PROJECT, DESIGN AND MANAGEMENT
ISSN: 2683-1597

PROJECT DESIGN & MANAGEMENT

How to cite this article:

Velásquez Triana, C. A. (2019 Design of an Integral Model to Manage Social Interest Housing Construction Projects with Emphasis in Socio-Environmental Variables in Family Compensation Boxes. *Project, Design and Management, 1*(2), 61-74. Doi: 10.35992/pdm.v1i2.338

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

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

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

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

Introduction

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

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

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

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

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

Method

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

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

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

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

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

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

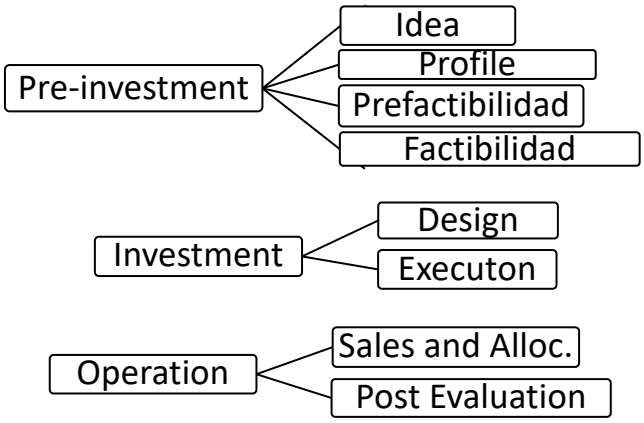

Figure 1. Housing Project Life Cycle

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Instrument

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

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

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

Results

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

Identification of success and failure factors

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

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

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

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

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

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

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

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

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

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

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

Table 1

Correlation between critical failure and success factors vs. GDP standards

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

Note: Retrieved from the author (2019)

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

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

Figura 2. Integration of the project management model

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

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

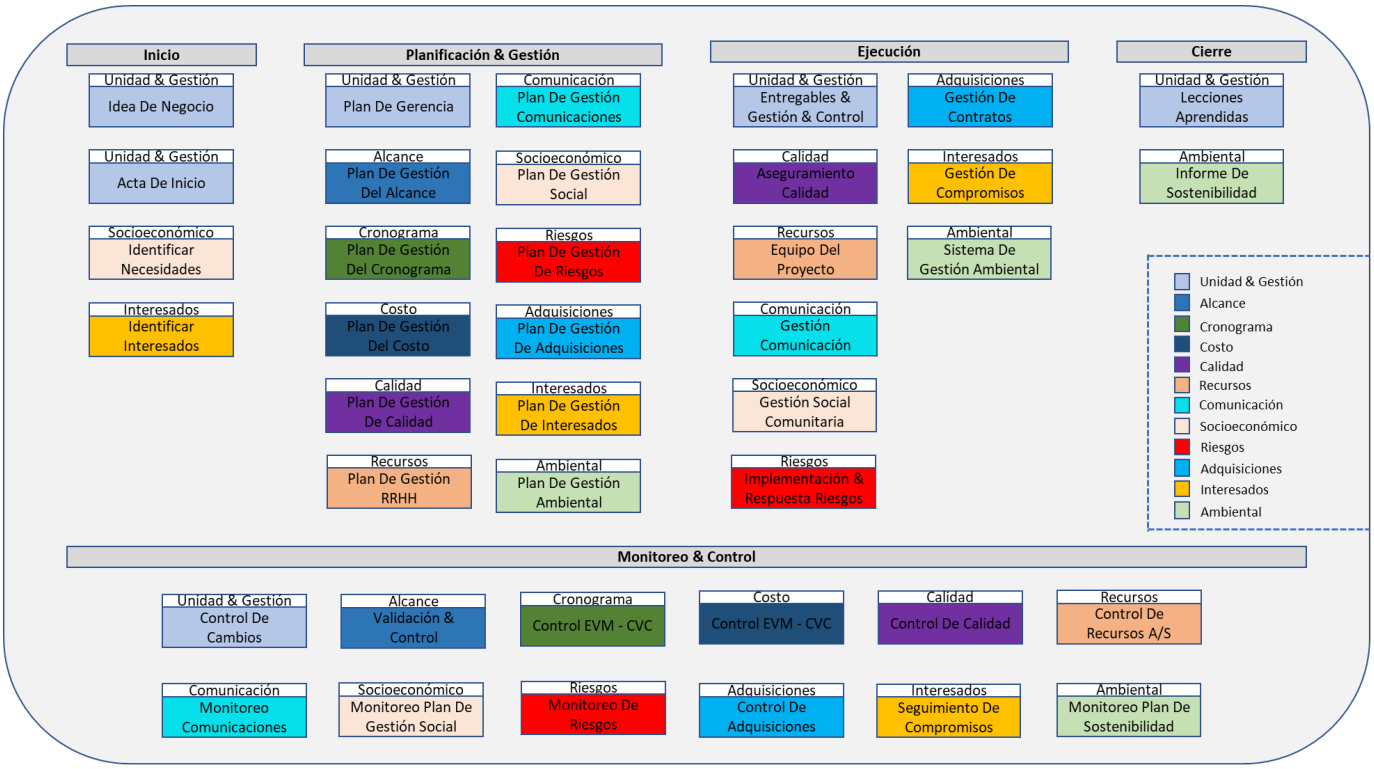

Figure 3. Methodological Model.

Discussion and conclusions

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

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

References

Charvat, J. (2003). Project management methodologies selecting, implementing, and supporting methodologies and processes for Projects.

Chiappe, M. (1999). La política de vivienda de interés social en Colombia en los noventa, financiamiento del desarrollo, Cepal, Santiago de chile.

GPM, (2017). Headquarters., PRISM™, Projects integrating sustainable methods. Retrieved from http://www.greenprojectmanagement.org/prism.

Lombera, J. (2010). Caracterización y transformación de un residuo industrial en un material con propiedades puzolánicas, materiales de construcción.

Luisa, C. (1999). La política de vivienda de interés social en Colombia en los noventa, Ilpes, Cepal.

María, N. (2005). Metodología de evaluación de proyectos de viviendas sociales, instituto latinoamericano y del caribe de planificación económica y social – Ilpes, Cepal.

Maricela, I. Guerra, F.,Gimena, N., Ramos, H., & Díez-Silva, M. (2012). Estándares y metodologías: Instrumentos esenciales para la aplicación de la dirección de proyectos.

Ministerio de ambiente. (2009 – 2011). Vivienda y desarrollo territorial, las normas aplicables en el desarrollo de viviendas de interés social, serie de guías de asistencia técnica para viviendas de interés social 3, república de Colombia.

Muñoz, F; Velásquez, C. (2015). Análisis y clasificación del estado actual de las metodologías existentes en gestión de proyectos, Dimensión empresarial.

Naciones, Unidas. (1999). Los asentamientos humanos en américa latina y el caribe: plan de acción regional; Presentado a la conferencia de las naciones unidas sobre los asentamientos humanos, hábitat II Estambul.

Ortegón, E., Pacheco, J., & Prieto, A. (2004). Instituto Latinoamericano y del Caribe de Planificación Económica y Social, Metodología del marco lógico para la planificación, el seguimiento y la evaluación de proyectos y programas.

Presidencia de la República de Colombia. (1998-2002). Departamento Nacional de Planeación, Plan Nacional de Desarrollo, "Cambio para construir la paz"

Project Management Institute, (2017). A guide to the project management body of knowledge, Pmbok Guide, Global standard, Sixth Edition.

Date received: 05/10/2019
Date reviewed: 18/11/2019
Date accepted: 23/12/2019