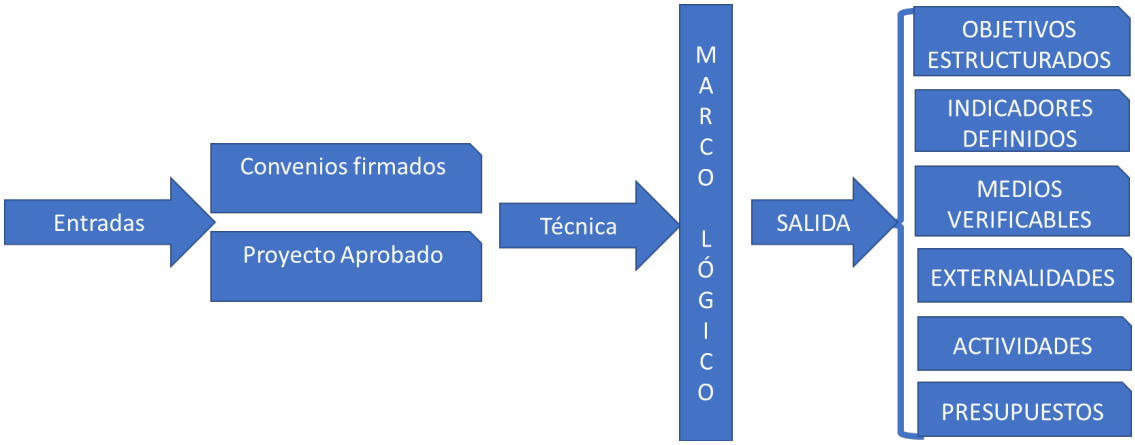

Figure 10. Logical Framework Instrument.

In order to know the EP Programmatic Structure, the project team starts the breakdown of the activities starting from the central objective of the project up to the level of the Lines of Action. It is a structure that facilitates the order of the different levels in the PD: 1) Project objective: the central objective of the project to be achieved. 2) Components: the set of products grouped according to their nature. 3) Action lines: the groups of activities or tasks that are performed to achieve the project's outputs; it is the lowest level of the WBS. Figure 11 shows a diagram of the hierarchical ordering of PD.

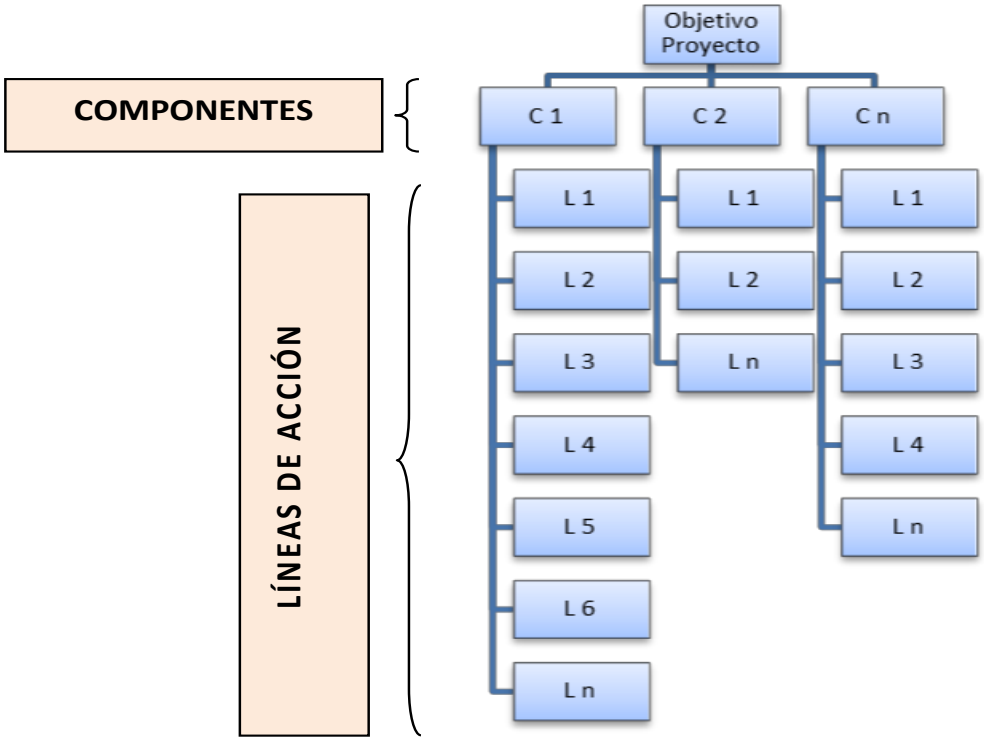

Figure 11. Instrument programmatic structure.

As an extension of the ***PD*** , a *scorecard* was generated that incorporates the assignment of staff responsibilities, directly linked to the objectives of the components and lines of action as shown in Table 1.

Table 1
Scorecard

Team	**Component 1**							**Component 2**			**Component n**					
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**Ln**	**L1**	**L2**	**Ln**	**L1**	**L2**	**L3**	**L4**	**L5**	**Ln**
Staff 1	A2	A2	A2			A2		A1	A2	A2		R	R	A1	A1	
Staff 2	R	R		A2	R			R			A1	A2	A2			A1
Personnel n		A2					A2	A2	A1						A2	
R: Responsible	Ln: Lines of action							Ln: Lines of action			Ln: Lines of action					
A1: Primary Support																
A2: Secondary Support																

The instrument for the determination of the Time (Chronogram) or Critical Path Diagram PERT, CPM was defined starting from the beginning to the end of the project and took more time compared to other routes this presents spaces or slack between

activities, which means that any delay in any of the activities could affect the route resulting in a delay of the project as shown in Figure 12, which has a network of a project with four routes.

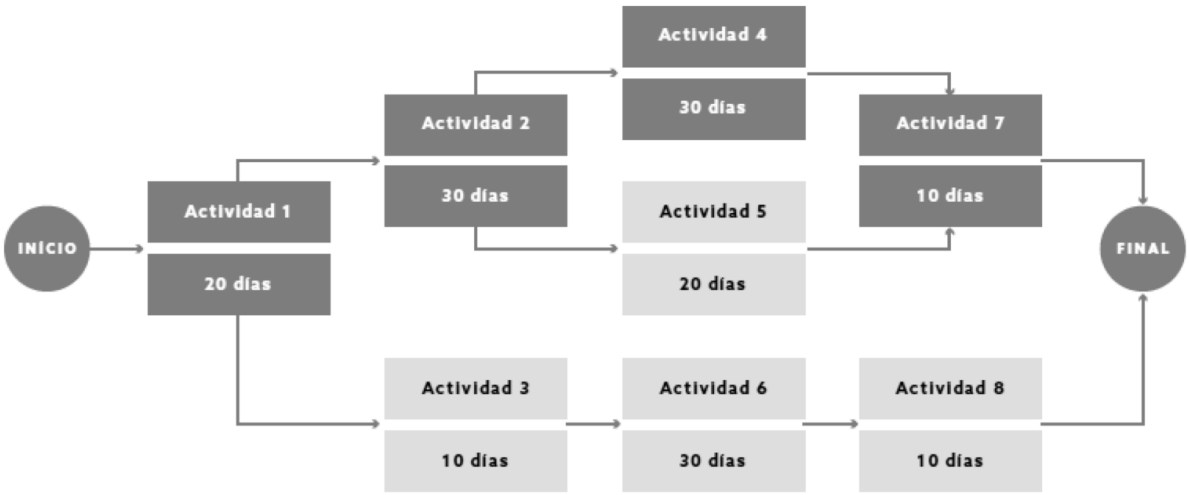

Figure 12. Instruments for the schedule, critical path
Note. Source: Project Management Institute.

The *Gantt chart* shows the expected duration of the different activities over the total project time. This method is frequently used to represent the project schedule since its graphic presentation favors its comprehension; basically, the diagram is composed of a vertical axis, in which the activities that constitute the work to be executed are established, and a horizontal axis that is shown in the form of a calendar and the duration of each one of them. The activities are presented in the form of a bar or line showing the start and end, the groups of activities related to each other and the dependencies between them as shown in Figure 13.

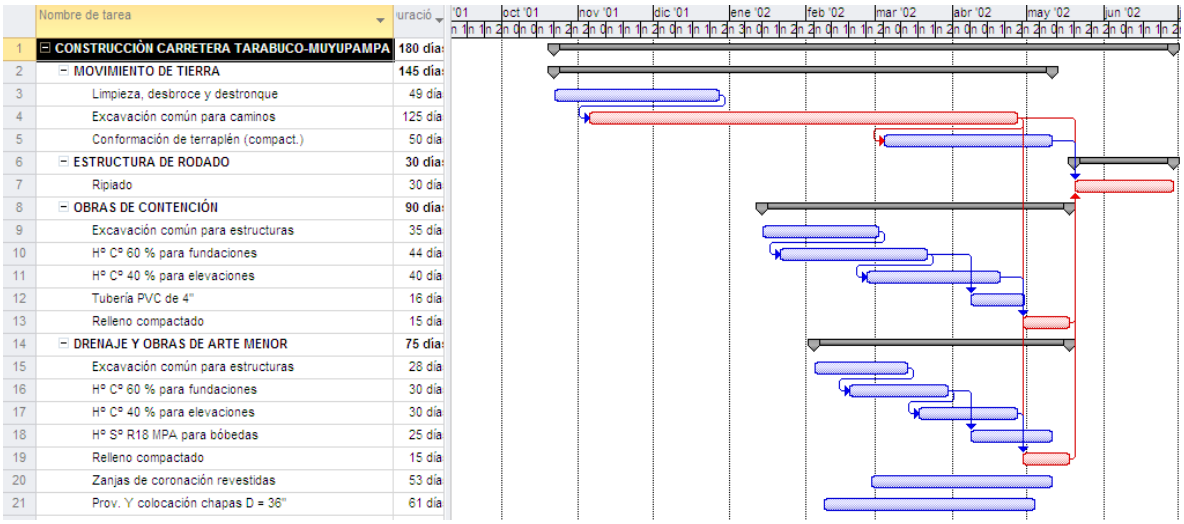

Figure 13. Gantt chart tool
Note. Source: Project Management Institute.

An important part is the *project schedule* (Table 2) whose technique is very similar to Gantt, but is intimately connected with the Programmatic Framework and the Logical

Framework, which relate the times, activities, objectives and persons responsible for the project and is widely used by ENL.

Table 2
Correlation table, knowledge and use

Code	Components and activities	Activity indicators	Responsible	Calendar in months											
				1	2	3	4	5	6	7	8	9	10	11	12
C.1.															
C.1.1.															

Once the project schedule was established, we proceeded to establish the Cost instrument, the process consisted in generating a cost curve, first the financial resources of the project were organized to complete and achieve the objectives within the approved budget, then the cost processes were analyzed and the cost use curve was determined, which contains: a cost estimate, the budget analysis and the creation of a baseline, in which the correct cost estimate consisted of assigning a cost or value to each of the activities necessary to produce a result and was represented by the S curve that represents the uses of resources as a function of time, the graph means as the beginning of the project, the low expenditures, then the increase and finally a reduced measure of the completion of the project, as exemplified in Figure 14.

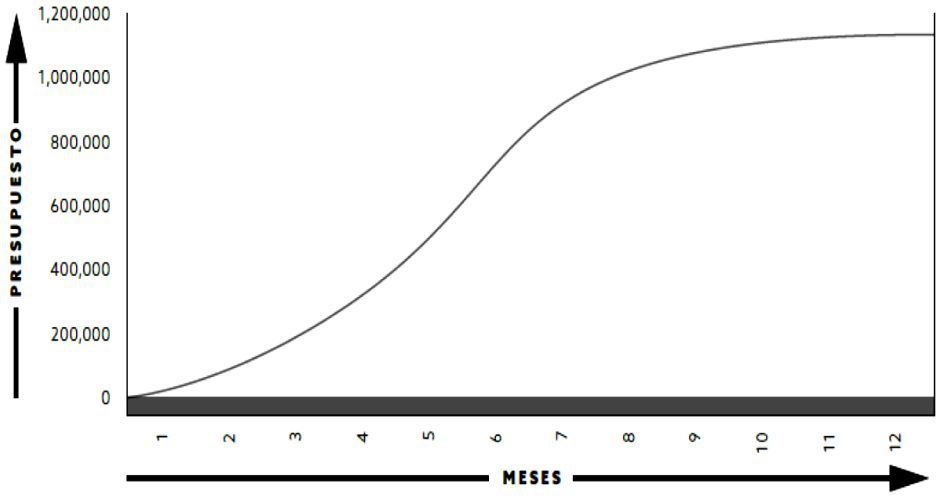

Figure 14. Cost S-curve.
Note. Source: Project Management Institute

To generate the *instrument for Costs and Times* , Earned Value Management was used, which allows controlling the execution of a project through instruments such as scope, schedule and costs, thus enabling the simple measurement of project performance based on the planning. It is essential that the evaluation and control instruments be applied jointly with the cost, as well as the execution of the activities, which avoids the limitations of other techniques that are being analyzed in a partial manner, without having an overall

view. Earned value management compares planned work with what has actually been completed to determine whether costs, times and tasks performed are being met as stipulated. The use of earned value management relies on project data to compare planned and completed work at a given point in time. The result is a measure that indicates the progress to date and estimates the remaining time and budget to complete the project. Figure 15 shows the relationship between the different elements of earned value management obtained from the technique: the Actual Cost (AC/Actual Cost), the Planned Value (PV/Planned Value), and the Earned Value (EV/Earned Value).

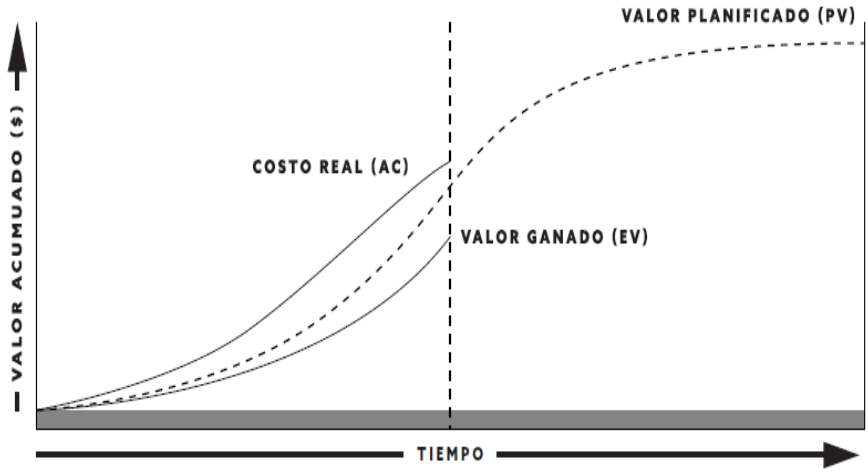

Figure 15. Earned Value Management.
Note. Source: Project Management Institute.

Discussion and conclusions

Discussion

In direct relation to the research objective, it was noted that the NLAs do not give greater importance to the project execution phase, while the formulation and evaluation phases are given greater priority. This causes these types of organizations to fail to develop and use tools for performance management, especially those related to Scope, Time and Costs. Another cause to highlight is that, of the 3 standard processes in Project Execution Planning, which have been taken into account in this work (Scope, Time and Costs), only the *Scope* is prioritized, which is closely related to the nature of these organizations because it comes from the donated funds, does not induce a cost/benefit analysis, and for this reason, it is not given greater importance to the instruments to rationalize the use of resources to achieve the objectives.

The instruments used for the Scope, Time and Costs processes are very limited, sometimes only one instrument is used, when there is an average availability of at least 6 instruments per process, or even when an instrument is used, it is used partially without using its true potential. The effects caused by the degree of use of the instruments are differentiated on the one hand for Scope, and on the other hand for Time and Costs. This may be due to the fact that the NLAs define their objectives, areas and populations in the project formulation phase, which is the best known and most experienced phase, having little impact (68%) on the performance of the entities interviewed.

On the other hand, the effect on performance in relation to Time and Costs is important (regular) and very important (very important). The low use of instruments for project execution causes the effect on performance to be between important and very important, between 56% and 44% for time and 64% and 36% for costs, which affects

performance in an important and very important way, respectively. Of the 18 instruments found for performance management proposed in the study and mostly rescued from the business world, 10 of them can be adapted without problems for 100% of the non-governmental entities; 4 of the instruments can be adapted for 36% of the NLA; and the instruments from the business world can be adapted for only 28% of these entities, this means that a greater effort would be required to adapt the instruments, as well as more training for those in charge of implementing them. Finally, the instruments for the improvement of project execution based on Scope, Time and Costs were rescued and adapted, so that the NLEs have the standardized model proposed as a minimum to improve their performance. This model represents an initial proposal that can be analyzed, modified and is subject to continuous improvement.

Conclusions

The instruments of the project execution phase for ENL that are currently used by non-profit entities are within the processes of: Scope, Time and Costs, these instruments have adverse effects on the performance of the projects, since their use is very restricted and limited. Of the 18 tools found for performance management, which were mostly developed and rescued from the business world, 10 of them were adapted without any problems 100% for non-governmental entities; 4 of them for 36% of the NLAs, while the business world's own tools can only be adapted for 28% of them. In general, it was possible to identify, based on the results, that the NLAs do not have a functional structure that facilitates the formulation and implementation of projects because decisions are made at high levels, which sometimes lack experience in evaluation, making it difficult to apply the tools, delaying the procurement and attraction of resources through projects. Finally, the instruments for the improvement of project execution based on Scope, Time and Costs were rescued and adapted, so that the NLEs have the standardized model proposed as a minimum to improve their performance. This model represents an initial proposal that can be analyzed, modified and is subject to continuous improvement.

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EVALUATION OF SUPPLY CHAIN MANAGEMENT IN THE CONSTRUCTION SECTOR AS A PLANNING TOOL IN HIGH-RISE HOUSING PROJECTS

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Summary. This research project evaluates supply chain management as a planning tool for high-rise housing construction projects; its scope is to determine the main and secondary causes that affect the productivity of such projects. The above, through a self-administered sample survey of analytical type, where a population of small and medium-sized construction companies in the city of Medellin was selected, focused on high-rise housing; surveying residence assistants, teachers, construction managers, warehousemen, among others. The information was evaluated through Pareto diagrams and root cause analysis, taking into account the 80/20 rule; the results showed that the links that make up the Supply Chain Management such as suppliers, order delivery and storage work separately, which delimits the generation of value in these companies. And that, in this case, the lack of knowledge of the Lean Construction philosophy leads to inadequate logistics of waiting and idle times. In addition, it was found that these companies do not incorporate logistics management as an integral tool for internal and external processes of the work, avoiding the just-in-time model for the supply of resources.

Key words: Logistics management, resource optimization, inventory management, productivity, supply chain.

EVALUACIÓN DE LA GESTIÓN DE LA CADENA DE ABASTECIMIENTO EN EL SECTOR CONSTRUCTIVO COMO HERRAMIENTA DE PLANIFICACIÓN EN PROYECTOS DE VIVIENDAS EN ALTURA

Resumen. Este proyecto de investigación evalúa la gestión de la cadena de abastecimiento como herramienta de planificación de proyectos de construcción de viviendas en altura; su alcance está en determinar las causas principales y secundarias que inciden en la productividad de dichos proyectos. Lo anterior, a través de una encuesta muestral autoadministrada de tipo analítico, donde se seleccionó una población de pequeñas y medianas empresas constructoras de la ciudad de Medellín, enfocadas en viviendas en altura; encuestando a auxiliares de residencia, maestros, directores de obra, almacenistas, entre otros. La información se evaluó a través de diagramas de Pareto y análisis de causa raíz, teniendo en cuenta la regla del 80/20; cuyos resultados arrojaron que los eslabones que componen la Gestión de la Cadena de Abastecimiento como proveedores, entrega de pedidos y almacenamiento funcionan de forma separada, lo que delimita la generación de valor en dichas empresas. Y que, en este caso el desconocimiento de la filosofía Lean Construction conlleva a una inadecuada logística de los tiempos de espera y los tiempos ociosos. Adicionalmente, se encontró que estas empresas no incorporan la gestión logística como herramienta integral de procesos internos y externos de la obra, evadiendo el modelo de justo a tiempo para el aprovisionamiento de recursos.

Palabras clave: Gestión logística, optimización de recursos, gestión de stocks, productividad, Cadena de abastecimiento.

Introduction

For construction, logistics management is an area of vital importance for the continuous improvement of supply, production and resource distribution processes; therefore, it is necessary for the constructor to appropriate the content of this area of knowledge in order to not only standardize procedures, but also to optimize the support times of the works and everything related to the assignment of specific roles and functions to carry out the approaches that are postulated in the logistics plans for the administration and control of resources.

Problem statement

Supply Chain Management (SCM), better known as "Procurement Supply Chain Management", is a relatively new concept; it can be defined as

> A network of means of distribution of facilities whose function is based on obtaining materials, converting them into finished products and the corresponding distribution in the market; it can be said that the CA concentrates on three fundamental elements: supply, manufacture (production) and distribution (marketing) (Malagón et al. 2012, pp 12).

Knowledge management in the supply chain in the construction sector has particular characteristics, which can be identified as preconstruction: stage that includes all the activities prior to the start of the project; construction: stage that is linked to the development of coordination tasks of all the parties involved, such as the permanent control of time, costs and quality. And finally the dissolution stage, related to managing the transfer of knowledge from two perspectives; project to project and company project, so they are configured for each construction project, since each one will imply certain requirements from the client of an infrastructure or construction element (Capó, 2005, p. 3).

Consequently, the management of this supply process becomes of vital importance to perceive the conformation, coordination and management of the CA of each of the construction projects.

Supply management in the construction industry in Colombia has been characterized by considerable delays with respect to other industries in the area of planning, specifically due to the lack of standardization, measurement and control of processes, considering that support activities such as procurement, reception and storage of resources represent slightly more than 20% of the time spent on construction activities. (Fonseca, 2011, p. 25).

In addition, many of the losses in projects are caused by long waiting times due to the deficit of such support activities, which means that 31% of the time spent is susceptible to be reduced through the applied logistics management approach. (Fonseca, 2011, p. 25).

Therefore, this research analyzes the main characteristics of the supply chain in high-rise housing construction SMEs in the city of Medellin; and its implementation within these organizations; in order to identify the problems presented in the logistics used for the supply of materials in the processes of execution of a work.

Theoretical framework

The construction industry has one of the largest contributions to the world GDP causing a great impact on productivity and world economic indicators; in the case of Colombia, the Technical Bulletin of the National Administrative Department of Statistics (DANE) on "Economic indicators around construction - IEAC" for the second quarter 2018 - 2019, showed a positive increase to the GDP by different countries, within which Colombia stands out with an increase of 0.6%. (Economic, 2019).

Taking into account such statistics, this work focused on the importance of targeting the shortcomings that occur in the field of construction at different scales; in this case, the failure in the project planning process was addressed, since, Zou (2017), states that the determining factors of the level of efficiency of these in the field of construction are located in the initial stages (p. 89); that is why, one of the focuses of greater attention in front of such planning led to the possibility of using new technologies and methodologies.

Therefore, taking as a central focus the improvement of the efficiency level of project planning, Supply Chain Management, used in several industrial sectors as a tool to achieve a rational and systematic integration between suppliers, customers and the company as such, is proposed as a new methodology.

Consequently, the joint work of all these elements aims at improving the conditions of delivery, quality and timeliness; the purchasing work plan being objective, anticipating needs, guaranteeing better prices, quality, timely delivery, delivery times, compliance with specifications, stock rotation, avoiding the risk of obsolescence, alternative sources of supply, purchase contracts, favorable relations with suppliers, purchasing templates, personnel training, information recording and integration with the other areas of the company. (Ferrín, 2007).

Based on the above, Capó (2007) states that it is necessary to work with more specialized contractors in the construction processes, leaving aside the concern for the price war and concentrating on delivering projects in which execution times are optimized and quality is guaranteed. To this end, the interaction of the links in the construction supply chain should be taken into account, describing the levels and characteristics of their integration, as follows: at the first level, contractors and consultants: because they generate and deliver vital information in the design and specification phases, having clear laws applicable to the projects

and proven experience. In the second level we found the subcontractors who are employed for their level of experience in different phases of the project; in third place, the suppliers of construction materials that can range from hardware stores to high level specialized marketers; and finally the producers of the aforementioned materials. (London, 2001).

Based on the above, *layout* planning *and* CA management in the construction sector becomes a vitally important tool.

Layout planning refers to the planning of the distribution and location of facilities applicable to new and existing plants, which are part of the logistics applied to the optimization of the sites where production processes are carried out; its objective "for the effective conformation of an optimal supply chain is to minimize time and displacements and facilitate the location of products" (Fonseca, 2011, p. 44). According to the Polytechnic University of the Bicentennial (2017), the flow of materials must be incorporated into the study of this distribution, organizing it in a rational way and establishing a series of phases that allow the identification, assessment and visualization of all the elements involved in this implementation.

Therefore, with the intention of carrying out the layout planning regarding the conformation of a CA, the Lean Construction (LC) philosophy is proposed, which according to the Lean Construction Institute (ILC), is oriented towards the management of production in construction and its main objective is to reduce or eliminate the activities that do not add value to the project and optimize the activities that do, therefore it focuses mainly on creating specific tools applied to the project execution process. (Lean Construction Institute, 2013).

The functionality of the application of the tools is in the creation of a production system that minimizes waste, which would be activities that do not add value to the project, and which will be defined as: everything that does not generate value to the activities necessary to complete a productive unit, classified into seven categories: defects, delays, excess processing, excess production, excessive inventories, unnecessary transportation and non-useful movement of people; which are not taken into account in the daily management where it is considered only as a transformation process to obtain a product and the optimization of flows of such materials is left in the background.

Therefore, the "Lean" philosophy takes into account the transformation of materials as a flow of resources and a generation of value, for example, in the manufacture of a wall, bricks bonded with mortar are transformed into square meters of wall, the flow is the putting of resources and materials to elaborate the wall and the value is the amount of square meters of wall that are achieved in a certain time (Porras et al., 2014).

Consequently, Koskela (2000) proposes eleven principles for their operation:

- Reduction or elimination of activities that do not add value.
- Increase in the value of the product.
- Reduction of variability.
- Reduction of cycle time.
- Process simplification.
- Increased production flexibility.
- Transparency of the process.
- Control approach to the complete process.
- Continuous process improvement.
- Balance of flow improvement with conversion improvement.
- Referencing.

These "Lean" principles, are only possible to apply effectively in the construction industry if stakeholders focus on improving the entire project management process to devise the new production approach proposed by these principles (Arif, 2012, p. 91). To implement CA in projects it is necessary to start with the commitment to have a culture of continuous production improvement, so that by applying the "Lean" principles correctly improve the safety, quality and efficiency of the project (Hamed, 2013).

Lean construction is a philosophy that is oriented towards production management in construction and its main objective is to reduce or eliminate activities that do not add value to the project and optimize the activities that do, therefore it focuses mainly on creating specific tools applied to the project execution process and a good production system that minimizes waste (Lean Construction Institute, 2013). Waste is understood as everything that does not generate value to the activities necessary to complete a productive unit.

The objective of LC is to optimize transformations by minimizing or eliminating the flows that materials must follow to the sites of execution of the works to obtain more value in the final products (Orihuela, 2013, p. 1). One of the most effective ways to increase efficiency in construction is to improve the planning and control process. In the LC philosophy, planning and control are complementary and dynamic processes, where planning defines the criteria and creates the strategies needed to achieve the project objectives and control ensures that each event will occur after the planned sequence (Fayek, 2013).

On the other hand, in the administrative processes involved in the materials procurement process, we find planning as a fundamental factor; the latter refers to the identification of each of the materials required for the construction of the project, as well as the quantification of the quantity of each one required, including waste or scrap.

Then, during execution, the purchase of materials begins with the order, which has as its initial event the request made by the production area of the supervision residence for a quantity (or lot) of one or several materials; this request is addressed to the administrative area and is usually called requisition in the language of construction. Once the supplier places the material on site, the construction company employee in charge of the warehouse proceeds to verify its specifications, completeness and quantity.

Finally, control consists of the establishment of systems that make it possible to compare what has been executed with what was planned, detect errors, deviations, as well as the causes and possible solutions, all of which makes it possible to take timely corrective actions to improve or maintain the project's good performance. (Isidore, 2002).

To control variability in planning, the LC philosophy proposes the Last Planner System (LPS), one of the most useful tools in the application of LC.

After an approach to the conceptual and theoretical bases of this topic, the legal framework under which CA management is based is discussed. ISO 28000 is a management system specification that provides, for the first time, a model for all types and sizes of organizations that operate or depend on any aspect of the supply chain, this standard is compatible with ISO 9001 and ISO 14001. ISO 28000 was developed with the purpose of contributing to the integration of quality, environmental and CA safety management systems within the organization. (Colombian Technical Standard, ISO 28000, 2007).

State of the art

Initially, there is a study conducted in 2019 regarding the coverage and coordination of the different periods contained in the CA, focusing on prefabricated construction; from this, they implement a strategy called buffer space coverage which increases the accuracy of Lean Production (LP) which involves the additional costs that may arise due to storage and

maintenance issues. Within the results obtained, it was observed that through these two methods it is allowed to have benefits, at a lower cost of unit expansion, higher penalty for tardiness and unpredictable and uncontrollable assembled and installed prefabricated determined by the construction process (Zhai, 2018).

Studies have been conducted on the coordination, supplier selection and scheduling of projects in construction CA when resources are limited, based on multiple recurring projects which are independent in operation, but are subject to shared suppliers and quality inspection by the same committee. For the solution of this problem, a heuristic based on mathematical programming is proposed, which manages to decompose the problems into subproblems, -that is, it reduces their size-, which contributes to solve them more quickly and the benefits of coordination can be foreseen (Chen, 2018).

Research has also been done to understand the importance of customer-supplier relationships in the CA through a technique called DEMATEL; where the most important barriers that prevent collaboration in the relationship between both parties were studied. Through this technique, it is possible to obtain cause and effect associations; among the causes, three were found that are caused by the industry, and another that is mainly linked to the definition of roles and responsibilities of a project, thus impacting collaboration within the construction field (Costa, 2019).

Another study is related to the green management of CA in construction, in this research a literature survey is made where the results are synthesized for the categorization of the comprehensive approach and definition describing the need to emphasize on an end-to-end perspective that allows greening the industry, i.e., obtaining environmental sustainability (Badi, 2019).

On the other hand, a research was raised where a process reference model is created for claims management in construction CAs regarding contractors; in this way, analyzing the already existing models, the established one tries to improve the claims process by identifying deficiencies such as the lack of transactions between the contractor and the supply chain; with the intention to increase the awareness of this relationship through supply chain management (Stamatiou, 2019).

In another project, in addition, the risks and delays that occur in CA management were studied; by reviewing literature and obtaining details of specific construction projects, thus having an event-based simulation that allowed to see the performance of the system, discovering that construction delays influence both the magnitude and probability of disruption (Panova, 2018).

Also, a research was conducted where CA is integrated in construction within a circular economy; within this study a computational tool based on BIM (Building Information Modeling) is developed, such tool is a construction waste prediction model called ANFIS (Adaptive Neurofuzzy Inference System) in the Autodesk Revit BIM platform. The study yielded that gross floor area and construction type are the two key predictors of waste minimization (Akinade, 2019).

In the city of Bogota (Colombia), a study was made of all construction companies, focusing on the failures or problems in supply logistics in this area and possible improvements. Within the analysis based on the SCOR model, it was found that the main problems in the supply logistics of construction companies in Bogota are inventory control and management, poor storage and lack of information systems (Arce, 2009).

In conclusion, and in relation to the topic of CA, different studies have been conducted by authors around the world in places such as London, Italy, United States, Sweden, Bogota,

among others. These allow us to foresee that the approaches to CA are varied, and that, within them, this research focuses on understanding this tool for the planning of construction projects in the city of Medellin.

Method

With the intention of analyzing CA Management in the construction sector as a project planning tool, information collection was carried out through the descriptive survey technique, with 41 questions in total, of which 33 are closed response and 8 open response; conducted between March 28, 2019 and May 9, 2019. The purpose of this study is to obtain the most evident causes and problems that arise within the work in terms of the object of study, which is Supply Chain Management. Through these surveys, data were obtained, which were then tabulated, graphed and analyzed, taking into account the type of population coverage at which this research was focused, with a quantitative, non-experimental and probabilistic sample approach.

Having said the above, the selected population was the construction SMEs in the city of Medellin; focused on high-rise housing. According to CAMACOL Antioquia's classification, there were 20 companies that met these characteristics. Once the population was established, a formula was applied, which yielded a total of 17 companies that were the working sample. Based on the above, within these organizations, the profiles of the people involved in the CA were selected, which were: the construction manager, the construction resident, the residence assistant, the master builder, the warehouseman, among others.

From the selected population, each company had one person who responded to the survey, which were related to the following profiles: 7 construction managers; 2 residence assistants; 2 budget managers; 1 construction resident; 1 warehouseman; 1 warehouseman; 1 CEO; 1 budget resident; 1 PPM manager; 1 procurement manager; 1 consultant and teacher; and 1 administrative assistant.

To calculate the sample size when the universe is finite, i.e. countable and the variable is categorical, you must first know "N", i.e. the total number of cases expected or that have occurred in previous years. If the population is finite, i.e. we know the total population and we want to know how many of the total we will have to study, the formula would be:

$$\frac{(N*Z_{a^2})(p*q)}{(d^2*(N-1)+Z\_(a)^{2*p*q}} \quad (1)$$

Where:

N = total population.

Zα = 1.96 squared (if safety is 95%).

p = expected proportion (in this case 5% = 0.05).

q = 1 -p (in this case 1-0.05 = 0.95).

d = precision (in the research use 5%).

In order to understand the results, the Pareto diagram and the root cause analysis were implemented, which made it possible to show in the surveys which were the most relevant causes or problems and which are their logistic and resource supply processes, taking into account the 80/20 rule, thus being able to propose processes for the improvement of the shortcomings presented.

The Pareto diagram is a bar chart that helps to identify priorities and causes, since the different problems that arise in a process are arranged in order of importance; its field of analysis or application is categorical data, and its objective is to help locate the vital problem or problems, as well as their main causes. The idea is that when we want to improve a process or address its problems, we work on all the problems at the same time, attacking all their causes

at the same time, but rather, based on the data and information provided by a statistical analysis, we establish priorities and focus our efforts where they have the greatest impact (Gutiérrez & de la Vara, 2009).

The viability and general usefulness of the diagram is supported by the so-called Pareto principle, known as the "80-20 Law", which recognizes that few elements (20%) generate most of the effect (80%), and the rest of the elements generate very little of the total effect (Gutiérrez & de la Vara, 2009).

On the other hand, there is the root cause analysis tool, whose goal is to identify the root causes of the problem, understand how they generate the problem and confirm the causes with data. Then, it is a matter of understanding how and why the problem is generated, seeking to get to the deepest causes and confirming them with data. To do this, it will first be necessary to identify all the input variables and/or possible causes of the problem (Gutiérrez & de la Vara, 2009).

Finally, the Ishikawa or cause and effect diagram, which is a method that relates a problem or effect with the factors or causes that possibly generate it. The importance of this diagram lies in the fact that it forces us to look for the different causes that affect the problem under analysis, thus avoiding the mistake of looking directly for solutions without questioning what the real causes are (Gutiérrez & de la Vara, 2009).

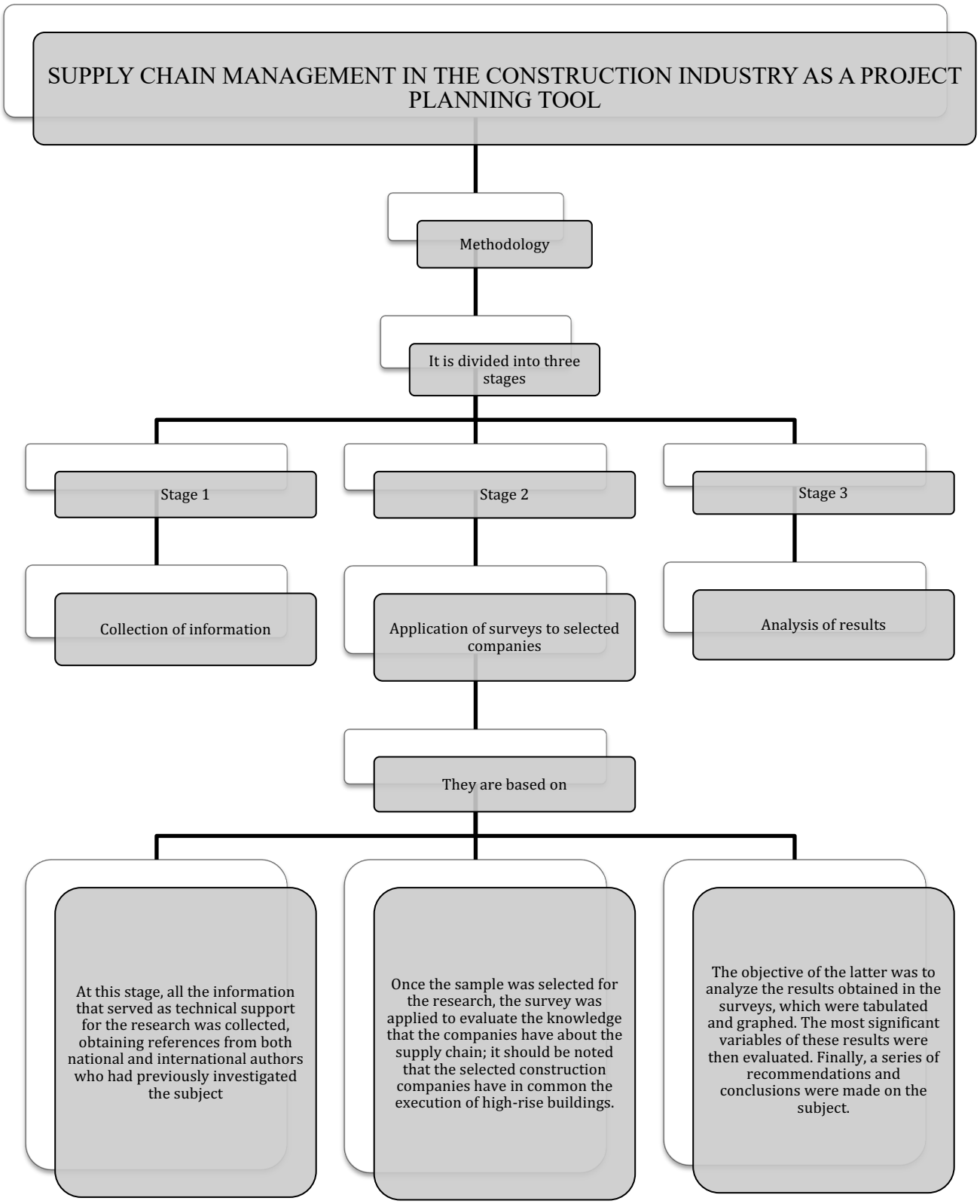

Figure 1. Concept map methodology

Results

Once the measurement instruments were applied in each of the construction companies duly selected according to the characteristics of the study, the following results were identified.

Figure 2 illustrates the general knowledge and management of CA management in the construction sector, in which 4 variables associated with the subject are given, showing that 63.2% of the sample surveyed did not respond, which could be interpreted as one of the main causes that directly influences the lack of productivity, if it is understood that CA is structured as the efficient combination of production processes and delivery of services.

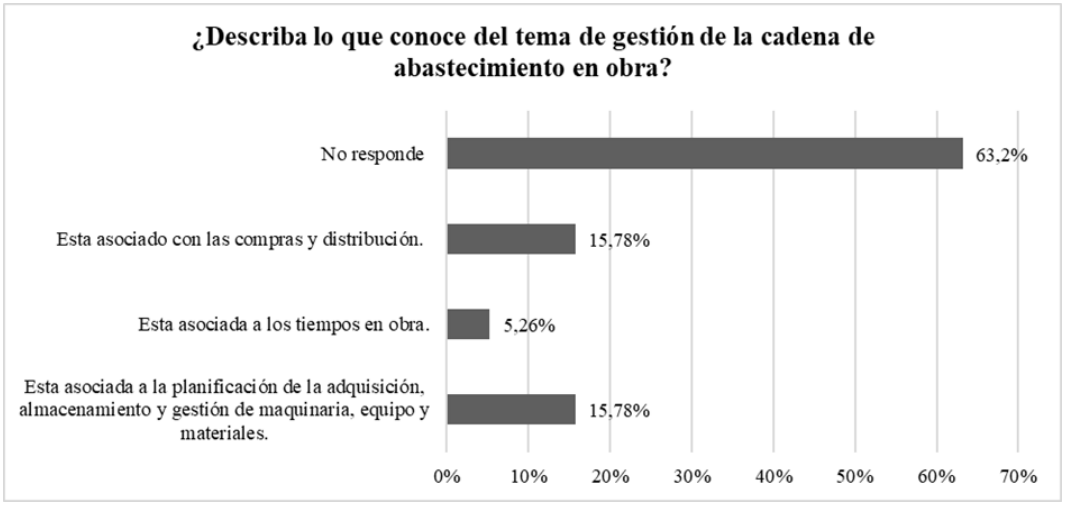

Figure 2. Supply chain management

Additionally, in Figure 3, the previous knowledge of the construction companies on the subject of supply logistics was evaluated, in which it can be observed that 21.05% of the surveyed sample has no knowledge and 42.12% of the sample does not respond. This leads to a considerable deficit in the planning, organization and control of resources.

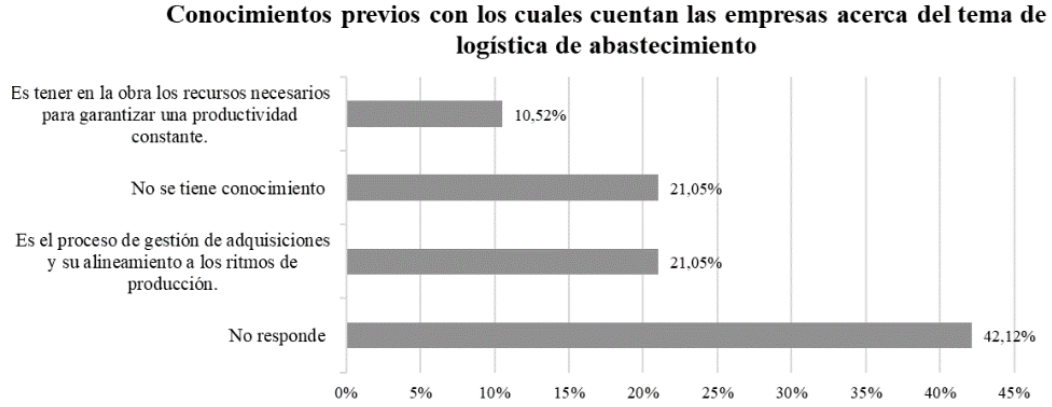

Figure 3. Knowledge of supply logistics

On the other hand, Figure 4 shows an 80/20 analysis that allows us to know which are the shortcomings of the CA within the surveyed companies. Noting that these difficulties are related to suppliers, tools and equipment, lack of planning and prerequisites. It should be noted that the design of the CA varies according to the type of company and is composed of the logistics phases of suppliers, production, distributors and customers.

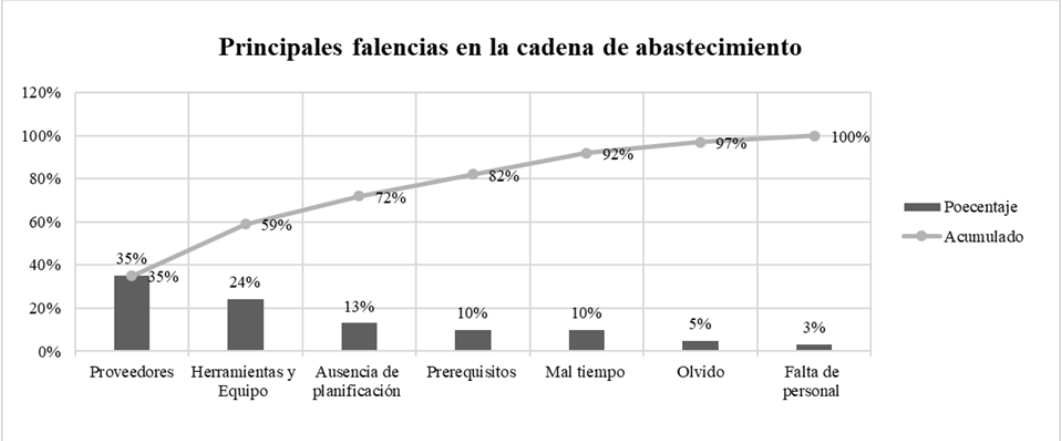

Figure 4. Shortcomings in the CA

Figure 5 illustrates the main causes of delays in delivery times at the construction site. Of the eight causes that have an impact on delays in delivery times, five of them account for 78% of the negative effects of this problem, distributed as follows: 26% are related to delays in deliveries by suppliers; 15% to lack of supply of materials; the next 15% to shortage of resources; 10% to lack of control in planning; and the other 10% to environmental factors.

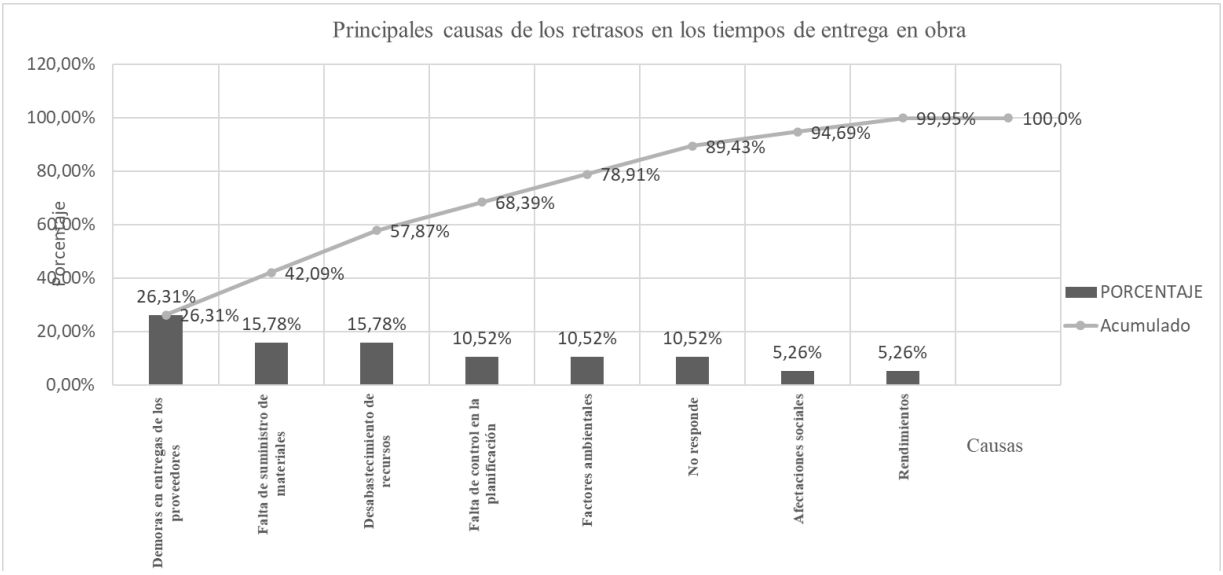

Figure 5. Causes of delays in delivery times at the construction site

On the other hand, Figure 6 highlights the importance of the purchasing area within the CA, since one of the main sources of complexity of the construction activity is the use of many resources, and in large quantities; hence the requirement for all organizations to have a system that allows them to manage the resources used in this activity.

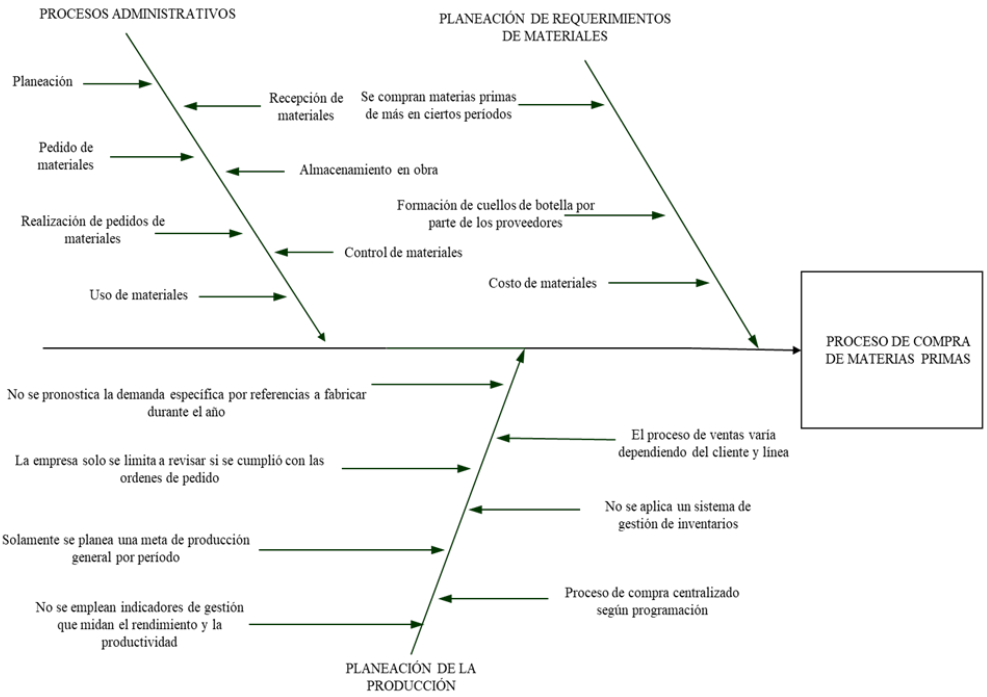

Figure 6. Cause-effect diagram of shortcomings in materials procurement

The process of purchasing materials begins at the planning stage, when the programs for the use of each material are drawn up. However, in the investigation it was reported that 67% of the companies stated that they prepared their programs for the use of materials before the beginning of the execution of the work; additionally, it could be inferred that 71% of the companies did not analyze in detail the construction processes to obtain these programs, so it could be expected that in most cases the management of materials has been deficient.

Similarly, Figure 7 analyzes the distribution process or internal transportation of materials, which is a fundamental part of the supply chain, since it can have a fundamental impact on the overall success of the CA. This must be related to the materials collection center, which must be located in an optimal site, be designed according to the nature and operations to be performed on the product, use the necessary equipment and be supported by an adequate organization and information system.

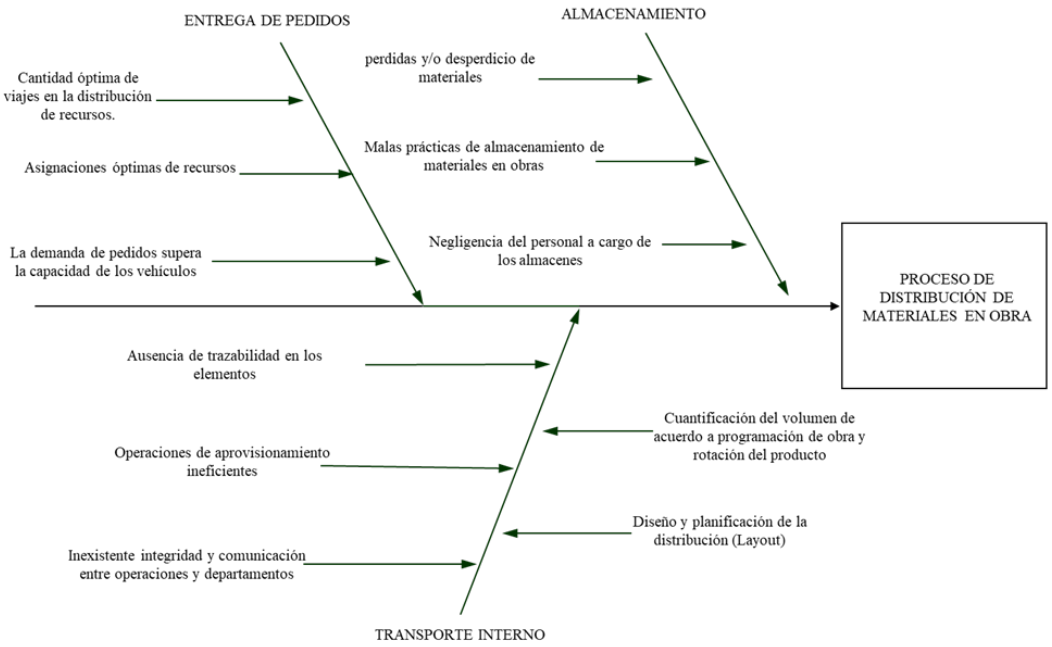

Figure 7. Cause-effect diagram of material distribution shortcomings

However, the research revealed that one of the shortcomings in distribution is that the locations of the materials are not known, which leads to longer handling times and, therefore, longer delivery times to the customer.

Additionally, only 33% of the surveyed companies recognize and implement the objectives of the design and layout of the warehouses, since they facilitate the speed of order preparation, the accuracy of the same and the more efficient placement of materials, all in favor of achieving the competitive advantages contemplated in the strategic plan of the organization, regularly achieving faster order cycles and better customer service.

Finally, Figure 8 analyzes the implementation of Lean Construction in the CA as a methodology for the elimination of losses, where it is evident that it brings different benefits for the processes carried out in the execution and planning process of the works, among which are the control of production and work, promotes the flow of transformation, helps to stabilize production, promotes effective relationships between the parties involved, among others.

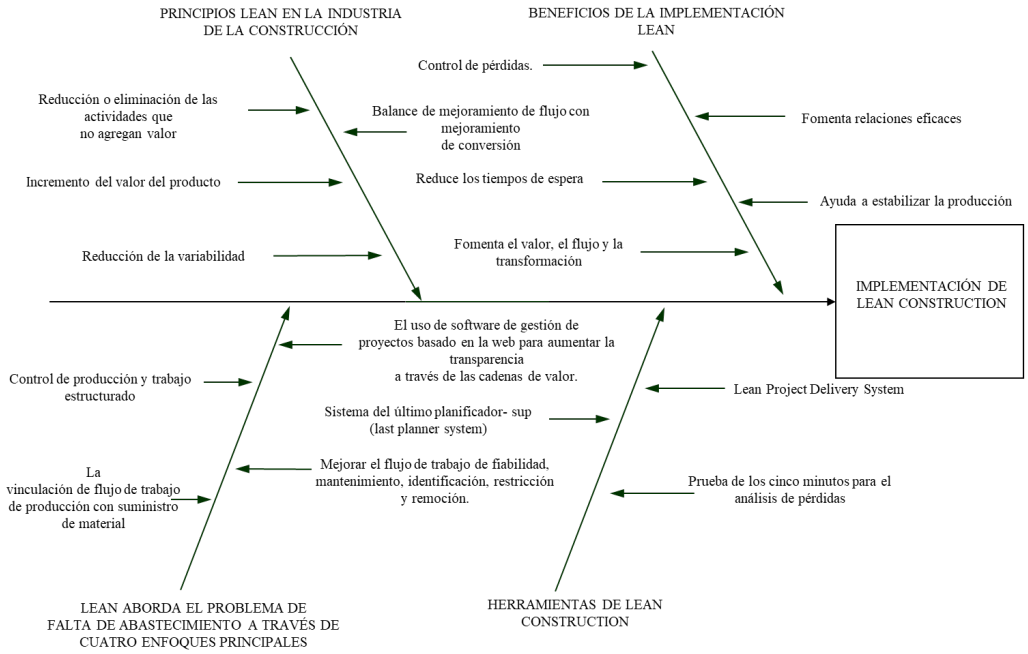

Figure 8. Cause-effect diagram of Lean Construction implementation

Discussion and conclusions

Supply chain management is becoming increasingly relevant in the efficient improvement of production processes and is considered as a measure to implement and consolidate in the search to enhance and increase profits through cost reduction and customer satisfaction (Keat, 2004). For this purpose, it should be taken into account that the CA is based on three fundamental pillars: suppliers, order delivery and warehousing.

Among the results found, it can be seen that 63.2% of these entities omit to respond to the knowledge they have about the CA, which suggests a possible reason why the control of these three fundamental pillars is deficient.

Thus, 35% of the sample affirms that the CA's shortcomings are related to suppliers and 24% to tools and equipment, which suggests a relationship with the pillars mentioned above. It should be taken into account that one of the most important tasks in the purchasing area is the selection of suppliers, since they are in charge of supply and must guarantee timely, quality deliveries with the best commercial conditions.

Additionally, the third pillar is also affected as a consequence of the impact generated in the first two, taking into account that in the process of supplying materials when one or more of them are not available at the time they are required, this has a negative impact on the productivity of labor and equipment. As a result, it generates the interruption of work with a probable increase in total overhead costs. It should be noted that in Colombia there are no measures of productivity losses associated with materials, which is one of the most important factors to consider in the management of material inventories (Sherpell, 2002, pp. 291).

Consequently, efficient materials management has become a priority where efficiency in industrial and production processes is an imperative. An adequate materials handling system can be used to increase productivity and achieve a competitive advantage in the market (Arce, 2009, pp 98). It is evident from the research that the shortcomings stem from the fact that in the distribution process the location of the materials is not known and only 33% of the sample

recognizes that it implements the objectives of design and layout of the warehouses, which suggests the speed of the separation of materials and their accuracy.

Consequently, one of the main reasons that these three fundamental pillars of the CA are affected, initially comes from the lack of knowledge of the CA as a tool that can benefit the planning within the works and the implementation of distribution standards that start with the reception of resources, storage and transportation within the storage site to the final work site, having as main objective to optimize the logistics area; since by reducing the distribution times, the waiting times improve distribution that starts with the reception of resources, storage and transportation within the storage site to the final work site, having as main objective to optimize the logistics area; since by reducing distribution times, waiting times improve, being more efficient the reception and storage times.

Therefore, warehousing plays a key role within the CA, whose main objectives are effective and efficient inventory turnover, optimal management of obsolete inventories, optimization of warehouse space, optimization of receiving and delivery routes, and optimization of equipment. Within the CA, the configuration of the warehouse is a determining factor for increasing productivity in the production phase; the concepts to be taken into account from the planning phase are location, size and distribution. (Fonseca, 2011).

Thus, after analyzing the methods used by construction SMEs focused on high-rise housing in the city of Medellin, it was concluded that:

- They do not understand logistics management as an integral tool that affects the internal and external processes of the work, avoiding the "just in time" model used in the provisioning of resources aimed at improving logistics management. This happens even when quality management systems are defined, which leads to the multiplication of the time spent on the site for the performance of different activities and the increase of risks for workers due to poor layout planning and the spaces used for the placement of resources within the site.
- There is no evidence of controls exercised on logistics flows, the logistics plan and the CA, which means that the processes that guarantee order within the worksite are affected and have repercussions on processes such as storage, delivery of orders and distribution of resources within the worksite.
- There is no integration between the company and its suppliers in these logistics plans, which is understandable, since if the company itself does not have a well established plan, it is difficult to integrate the parties involved, causing a constant accumulation of materials and prolonging their waiting time.
- As the three objective points of resource allocation - order delivery, warehousing and delivery costing - are inefficient, production and distribution levels will be affected by lead times.
- If the three points of resource allocation, which are storage, transportation and delivery cost, are inefficient, production and distribution levels will be affected by delivery times.

Therefore, it is proposed that SME construction companies focused on high-rise housing in the city of Medellin, before evolving in terms of construction processes, machinery and materials, rethink the methods of project planning in the logistics and administrative part, because from the identification of existing weaknesses in the CA, losses and reprocesses observed and measured on site, you can choose with an established criterion for the appropriation of new materials and equipment to help the implementation of such projects. In addition, in order to improve logistics management, we suggest the implementation of CA Management as a project planning tool linked to the LC philosophy.

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