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SUMMARY

Project, Design & amp; Management, Year 1, No. 1, January-June 2019, is a biannual publication edited by the Universidad Internacional Iberoamericana A.C., Street 15 No. 36 between 10 and 12, Col. Imi II, C.P. 24560, Campeche, Campeche, Tel. (981) 81-102-46, https://www.mlsjournals.com/Project-Design-Management, journalmanager.pdm@mlsjournals.com, Editor in Chief: Dr. Luis Alonso Dzul López, Reserva of Rights to Exclusive Use No. 04-2018-073112062200-102, ISSN: 2683-1597, both granted by the National Institute of Copyright. Responsible for the latest update of this issue, Journal Manager, Beatriz Berrios Aguayo, Street 15 No. 36 between 10 and 12, Col. Imi II, C.P. 24560, Campeche, Campeche, date of last modification, March 14, 2019.

Editorial

It is our great honor to present the MLS Project Design & Management Journal as a space for the scientific discussions of all researchers of the world. Our fundamental interest is to become an medium of expression through which diversity enriches us, so as to disseminate scientific works and deepen the knowledge associated to current problem solving within all types of projects. Without a doubt, we intend to carry this out with the support of our expert partners, from the very conception of the art of projecting, to developing a set of research topics. This offers an interdisciplinary space under a new innovative, collaborative and integral concept toward all participating areas, not only within the administration of the necessary resources for a project, but for its design and development as well.

The journal we present today is a biannual publication, including this first volume of 6 articles on diverse topics and methodologies that are of interest due to their variety.

The bases for the economic growth of Peru are studied in the first article through a non-parametric methodology via the Malmquist Index, whereby it achieves breaking down multifactorial productivity in technical efficiency, as well as, in a pure technological change, with Peru, unlike other Latin American countries, having experienced an increase in the efficiency component with which its economy now operates.

The second article presents the design ad application for a research program in the socio-educational intervention for a group of retired professors older than fifty years of age in Papantla, Veracruz, Mexico. The purpose for the study was to promote a healthy lifestyle to achieve healthy aging, having the participants become involved in the different activities of the program and so improving their lifestyles.

The third article presents a preventive, predictive and corrective maintenance information system related with the data obtained through a Criticality Matrix, using parameters based on the maintenance and observational intervention history for audio and visual equipment such as Mechanical Scales, Winches, Hoppers and Sterilizers. Benefits were established, such as for the availability and security of equipment and product quality improvement.

The fourth article presents a research-action methodology focused on education with the objective of describing the self-evaluation of the competency levels for the International Project Management Association (IPMA 4.0) certification within a sample of students studying the Design Module. The relevance focuses on implementing the measuring tool associated with 28 competencies as pointed out by the IPMA.

The second to last article presents an introduction toward project environment and its systematic nature, highlighting the importance of carrying out this management through best practices, seeing as it is no easy task. Those factors that contribute to a project's success are also highlighted, for example, a high-level sponsor that influences the decision-making organization in favor of the project in an effective manner.

Lastly, the main theories are developed on early stimulation and the analysis that leads to the structuring of four constructs, so as to design project models for said stimulation through means of the systematic information management method denominated Metanalysis. The search for strategic information will be assessed, along with the inclusion and exclusion criteria from the respective information of each construct, identifying the strategic functions and the managerial elements that contribute to the information's quality.

Finally, we cannot end this editorial without thanking the Fundación Universitaria Iberoamericana (FUNIBER) and those Universities who have provided human and material resources so that this first issue could be published. We would also like to thank the entire collaborating team that has supervised and contributed for this project to be realized.

Dr. Luis A. Dzul López
Dr. Roberto M. Álvarez
Editor in Chiefs

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THE BASIS OF ECONOMIC GROWTH IN PERU

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THE BASIS OF ECONOMIC GROWTH IN PERU

Abstract. The foundations of Peru's economic growth are studied. Peru is an economy that has experienced considerable growth and we want to know if it is sustainable or not. The research is aided by the estimation of the Total Productivity of Factors (TFP) for Latin America in the light of the international context and with the purpose of obtaining, for Peru, the TFP and its components in a disaggregated manner. To do this, a non-parametric methodology is used to obtain the Malmquist Index, which makes it possible to decompose multifactor productivity into both technical efficiency and pure technological change. The estimation of the multifactorial productivity is made on the basis of the Peruvian economy and of 50 more economies worldwide for the period from 1993 to 2003. The results obtained are consistent with the empirical evidence for that period that suggests that the countries Latin American countries experienced a stagnation in their multifactor productivity and therefore have not been able to experience an extraordinary growth compared to the regional average, however, for Peru, there is an increase in the efficiency component with which this economy operates. It suggests that the key to long-term growth lies in the productivity of this economy and the institutional framework that surrounds technology and the innovation process, components that can offer sustainable and long-term growth.

Keywords: Total Productivity of the Factors, Technical Efficiency, Technological Change, Economic Growth, Peru.

LAS BASES DEL CRECIMIENTO ECONÓMICO DE PERÚ

Resumen. Se estudian las bases del crecimiento económico del Perú. Perú es una economía que ha experimentado un crecimiento considerable y se desea saber si éste es sustentable o no. La investigación se auxilia de la estimación de la Productividad Total de los Factores (PTF) para América Latina a la luz

del contexto internacional y con el propósito de obtener, para Perú, la PTF y sus componentes de forma desagregada. Para ello, se emplea una metodología no paramétrica que permite obtener el Índice de Malmquist y que hace posible descomponer la productividad multifactorial tanto en eficiencia técnica como en cambio tecnológico puro. La estimación de la productividad multifactorial se realiza sobre la base de la economía peruana y de 50 economías más a nivel mundial para el periodo de 1993 a 2003. Los resultados que se obtienen son consistentes con la evidencia empírica para ese periodo que sugiere que los países latinoamericanos experimentaron un estancamiento en su productividad multifactorial y por ello no han podido, hasta el momento, experimentar un crecimiento extraordinario respecto del promedio de la región, sin embargo, para Perú, se aprecia un incremento del componente de eficiencia con que opera esta economía que sugiere que la pieza clave del crecimiento de largo plazo se encuentra en la productividad de esta economía y el marco institucional que envuelve a la tecnología y al proceso de innovación, componentes que le puede ofrecer un crecimiento sustentable y de largo plazo.

Palabras clave: Productividad Total de los Factores, Eficiencia Técnica, Cambio Tecnológico, Crecimiento Económico, Perú.

Introduction

Until a few decades ago, Peru was not included in the issue concerning the world economic growth. At the regional level, its performance was among the lagging economies in Latin America. This poor performance would have had repercussions on its population, affecting the standard of living and quality of life of its inhabitants. In the early 1960s, economies such as the Republic of Congo and Pakistan showed a higher Gross Domestic Product (GDP) than Peru, however, it only needed a few decades to recover.

Peru's FDP in 2016, according to World Bank (WB) data, was multiplied by a factor of seventy-four times more than it was in 1960s. Today Peru holds the 49th position of 195 economies in the World Bank ranking with a GDP of 192.94 billion US dollars, significantly higher than most countries in the Latin American region (e.g. Ecuador, Guatemala, Dominican Republic, etc.) and very close to the performance, for example, of economies such as: Portugal, Finland, Chile and Colombia. Concerning Latin America, Peru ranks as the sixth most important economy. Compared to the World GDP, in 1960 Peru represented 0.19%, by 2016, this same economy was already 0.25%.

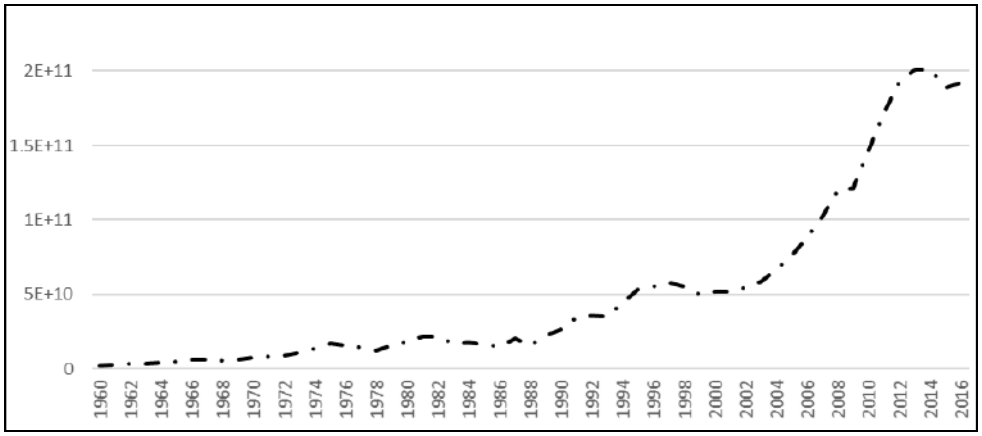

Figure 1. Gross Domestic Product of Peru 1960-2016 (Current U.S. Dollars).

Note: Source. Authors' own creation based on data from the World Bank economic indicators.

This growth has not been sustained over time if we consider the entire period from 1960 to 2016 for which we have available data. At the end of the 1970s and beginning of the 1980s, Peru recorded negative growth rates, an experience that was not unusual for countries in the region that incurred fiscal deficits or what in those years in Mexico was known as the "debt crisis" (Moreno-Brid and Ros, 2004). At the end of the 1980s, prior to the Fujimori era, Peru recorded negative growth rates of -12.3% like the one it experienced in 1989. Five years later, in 1994, in the middle of President Fujimori's administration, Peru would reach the highest figure of economic growth of the second half of the 20th century with a rate of 12.3%.

This evidence shows that Peru is currently experiencing exceptional economic growth, not only for the region but for a large part of the countries of the world; it is like the Latin American experience of the “economic miracle” experienced by the Asian tigers. It is incredible to see how, within a generation, we may go from a lagging to a better performer, with those people born in 1960 having been able to see these changes from a more productive nation today than they were five decades ago. Economic growth is the prelude to development, that is, it is presented as a condition, although not enough, but necessary to be able to carry forward the levels of development and well-being of its population. One of the indicators that best reflects this level of well-being of life of the Peruvian population is GDP per capita, which results from dividing GDP by the number of inhabitants. As this indicator improves, so too would their living conditions be expected to.

Peru’s GDP per capita is considerably high; by 2016, an average individual had an annual income of just over US$6,000 or the equivalent of US$16.5 per day. These figures would place the income of an average Peruvian much higher than that recorded for that same year of inhabitants from such economies such as: Ecuador, Colombia, Jamaica, Belize, Guyana, El Salvador, Guatemala and Paraguay. These statistics show that Peru has changed in terms of its economic performance. In theory, significant advances have been made in order to have a practical accounting of economic growth and thus obtain an estimate of the contribution that each production factor makes to the product. In the economic growth theory, the residue, in other word, the part that is explained by determinants related to the accumulation of production factors, particularly, is understood as Total Factor Productivity (TFP) or Multifactorial Productivity (Rogers, 2003; Kong, 2007).

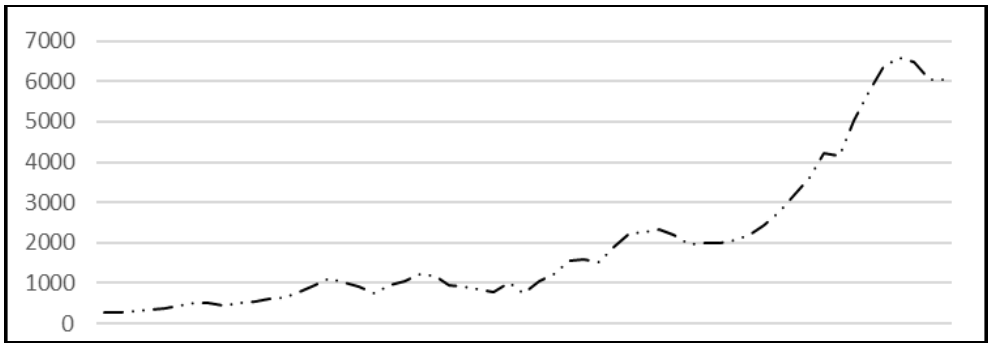

Figure 2. Peru. GDP per capita 1960-2016 (US Dollars).

Note: Source. Authors’ own creation based on data from the World Bank economic indicators.

Internationally, estimations have been made of the productivity with which economies operate (Islam, 2003), while other more disaggregated studies try to explain the behavior of the TFP in relation to its components, i.e. technical efficiency and pure technological change (Han, Kalirajan and Singh, 2004). In this research, the TFP is estimated in a disaggregated manner using the Data Envelopment Analysis (DEA) methodology, particularly using the Malmquist Index regarding the case of Peru for the study period (1993-2003). This period is chosen because it precedes the exponential growth experienced by the economy in the last decade of the twentieth century and the beginning of the twenty-first century and is already documented in authors such as Loayza, Fajnzylber and Calderón (2004) and Loayza (2008, 2016).

It is aimed at explaining the basis of Peru's economic growth and providing evidence that more than the increase in the accumulation of production factors, the Peruvian economy has experienced improvements in the efficient use of its resources and in this sense its growth could be characterized as sustainable in the long term. This research joins the literature that attributes long-term growth to institutions and the role they play as regulators of productive activities in a country (Weil 2006). Institutions can be those that encourage the efficient use of Peru's resources and motivate both its business class and its political class to think not only about economic growth but also about long-term social welfare.

More efficient institutions also allow to respond to the technological change experienced in the frontier of knowledge at the world-wide level and offers certainty and certitude to entrepreneurs and investors that wish to encourage activities based on innovation. It is undoubtedly essential to review the literature that studies the institutional framework surrounding the innovation process, in particular, reference is made to the National Innovation System (NIS), however, concern is left as part of a future research agenda. In the following sections, the DEA methodology and the Malmquist Index are explained in greater detail, where the results of Latin America are analyzed in a general way, with particular concern in Peru. Lastly, the main aspects of the research are concluded.

Method

The TFP is estimated using the Data Envelopment Analysis (DEA). The DEA makes it possible to evaluate the relative efficiency of a set of decision units that are considered homogeneous (UDH, because of its Spanish acronym) i.e., that produce similar outputs from a common set of inputs. The constructions of its indicators establish a series of very flexible assumptions that make it possible to construct a frontier of efficiency as an approximate measure of effectiveness. In this way, it integrates units into its decision that maintain a better relationship between the use of their inputs and the generation of their output, qualifying the units far from the frontier as inefficient (Cooper et al., 2009).

Within the extensions of the DEA models, the Malmquist Method allows to obtain an index to calculate the TFP and to decompose this indicator in what corresponds to pure technological change and technical efficiency. According to Coelli (1996), the Malmquist Index uses distance functions compared to the technology of a given period, i.e., it measures the changes in PFT between two periods of time by calculating the distance quotient of each data and regarding a common technology. In

this way, the calculation can be made input or output orientations without specifying the units of measurement. Thus, TFP indexes and their components can be obtained, on the one hand, due to changes in efficiency (the position of homogeneous decision-making units towards the frontier) and, on the other hand, due to pure technological change (modifications in the frontier itself).

To calculate Latin America's TFP as a whole and, particularly Peru, the data were taken from Extended Penn World Tables (EPWT) version 3.0. The database originally contained a sample of 102 economies, however, our calculations are carried out on a sample of 51 countries due to the availability of information for the 1993-2003 study period. Inputs are taken from the number of workers employed for each economy and the standardized capital stock at 2,000 prices calculated with the Purchasing Power Parity (PPP). Concerning output, the real Gross Domestic Product (GDP) for the year 2,000 is used, calculated in the same way by means of PPP. The sample of countries is composed of: 1 country from Southeast Asia, 17 countries from Western Europe, 2 countries from North America, 2 countries from Oceania, 6 countries from Asia, 1 country from the Middle East, 7 countries from Africa and 15 countries from Latin America, among which Peru is the economy that deserves our particular interest.

Results

Economic history shows that Latin America (LA) has experienced unstable economic performance characterized, among other things, by chronic crises and low growth. According to economist Sebastian Edwards, the region's average per capita GDP growth between 1979-2004 was 1.01% and 0.52% between 1982-2004. On the other hand, the growth experienced for those same periods by the Asian region yield values of 2.95 and 2.99 percent, respectively. These results suggest to the author, among other things, that, on average, the Latin American region has not only experienced a deterioration in its economic (low growth) and social (unemployment, inequality and poverty) conditions. The union of these with the vulnerability that characterizes it towards external shocks, also places the region in a dilemma between recovery or economic stability. (Edwards, 2007).

The economic performance experienced at the regional level does not differ from what is experienced within the economies that make up the region. According to Loayza, Fajnzylber and Calderón (2004), the average per capita GDP growth between 1961-2000 for Argentina, Brazil, Mexico, Colombia and Chile was 1.04, 2.49, 2.06, 1.92 and 2.53 percent, respectively. This explains why, for this same period, the region has presented an average growth of 1.75 percent compared to 5.19% recorded by the Asian region. Chumacero and Fuentes (2006) present data for 1961-2004, showing regional differences in terms of GDP per capita, which would be expressed as follows: LA (1.59), Asia (5.16), OECD (2.51), world growth (2.33) and for the United States (2.39).

Productivity in Latin America has particularly gone through stages of growth and decline. It is known that this represents about 80% of that experienced by the United States between 1960-1980. However, in the 1970s it would represent a drop of just over 20%. Regarding the particular case of Mexico, where these figures would go from 1.09% in 1960 to 0.77% in 2,000, while Argentina and Venezuela would obtain values of 0.69 and 0.61 percent, respectively. Productivity is, therefore, placed as one of

the main factors that make it possible to achieve the most industrialized economies (Loayza et al., 2004).

An interesting controversy occurs in the behavior of productivity in Latin America, particularly in the period of Latin American industrialization that would have been characterized by greater state interventionism. Recently, there is a clear trend towards the decrease of international trade barriers and financial deepening in the region at the beginning of the globalization stage in the twenty-first century. Originally, after the restrictive measure that was implemented due to the neoliberal model, it was considered that it would be a good mechanism to stimulate the advance of productivity and that it would allow a greater adoption and use of technologies coming from abroad and ultimately, an approach to the economic success experienced by western countries. However, this did not happen so literally, as documented by Lederman, Maloney and Servén (2005).

Lastly, Solimano and Soto (2005) argue that LA's unfavorable performance in the productivity area is due to the macroeconomic volatility that has recently been experienced in the global context and that has had an enormous impact on the region. According to the figures presented by the authors in Table 3, the Latin American region records close to 30% of the total for the 1960-2002 period, crisis scenarios with negative figures in GDP growth rates. This is a fundamental difference if these data are contrasted with the 12.3 percent experienced by the reference group composed of Asian and European countries.

The contribution of the TFP to the growth of Latin American economies regarding productive factors is minimal, and these differences intensify when compared to what is reported by Asian economies. For example, in Argentina, only 0.7 of the 2.4 percent of output growth between 1960-2002 is explained by the TFP contribution , with the remaining by contributions from physical capital (1.2) and labor (0.5); while for Korea, of the 7.9 percent increase in output, 3.7 percent is explained by contributions from TFP, 2.5 to capital and 1.7 to labor. In this sense, the low growth of the region is based on the low participation of productivity. This is a crucial factor if we bear in mind that productivity expresses the use and generation of technology. There is no doubt that productivity is prevailing in a volatile external environment with high demands for competitiveness.

Calculations using the DEA methodology allow us to obtain the Malmquist Index, which presents the productivity broken down between technology and technical efficiency for the 51 economies as a whole. The results are presented for the (1993-2003) period for which each of the indicators is averaged as presented in the following table.

Table1

TFP and its Breakdown (1993-2003)

	Efficiency	Technology	TFP
Argentina	0.975	1.184	1.148
Australia	1.017	1.335	1.360
Austria	1.114	1.283	1.429
Belgium	1.177	1.322	1.556
Bolivia	1.269	0.948	1.185
Brazil	1.210	1.160	1.406
Canada	0.885	1.141	1.004
Colombia	1.239	0.938	1.162
Korea	0.932	0.960	0.895
Costa Rica	0.946	0.842	0.796
Denmark	1.022	1.290	1.315
El Salvador	0.987	0.868	0.852
Spain	1.048	1.087	1.131
United States	0.955	1.173	1.120
Ethiopia	1.070	0.948	1.019
Philipines	1.102	0.783	0.861
Finland	1.275	1.420	1.811
France	1.066	1.255	1.333
Guatemala	1.194	0.914	1.089
Honduras	0.778	0.906	0.697
Iceland	1.067	1.342	1.434
India	1.201	0.986	1.176
Ireland	1.464	1.108	1.628
Israel	1.277	1.195	1.518
Italy	1.332	1.355	1.803
Japan	1.005	1.260	1.263
Kenya	1.024	0.959	0.971
Luxembourg	1.063	2.034	2.160
Mauritania	1.555	1.127	1.750
Mexico	0.906	1.163	1.052
Morroco	0.939	0.790	0.740
Nicaragua	0.631	1.066	0.667
Nigeria	1.003	0.997	0.998
Norway	1.136	1.738	1.978
New Zealand	0.793	1.283	1.013
Low Countires	0.944	1.493	1.409
Panama	1.215	1.096	1.332
Pakistan	1.342	0.926	1.242
Peru	1.082	1.074	1.170
Portugal	1.197	1.143	1.362

United Kingdom	1.078	1.092	1.179
South Africa	1.161	1.125	1.306
Sri Lanka	1.664	0.867	1.436
Sweden	1.012	1.298	1.312
Switzerland	0.673	1.773	1.196
Thailand	1.128	0.789	0.885
Trinidad and Tobago	0.961	1.156	1.119
Turkey	0.807	0.775	0.623
Uganda	1.000	0.882	0.882
Uruguay	1.180	1.127	1.327
Venezuela	1.023	1.139	1.162
Average	**1.081**	**1.136**	**1.221**

Note: Authors' creation.

Latin American economies show an unfavorable TFP performance. The period between 1993-2003 covers both the period of economic openness, and the period of greater degree of globalization. Only the economies of Brazil (1,406), Panama (1,332) and Uruguay (1,327) recorded a TFP above average (1,221) of the 51 total economies included in our study sample, including Peru. Since 1980, efficiency declines paradoxically in the face of a recovery of the technological factor, but it does ultimately keep TFP with no significant variations. There has been a neglect of the factors in the region that provide efficiency in the conduct of economic activities both in the private sector (perhaps due to privatization), and in the public sector (perhaps due to the lesser intervention that the State has had in these economies), and the effort that has been emphasized to leave productive activities in the hands of market forces.

The region has benefited from the availability of technology as a result of the economic openness gradually experienced by each of the region's economies, but without the efficiency mechanisms, or rather, the institutional mechanisms, to make the best possible use of the available technology. A review of some statistics on the innovation process is enough to evidence a lack of interest in this sector. For example, they spend less than the minimum required expenditure (1%) on R&D. According to Melo (2001), data from the Ibero-American and Inter-American Network of Science and Technology Indicators (RICYT) for 1999, suggests that spending on Science and Technology (S&T) as a percentage of GDP was 0.54, 0.63 and 0.41 for Argentina, Chile and Mexico respectively; while Spain, Canada and the United States recorded values of 1.61, 0.89 and 2.59.

In Latin America, there is a clear lack of interest on the part of the private sector in directing its resources to technological activities, which is not the case for industrialized and newly industrialized countries. In 1998, about 67% and 74% of total R&D expenditures were financed by industry, while the government accounts for slightly more than a third in the United States and Japan. Conversely, in the case of Latin America almost three quarters of the total expenditure on S&T is financed by the government sector, while the rest is distributed among companies, higher education, nonprofit organizations, and the external sector. In Mexico, for example, total expenditures on S&T are financed 71.1% by the government, 16.9% by businesses, 8.6% by higher education, 0.9% by the nonprofit organization, and 2.5% of the total through foreign channels, with all these data for the year 1997.

The review of PTD's behavior in Latin America is needed to have a clear understanding of the economic context surrounding the region within the studied period. Peru, as a member country, has also had to overcome both, the wave of globalization, and certain neoliberal economic policies characterized, among other things, by severe corruption within this economy. However, the economic performance has been favorable, where several authors such as Loayza (2008), consider that between the end of the nineties and the beginning of the 21st century a watershed is marked for this economy and that is why the TFP estimation is justified during this period.

Between 1993 and 2003, Peru's TFP had a favorable performance of 1,170. This positive behavior is also composed of favorable indicators, both of its performance in efficiency (1,082) and of its performance in the component of pure technological change (1,074). Authors such as Reyes-Mondragón (2019) make longer-term estimations for a period from 1966 to 2003. The results obtained show that the Peruvian economy improves its TFP, not only because it operates with positive efficiency indicators throughout the analyzed period, but also because improvements in technology are increasing, as can be observed in the following Table 2.

Table 2. Peru. TFP and its components for different periods.

Period	Efficiency	Technology	TPF
1966-1973	1.143	0.996	1.142
1973-1983	1.409	0.961	1.358
1983-1993	1.227	0.966	1.187
1993-2003	1.082	1.074	1.170

Note. Extracted from Reyes-Mondragón (2019).

In graphical terms, the bars in Figure 3 show the behavior of the TFP and its components during four time periods. We can see that, in all these periods, it is efficiency that contributes the most and improves the TFP. However, in the last period, the period that falls within our remit, improvements in technology provide a scope to the efficiency indicator, while both contribute in a similar amount to the increase in TFP.

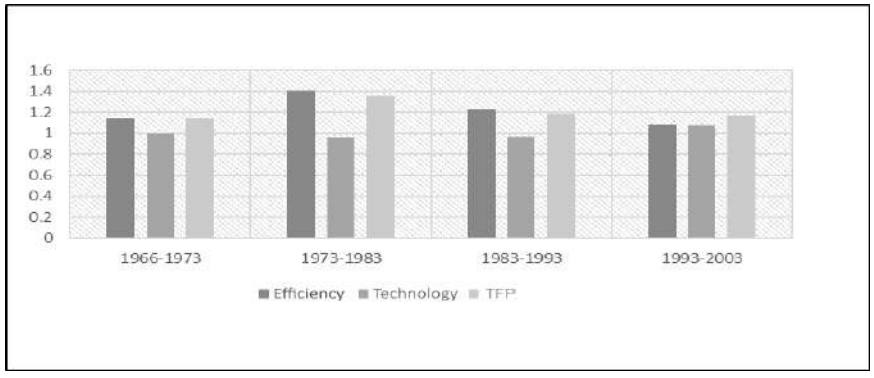

Figure 3. Peru. TFP and its components for different periods.

Note: Source. Extracted from Reyes-Mondragón (2019).

The above could indicate that in the Peruvian economy the institutional conditions have been established for its economy to operate efficiently, and to use its productive resources in the best possible way. While it is true that economic performance is not everything, in many cases it is presented as a prelude to better living conditions for the population. Peru still has issues that deserve attention, such as poverty, food security, inequality, social marginalization and discrimination, mineral exploitation, care for the environment, pollution, labor exploitation, etc., issues in which progress has been made without structurally addressing widespread social welfare.

Resources and their efficient use are not enough for an economy to be sustainable. Peru can still improve and strengthen its constitutional framework, particularly in key sectors such as science, technology and innovation. Some authors such as Díaz and Kuramoto (2010), review the main indicators of science and technology in Peru, as well as an institutional review. In their research, the authors use the SWOT methodology to point out the areas of opportunity to improve the main indicators that promote the generation, dissemination, and use of knowledge in Peru. The application of this methodology is useful and complementary to quantitative studies. Some authors have applied it to other areas, finding interesting insights, particularly for the design and implementation of science and technology policy that goes hand in hand with the expected economic growth. For example, Ghazinoory and Ghazinoori (2006), apply SWOT to Iran's innovation system, particularly focusing on strategies the government can implement to strengthen its innovation performance. Al-Mubaraki and Busler (2012), apply SWOT to innovation systems in a sample of European countries, pointing out the areas of opportunity that would favor the competitiveness of each system.

Discussion and Conclusions

The empirical bibliography evidencing the economic performance of different countries at the global level is extensive. The pattern of behavior is varied, with some showing a clear tendency towards convergence with leading economies and others towards divergence and economic lag. GDP turns out to be one of the main indicators for a nation’s wealth, either through a comparison in terms of levels or growth rates. This comparison based on the PPP methodology is also approximate to the level of development of the countries when considering the GDP per person. Economically, it is interesting to analyze the factors that affect the performance of an economy, particularly as in the case of Peru, which go from an unfavorable performance to an "economic miracle" type as occurred in East Asian countries (Lau and Park, 2003). The emblematic case is that of South Korea, which presented accelerated and sustained growth and which today, in terms of economic growth, has surpassed countries such as the United States. García-Blanch (2002) documents, for the Korean case, that the stimulus with respect to the profitability of investments and the returns to capital, in a first stage, allowed South Korea the expansion of the physical and human capital stock (from 1963 to 1981) to later give way to an improvement in the efficient use of its productive resources, that is to say, to an increase in its productivity (from 1982 to 1991).

The growth and productivity background for the Latin American region and also for Peru was presented in the document. The literature review on the subject suggests

that the unfavorable growth of Latin America is due to economic instability and the gaps in TFP that it maintains against the more industrialized economies. The region's economic vulnerability to external shocks, and the crisis scenarios that have enveloped the region seem to be common characteristics. The results of our Malmquist Index calculations, on the other hand, provide a better picture of TFP behavior due to the components of TFP, namely technical efficiency and pure technological change. Between 1993 and 2003, the TFP for Latin America would have little significant improvements due, on the one hand, to the increase in technology and, on the other hand, to the decline in efficiency in almost all the economies of the Latin American region.

These results suggest that the stagnation of TFP in Latin America is characterized by an increase in technology, but due to a fall in technical efficiency, which is noticeable, especially because of the efficiency determinants. One of these important factors are institutions, in particular the institutional framework surrounding the innovation process which, if complemented by global technological progress, would open up the possibility of recovering the region's economic performance. It is suggested that special attention should be paid to the region's institutional framework, since it is here that there is a promise of improvement towards multifactorial productivity that would ultimately ensure long-term economic growth.

TFP estimations in Latin America were made in order to have a context of the performance of the components of multifactorial productivity as one of the long-term determinants of the Region. The DEA methodology and particularly the Malmquist Index requires a set of homogeneous units that allow us to make a comparison of our economy in question, in this case Peru's economy. Once we consider the 51 economies in our study, all of which belong to the Latin American region, we can appreciate the multifactorial productivity and its components in the case of Peru.

Peru's economic growth has not been even slightly without ups and downs. However, the analysis period for 1993-2003 is used since it is in this period that the Peruvian economy reflects a better upward behavior. The question discussed in the document's body is whether Peru's growth is sustainable or not, in this sense, whether its growth is based on multifactorial productivity or on the accumulation of production factors. Our research is added to the literature that supports that economic growth is based on improvements in the efficiency with which it manages its resources, that is, on improvements in productivity (Chirinos, 2008; Loayza, 2008, 2016).

The behavior of the TFP and its components are better appreciated in the long term, which is why it is helped by the research of Reyes-Mondragón (2019) who also applies the Malmquist methodology, but for a longer period 1966-2003. The results of this author show that in the last period 1993-2003, both efficiency (1,082) and pure technological change (1,074) have increased, and this situation has been reflected in the TFP estimations (1,170). In this sense, the research corroborates the idea that Peru's long-term growth can be sustainable if it continues to improve its efficiency indicators that go hand in hand with institutional change. It is argued that the institutional framework plays a fundamental role in the growth of the Latin American economy, particularly because it is in the institutions where incentives, regulation and legal support are found so that the economies carry out productive activities that contribute to the country's product.

Within the institutional framework, this research also supports the need for more in-depth studies that make up the different institutional approaches to scrutinize the

areas of opportunity that Peru has in the coming years. One of the most important institutions is the one involved in the innovation process, known within the literature as the National Innovation System (SNI, Sistema Nacional de Innovación). A study that analyzes in greater detail the functioning of the SIN, with a mixed type study methodology, may provide evidence of whether the Peruvian economy has developed technological capabilities for the use of technological progress or has lagged behind in this area. This topic is left as a research agenda for specialists to resume and complement public policies that lead Peru to economic growth and sustainable social development.

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SOCIO-EDUCATIONAL INTERVENTION PROGRAM TO ACHIEVE A HEALTHY LIFESTYLE

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Abstract. The objective of this work was to design and apply a socio-educational intervention program for a group of retired teachers over fifty years old in Papantla, Veracruz, Mexico; with the purpose of teaching them, once a week for eight months, a healthy lifestyle and learning to make healthy aging. The research was developed following a quasi-experimental, longitudinal and trend design; to obtain the sample, the sampling technique "Grounded Theory" was used, so that ten people from a population of 36 were self-selected; four research instruments were used to analyze the variables of lifestyle, diet, sedentary lifestyle/activity and level of stress. The results were verified with the application of the questionnaire Do you have a fantastic lifestyle? revealing that of the ten people who participated in the health promotion program, nine practice an excellent lifestyle, one a good lifestyle; and, all perform a healthy lifestyle. In this way, it has been shown punctually that older adults have the ability to learn and to carry out a healthy lifestyle to achieve age-appropriate aging, by improving the inadequate habits of their lifestyle and thus increase longevity and improve their quality of life.

Key words: education, aging, lifestyle, health, healthy life.

PROGRAMA DE INTERVENCIÓN SOCIOEDUCATIVO PARA LOGRAR UN ESTILO DE VIDA SALUDABLE

Resumen. El objetivo de este trabajo fue diseñar y aplicar un programa de intervención socioeducativo para un grupo de profesores jubilados mayores de cincuenta años en Papantla, Veracruz, México; con el propósito de enseñarles, una vez a la semana durante ocho meses, un estilo de vida saludable y aprendieran a realizar un envejecimiento sano. Se desarrolló la investigación siguiendo un diseño cuasi experimental, longitudinal y de tendencia; para obtener la muestra se utilizó la técnica de muestreo "Teoría Fundamentada" por lo que se autoseleccionaron diez personas de una población de 36; se utilizaron cuatro instrumentos de investigación para analizar las variables de estilo de vida, dieta, sedentarismo/actividad y nivel de estrés. Se constataron los resultados con la aplicación del cuestionario ¿Tienes un Estilo de Vida Fantástico? revelando que, de las diez personas que participaron en el programa

de promoción de la salud, nueve practican un estilo de vida excelente, una un buen estilo de vida; y, todos realizan un estilo de vida saludable. De esta forma, se ha demostrado puntualmente que las personas adultas mayores tienen la capacidad de aprender y de realizar un estilo de vida saludable para lograr un envejecimiento adecuado a su edad, al mejorar los hábitos inadecuados de su estilo de vida y así aumentar la longevidad y mejorar su calidad de vida.

Palabras Claves- educación, envejecimiento, estilo de vida, salud, vida saludable.

Introduction

The main reason for carrying out this study was because it has been observed that some people older than 50 years old report noncommunicable diseases with impairment on their quality of life. The World Health Organization (WHO, 2011) in its annual report 2010, states that the percentage of noncommunicable diseases can be prevented by reducing the four behavioral risk factors of smoking, alcoholism, sedentary lifestyles and unhealthy diets. Noncommunicable diseases include chronic degenerative diseases such as cancer, diabetes, hypertension, hypercholesterolemia, obesity, cardiovascular diseases and pulmonary diseases. Thus, syndromes known as chronic degenerative diseases, those that are slow progressing, long lasting, rarely achieve complete healing, and affect old people, can be prevented.

Currently, it is possible to prevent these diseases with the help of health sciences; teaching people how to avoid the four risk factors mentioned. And according to the above, what could be the main problem to be solved so that people can maintain their health at an advanced age? Sartre (1996), existentialist philosopher, affirmed that consciousness is responsible for its relationship with its person. He considered that man's nature is of unlimited and absolute freedom; he said that man is born free and is condemned to be free; that is, thrown into the responsible action of his life, without excuses. For this reason, man is responsible for himself; so, he must consciously take charge of his actions to preserve health and life; and, his responsibility for himself extends to a responsibility toward his person.

Now, existential psychology points to a being in the world; it is of the opinion that, in the evolution of life, man becomes ill because of the absurdity of his own living, because of the lack of reason to make use of his freedom. From this we can deduce that, in some cases, man acquires chronic degenerative diseases because he does not know how to live in freedom, because he does not become aware of his personal conduct in order to carry out a healthy lifestyle. Faced with this situation, it is possible to prevent noncommunicable diseases if people are taught to avoid the inappropriate behaviors of the risk factors mentioned, through an educational program that teaches them a healthy lifestyle. Therefore, the objective of this research was to design and implement an intervention program with a socio-educational approach, once a week for eight months, to a group of retired teachers older than 50 years old, for them to learn to make a healthy lifestyle and thus achieve a healthy, active and functional aging.

The work began with a description of what is understood as a healthy lifestyle, the concept of the psychic structure of a healthy old adult was established and an analysis of the main theories of change and health behavior was made in order to create a lifestyle that helps them to maintain their health at an advanced age. To achieve this, fieldwork was carried out in three methodological phases; in the first phase, with a duration of five months (from June 17 to November 22, 2015), the lifestyle was

investigated using three questionnaires and a scale, which were validated by international organizations; in the second phase (from March 21 to November 18, 2016), the socio-educational intervention program was designed and applied once a week for eight months, with the purpose of modifying the reality detected in the first phase; and, in the third phase (from March 23 to November 25, 2017), the evaluation instruments were applied for the second time to carry out the management analysis, a process that lasted eight months.

A quasi-experimental, longitudinal and trend methodological design was used which allowed us to observe in a natural way the impact of the treatment and the change processes of the observed subjects, collecting data at different times to make inferences about the evolution of the research problem; in addition, the changes that were presented were analyzed. The research that was developed during these three phases, allowed recording the results that demonstrated that it is possible to prevent chronic degenerative diseases in adults over 50 years old, by carrying out a healthy lifestyle. The World Health Organization (WHO, 1998) defines the lifestyle that leads to health as a set of individual lifestyles characterized by identifiable patterns of behavior that can have a profound effect on the health of one individual and on that of others. In other words, lifestyle is a form of vital fulfillment based on identifiable patterns of behavior, determined by the interaction between individual and social characteristics, as well as socio-economic and environmental living conditions. For this reason, man must acquire the scientific knowledge and health techniques that allow him to consciously practice a healthy lifestyle according to his individual characteristics and the social environment in which he lives.

Rubio (2004) defines healthy lifestyles as a collective and social dimension that includes three interrelated aspects: material, sociological and ideological. The material aspect is manifested mainly in food and physical exercise; the social aspect by family relations; and, the ideological is expressed through values and beliefs that determine behaviors and conducts that are emitted in the form of responses and/or more or less structured reactions to the events of life. Likewise, this author points out that the important aspects for improving the lifestyle in relation to health consist of improving the body mass index and overweight, practicing physical exercises of physiological activation, as well as a balanced diet, in addition to avoiding stress, smoking and alcoholism. Therefore, old adults should permanently monitor their diet, overweight, sedentarism, stress, smoking and alcoholism; improve the cultural level and diversify the activities to which they dedicate themselves in their free time.

These concepts served as the basis for this study to investigate the lifestyle of the subjects with the aim of designing and implementing a health education program that would allow them to learn the main characteristics of a healthy diet, the importance of physiological activation and neuromuscular relaxation, as well as to inform them that they should avoid smoking and/or alcoholism. In relation to the mental structure of the healthy old adult, different theories try to explain the process by which an old person who has practiced a healthy lifestyle can enjoy an aging appropriate to their age, by integrating a functional mental structure to manifest a healthy personality at the physical, emotional, mental and spiritual levels. Among these, we find the theory of Vega y Bueno (2000), who expresses that the problem of stability, continuity and personality change after adolescence has been studied and analyzed differently. And by analyzing the scientific framework of the theories of behavior change in health, science shows that these theoretical concepts can be used for the creation, design and

implementation of an educational program for the prevention of health, achieving a positive change of healthy behaviors and conducts in old adults.

In this regard, Choque (2005), says that "there is no theory that dominates health education and health promotion; nor should there be one." This statement, in relation to the theories of health behaviors and conducts change, is accepted in the field of health education because it takes into account individual differences, social characteristics and the natural environment. In addition, because health problems, behaviors, conducts, populations, cultures and public health contexts are varied and very broad. And among the psychological theories that have been proposed to achieve behavior and conduct changes in health improvement are the theories of persuasion and models of individual behavioral change. These theories, also called behavioral theories, present a framework for understanding human behavior and its determinants, and have been the basis of studies developed by various researchers to promote changes in people's health.

Having said that, in order to carry out the execution and direction of the communication and education actions of the people who must change their behavior in health, there are two theories of behavior change in health, the theories that propose intervention at the individual level and those that act at the group level. For Choque (2005), the theories of individual change start from the point of view that the individual is the most important and immediate reference to favor changes in behaviors and conducts in the population. This opinion is accepted in the scientific field because the individual level is the basic level to initiate the development of behavioral changes and the practice of them in health promotion; but, in addition, they can be part of broader theories, due to the fact that, at group level, communities are integrated by individuals. This is why, in this research, the theories of individual change were applied and the stages of change theory that have to do with the willingness of individuals to change or to attempt to change towards healthy behaviors was used.

Also taken into account was the theory of health beliefs that addresses a person's perceptions of the threat of a health problem and the evaluation of a recommended behavior to prevent or resolve a perceived problem. Likewise, Choque (2005) indicates that it has been structured a model that provides a conceptual framework in which the therapeutic intervention of inadequate health behaviors is framed, making reference to the how, when and why an individual change, a certain unhealthy behavior. DiClemente & Prochaska (1982) cited by López (2004), explain a Trans-Theoretical Model of great relevance in the field of addictions, as a result of their research to study the psychological phenomenon of individual and intentional change of the subject. This model has been explained and analyzed through the stages, the processes of change and the levels of consciousness manifested in change. Therefore, in this work, the stages were first analyzed because they represent the temporal dimension; in other words, it is the time in which people change their behavior and/or conduct; therefore, at the moment of helping a person to make a certain change, the particular stage in which he finds himself at that moment must be considered.

In this way, it is essential to know in which stage the person is in relation to his problem in order to achieve success in behavior change, with the purpose of designing a specific procedure that can support the subject in his adaptation to change. The stages that a person can make to achieve changes in their behavior are precontemplation, contemplation, preparation, action, maintenance and termination.

Choque (2005), also establishes that the stages of change theory have as basic premise the change of behavior that manifests itself through a process to make the

necessary changes. The processes of change that occur most frequently are consciousness raising, self-reevaluation, self-liberation, environmental reevaluation, social liberation, reinforcement management, counter conditioning, dramatic relief, stimulus control, and helping relationships. Therefore, during the process that is being carried out, there are levels of change of consciousness that are manifested in the treatment carried out; which include the psychological problems that are susceptible to change by this means. In addition, Díaz (1983) adds that the levels of change proposed by the Trans-Theoretical Model are organized into five levels where psychotherapeutic evaluations and interventions are located; and, they are: i) symptom/situational problems; ii) current maladaptive cognitions; iii) current interpersonal conflicts; iv) long-term intrapersonal conflicts; and v) family/systems conflicts. This is the reason why it is recommended to start treatment at the first level; but it is also possible to start at the level that the subject considers to be the most important because the person who tries to change alone has the tendency to use it the most; it is the person who offers the least resistance, is the most accessible to the subject's consciousness and can represent the reason for the consultation.

Method

The methodology followed in this research paper corresponds to a quasi-experimental, longitudinal and trend study. The paper was developed on the basis of events that occurred spontaneously, without the direct intervention of the researcher, the observation of facts was made as they are presented in their natural context and were analyzed later; in addition, there were no conditions or stimuli to which the study subjects were exposed. Aspects of situations that occurred naturally at two particular moments were documented, and then the correlation of variables manifested in lifestyle in general was made; in particular: diet, sedentary level and stress level. A longitudinal study was carried out because the purpose of the research was to analyze the changes in the variables established over time and the relationships between them. This activity allowed to collect data in two moments in time; in the first moment a diagnosis and a prognosis were made; and, in the second moment inferences were made about the evolution of the research problem, its causes and its effects with the purpose of knowing the results of the educational intervention in health.

These activities made it possible to collect data, analyze changes in variables over time and the relationships between them, as well as to make inferences regarding the changes obtained, their determinants and their consequences. Likewise, the correlations between the variables of the behaviors manifested by the participants in a determined moment were described; activity focused in the study of reality, trying to describe, to explain and to predict the truth from an approximation to the behaviors of the subjects and through their natural dynamics. It was a longitudinal and trend study because it had the purpose of analyzing the changes that would present the proposed variables through time, and/or the relations between them; with the purpose of collecting the data in specific periods and being able to make the inferences with respect to the change, its determinants and/or consequences.

After the two main moments of the research, the respective correlation was made, taking into account the results obtained in the diagnostic phase and later the changes detected in the second application of the research instruments. Following this procedure, the aspects of what happened were documented and it was possible to know

and analyze the changes made in the lifestyle in general; and, in particular, it was possible to know and analyze the changes in the level of activity/sedentarism and the health risks due to the diet and the level of psychosocial stress. This quasi-experimental, longitudinal and trend methodological design allowed to analyze which was the state of the diverse variables in a determined moment; and, which was the relation between the set of variables in a point in time. The sample was made up by retired persons who regularly attend the monthly meetings of the Union Delegation of retired teachers in Papantla, Veracruz, Mexico.

The decisions made to carry out the sampling reflected the premises elaborated by the researcher, which constitutes a credible, reliable and valid database for addressing the problem. As older adults and in an ambulatory state, a procedure was sought that would allow a sample to be integrated that could be modified without altering the veracity of the study so that some of the subjects could withdraw from the research; but that would also allow other people who wished to participate to be accepted. As this is an investigation of the type of "grounded theory" study in which interviews are carried out and/or the behaviors of people under observation are analyzed; the sample size was integrated with 36 retired teachers who voluntarily participated, of whom ten concluded the study completely. Several people were interviewed and talked with, so events that have been observed in the socio-educational environment were collected and analyzed. They took notes and integrated the various impressions that could be perceived to define the attempt sample subject to the evolution of the suggested inductive process.

Being a small sample, it allowed all participants to permanently practice the interaction between themselves and the group with the enabler in each session. Three factors were taken into account in determining the type of sample. The operational capacity to collect and analyze the data; the possibility of understanding the complexity of the phenomenon to be researched and to understand the nature of the phenomenon to be analyzed. The research strategy allowed emphasizing the participants' lifestyles, where the researcher took an interactive stand with them, with the idea of building the knowledge of a healthy lifestyle, providing them with scientific knowledge and carrying out the proposed techniques together. A longitudinal method was applied to observe the behavior of two independent variables and four dependent variables; as well as to analyze their incidence and interrelation at two determined moments.

Independent variables of sex and age were analyzed; as well as the dependent variables of the lifestyle, the diet in the diet/nutrition, the sedentary/activity and the level of stress; allowing its manifestation of natural form. The lifestyle variable made it possible to know, through a structured questionnaire, the person's lifestyle, to elaborate a personal life project and to identify lifestyle improvements after the implementation of the educational program. The diet variable proposed an induced behavior to preferably eat vegetables, fruits, grains, seeds and fish; its objective was to learn how to make a suitable diet for the elderly. The activity/sedentary variable proposed practicing a regular routine of physiological activity exercises to reduce the levels of the observed sedentary lifestyle that come about in people with increasing age. The stress variable had the purpose of inducing them to a behavior and to a systematic practice of a neuromuscular relaxation technique in order to improve their capacity of coping with family and social stress to which the older adult is continuously exposed.

The evaluation instruments used in the research were three questionnaires and one scale. The questionnaires were: i) Do you have a Fantastic Lifestyle? (Wilson,

Nielsen and Ciliska, 1984); ii) the Mini Community Nutrition Screening Questionnaire (OPS/OMS, 2004); iii) the International Physical Activity Questionnaire (IPAQ, 2005); and, the Psychosocial Stress Scale (Holmes y Rahe, 1967). According to Suverza (2010), the questionnaire: "Do you have a Fantastic Lifestyle?" is used to identify and measure lifestyles; it is a self-application tool that explores people's habits, behaviors and conducts to identify and measure adult lifestyles.

For the Pan American Health Organization and the World Health Organization (PAHO/WHO, 2001), the Mini Community Nutrition Screening questionnaire, found in the Clinical Guide for Primary Care of elderly people, is a research tool that has been developed and approved by both institutions; it is therefore considered a valuable support for professionals in the field of food health promotion and disease prevention. It is made up of 28 questions grouped into ten specific areas: family and friends; associativity and physical activity; nutrition; tobacco; alcohol and other drugs; sleep; work and personality types; introspection; health control and sexual behavior, and other behaviors. The objective of this questionnaire is to provide conceptual and methodological elements to understand the nutritional situation of elderly people and to detect their nutritional risk, defining the behavior to follow in accordance with the identified nutritional situation.

On the other hand, the International Physical Activity Questionnaire (IPAQ,2005) is a questionnaire that was used to analyze activity and sedentary levels, while González de Rivera and Morera (1983) point out that the Psychosocial Stress Scales is an evaluation instrument that serves to identify the level of manifested stress and evaluate stressful vital events that may contribute to the presence of a psychological disorder. These instruments allowed the construction, the complementation and the expression in the projection of a lifestyle; in addition, with the respectful interpretation of the personal ideas of the partners who had the opportunity to know how to improve the lifestyle. As previously mentioned, the research was carried out at three methodological points in time; in the first, the initial application of the evaluation instruments was carried out in order to ascertain the perceived health status at that time, and the resulting data were collected.

At the second methodological stage and taking into account the results obtained in the initial use of the instruments, a socio-educational program was designed with the purpose of modifying the inadequate health behaviors detected in the first evaluation. This educational intervention program was designed taking into account the diagnosis with the analysis of the detected reality gathering the necessary information, obtaining a picture of the reality and identifying the health problems and the moment to establish the objectives of teaching/learning/evaluation. The content of the program was structured on the basis of scientific knowledge and health techniques that have proven their effectiveness, but also with a language accessible to the cultural level of the participants. Finally, in the third methodological moment, the evaluation instruments were applied for the second time and the management analysis was carried out by using strategies of contact with reality such as dialog in the interview, reflection, collective realization of the workshops, the expression of experiences in the work field and the participant observation. Likewise, a longitudinal method was applied to observe the behavior of the variables at different times.

Results

The results obtained are a logical consequence of the mentioned three methodological moments, with the purpose of identifying, defining and justifying the changes made in behavior and healthy behaviors, using the registration units related to the objective of the research. The sample was made up of 36 people who were voluntarily self-chosen; of these, ten participants completed the research, proving that they live a healthy lifestyle. Initially, 100% attendance was observed, but it decreased because some had health problems that prevented them from attending, others because they helped with their presence to solve family problems; but perhaps the main reason was the cost of the ticket to go to the place of the meeting. In this way, the economic factor, family solidarity and the health of elderly people are factors that may limit their health education.

The lifestyle variable was evaluated with the "Do you have a Fantastic Lifestyle?" Questionnaire, obtaining, in the first evaluation, one person with an excellent lifestyle, five with a good lifestyle and four with a regular lifestyle. However, in the second evaluation they improved because nine people had an excellent lifestyle and only one showed a good lifestyle. Thus, the improvement in the participant´s lifestyle was that four people managed to improve their lifestyle practice from regular to excellent; four improved from a good to an excellent evaluation; one who practiced a good lifestyle retained a good practice; and one who already had an excellent practice retained the same evaluation. In this way, the final result in the evaluation of this variable was that nine people improved their lifestyle practice, obtaining an excellent evaluation and one preserved the practice of a good lifestyle; so everyone ended up living a healthy lifestyle that was convenient for their age. The Mini Community Nutrition Screening questionnaire was used to assess diet in food/nutrition; in the first assessment, five people expressed high risk nutrition, four were moderately at risk and one person practiced good nutrition.

In the second evaluation they improved, as eight participants reported good nutrition and only two were moderately at risk. The improvement in diet was reflected in two people were able to pass the high to moderate risk assessment; three went from high risk to good nutrition; four from moderate risk to good nutrition; and, one person was sustained with a good nutrition assessment. Finally, the result was that nine people were able to improve their nutritional practice without risk to their health and one person maintained a good practice in his diet; but, in addition, all ended up practicing a healthy and convenient nutrition for their age.

Regarding the International Physical Activity Questionnaire, used to evaluate the variable activity/sedentary, it was obtained that, for the first evaluation, one person qualified with low physical activity, seven with moderate activity and two with high activity. However, in the outcome of the second evaluation they improved because four participants reported high physical activity and six participants reported moderate physical activity. When comparing physical activity assessments, one person who never engaged in any type of conscious physical activity went from a a low level to a moderate level; five preserved the level of moderate activity by increasing the number of days; two improved from moderate to high practice; and two, with a high level of physical activity, preserved that level. The result was that, by the end of the evaluation, all participants were able to improve their level of physical activity because they built the habit of walking thirty minutes a day, from Monday to Sunday. Finally, the psychosocial stress variable was evaluated by the corresponding scale, which was used to know the stress level of the participants. In the first evaluation three people showed a high risk of stress and seven intermediate risk.

In the second evaluation they observed an improvement because the ten participants presented a stress level with only intermediate risk. In the psychosocial/family stress assessment it was observed that three participants started with high risk stress level in their mental health but managed to overcome it at an intermediate risk level and seven who initially presented an intermediate risk stress assessment retained the same assessment. As a result, three participants improved their stress level, lowering their risk of developing psychosocial problems; but in addition, all participants ended up with only an intermediate level of risk. This improvement was achieved by the weekly the neuromuscular relaxation technique practice; but they will be able to overcome the manifested intermediate risk when they form the habit of practicing this technique two to three times a week.

As can be seen, the results obtained in this work show that elderly people do have the ability to have a healthy lifestyle and can achieve healthy aging, as long as they have the opportunity to know and acquire the necessary knowledge to practice healthy behaviors.

Discussion and Conclusions

Based on the results obtained from the implementation of the program, it is determined that the ten people who managed to complete the health education program practice a healthy lifestyle appropriate to their age. This result was possible thanks to the elaboration of two life projects; an individual project and a group project. For the individual life project, the starting point were the evaluations obtained in the first application of the "Do you have a Fantastic Lifestyle?" Questionnaire; and, as a healthy individual project, the participants set out to pass these evaluations. The group life project was elaborated according to the scientific concepts that the participants perceived and noted in the development of the educational program. At the end of these interventions, the group proposed to draw up a summary of what each person considered important to put into practice and as a group they committed themselves to comply with it, In the result of management as a group life project they self-intended themselves as a self-help group.

Likewise, all the participants ended up practicing a diet without risk for their health and convenient for their age. This result was possible because the majority of the participants were woman, and because of their interventions in the meetings it was possible to perceive that they were very interested in knowing the characteristics of a healthy diet. Therefore, they were able to change the concept of food abundance for a quality of nutrition and to understand the difference between food and nutrition. Regarding physical activity, all participants were able to improve their level of moderate physical activity and they understood that moderate exercise is ideal for elderly people. In order to carry out a systematized physiological activation, they were proposed to practice the structured exercises of yoga, taichi, psychophysical gymnastics, chikung and conscious walking. However, yoga exercises could not be performed due to lack of adequate facilities, including space, showers, rug purchase, etc.; but one participant signed up and currently practices in a yoga gym.

Likewise, the taichi practices could not be performed because they could not learn the gait, which is the first basic exercise, because the following exercises are with the displacement of the body in a given space. Throughout the development of the

program, that is to say, once a week for eight months, they practiced exercises of psychophysical gymnastics, chikung and the technique of conscious walking. The purpose was these techniques to be learned and to practice them during the week. The objective was achieved because all participants improved their physical activity level by practicing a moderate level of activity due to the consciously structured habit of practicing the walking technique daily, from Monday to Sunday. In this way, the stress level also improved and decreased the risk of manifesting psychological problems. This improvement was achieved by all the activities carried out with the purpose of improving health, mainly in the weekly practice of the neuromuscular relaxation technique; but they will be able to overcome the manifested intermediate risk when they form the habit of practicing this technique two to three times a week.

In conclusion, and as a consequence of the above, we can deduce that, from holistic concept of health that perceives the individual as a whole, the physical health, the emotional balance and the mental health of the individual is accentuated, because these areas of human nature should not be perceived in isolation. And according to this eco-systemic vision, physical, emotional and mental functions must be taken care of, since a state of psychological well-being increases resistance to diseases of physical and behavioral origin. The success in this work was achieved thanks to the application of the knowledge that was proposed in the designed educational program; fully demonstrating that aging is an interactive, comprehensive, dynamic, adaptive and systemic phenomenon. Furthermore, with the application of knowledge in daily practice, it is demonstrated that lifestyle is recreated in perception/sensory and that it is a multidimensional, cognitive, volitional, aesthetic, pragmatic and communicative phenomenon. Therefore, this research work will be one more contribution to deepen the improvement of the state of health of the aging population in future times.

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APPLICABILITY OF CRITICISM IN THE MAINTENANCE OF EQUIPMENT

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Abstract. This work presents an information system of preventive, predictive and corrective maintenance related to the data obtained from Criticality Matrix whose parameters were based on the history of maintenance interventions and the visual and auditory observation of equipment such as Mechanical scales, Winches, Hoppers and Sterilizers. Criticality analysis determined trends of preventive and predictive maintenance for the pairs "Hoppers, Sterilizers" and "Mechanical scales, Winches", respectively, establishing in this way a preventive maintenance planning system for Hoppers and Sterilizers through the design, elaboration and data feed to the information system that anticipates the planned control over the actions of the maintenance and production department. These actions generate benefits such as the availability and safety of the equipment plant, improvement in the quality of the products, a better register with the capacity of first hand information on the conditions of the machinery, a good capacity in quantity and quality of maintenance activities, optimization in the handling of repair parts, improvements in the design of equipment which leads to reduction of costs for maintenance.

Keywords: Maintenance, faults, criticality matrix, planning

APLICABILIDAD DE LA CRITICIDAD EN EL MANTENIMIENTO DE EQUIPOS

Resumen. Este trabajo presenta un sistema de información de mantenimiento preventivo, predictivo y correctivo relacionado con los datos obtenidos a partir de una Matriz de Criticidad cuyos parámetros fueron basados en el historial de intervenciones de mantenimiento y la observación visual y auditiva de los equipos tales como: Básculas mecánicas, Malacates, Tolvas y Esterilizadores. El análisis de Criticidad determinó tendencias de mantenimiento preventivo y predictivo para los pares "Básculas mecánicas, Malacates" y "Tolvas, Esterilizadores", respectivamente, estableciéndose de esta manera un sistema de planeación de mantenimiento preventivo para Tolvas y Esterilizadores mediante el diseño, elaboración y

alimentación de datos al sistema de información que anticipa el control previsivo sobre las acciones del departamento de mantenimiento y producción. Estas acciones generan beneficios tales como la disponibilidad y seguridad de la planta de equipos, mejora en la calidad de los productos, un mejor registro con capacidad de información de primera mano sobre las condiciones de la maquinaria, una buena capacidad en cantidad y calidad de actividades de mantenimiento, optimización en el manejo de partes de reparación, mejoras del diseño de equipos, lo cual conduce a reducción de costos por mantenimiento.

Palabras clave: Mantenimiento, fallas, matriz de criticidad, planeación

Introduction

Equipment maintenance is one of the main strategies applied at the company level, since through it is possible to reduce costs. Equipment maintenance represents savings for the economy of companies; in addition, it offers a way to maintain the continuity, security and efficiency of the same ones. Equipment maintenance is defined as the improvement or restoration, associated with services where the requirements for an adequate maintenance enable adding physical value and quality to the equipment. In addition, equipment maintenance offers alternatives of consideration that enables the identification of possible problems or causes of failure, as well as the possible consequences. Through maintenance, it is possible to decide if repairs or replacements of the damaged part or parts were executed, to carry out periodic maintenance, to fix intervals of revision or to simply give answer to user requirements (Horner, El-Haram, Munns, 1997). The application of an equipment maintenance system in general is defined as a methodology related to administrative and technical services, which help its control and measurement, facilitate its efficiency through operations that are focused on diagnosis and guarantee quality processes free of failures (Zul-Altfi, 2017). A maintenance system can be built through three diagnostic strategies such as preventive, predictive and corrective maintenance, which integrate an overall coordination system that improves communication between the operational and maintenance parts (Horner, El-Haram, Munns, 1997; Zul-Altfi, 2017).

Today, the principle of a preventive, predictive, corrective maintenance system in the industry marks a breakthrough in achieving productivity standards, world-class quality, and as a result, reduced cost (Swamson, 2001). Companies are implementing ever more preventive, predictive and corrective maintenance methods based on performance indicators, and practices based on the maintenance philosophy, since these enable ensuring the equipment's functionality, as well as to reduce the deterioration and increase of the costs for repair or change of equipment (Swamson, 2001; Nazmul, Taib, 2013).

The development of these types of systems is done through the three phases mentioned above: a) preventive maintenance, which is based on operating times and the specific statistical operational history of each piece of equipment; b) predictive maintenance, which is based on direct monitoring, operating conditions, efficiency, and temperature distribution in the equipment, and non-operational indicators due to failure or loss of efficiency (Nazmul, Taib, 2013; Fluke, 2005); and finally, c) corrective maintenance operation, based on total equipment repair (Wang, Ye, Yin, 2016).

In general, we can say that preventive, predictive, and corrective maintenance processes are based on cleaning, verification and inspection. However, failures and

maintenance requirements have become a key point in the operation and planning of different industrial processes (Kogbaa, Huang, 1992).

In recent years, the maintenance of fixed assets in the industry has undergone a series of technological, financial, and organizational transformations that are a consequence of competitiveness, which has led to the implementation of new tools that allow greater reliability in the life cycle of equipment. The maintenance of processing equipment increases productivity and reduces operating costs, which is why many organizations apply these types of activities to ensure that there are no inconveniences that affect production (Fluke, 2005). Conversely, maintenance failures result in equipment malfunctioning, that lead to poor quality products, reduced operational life, frequent repairs and, ultimately, equipment replacement (Swamson, 2001). Predictive, preventive and corrective maintenance represents one of the strategic analysis operations, suitable for critical operations, since it improves the operation of production equipment and represents a high reliability and availability for the productivity of industrial plants (Fore and Msipha, 2010).

General Maintenance Characteristics

Preventive Management (MP)

Preventive maintenance (PM) is an important component of maintenance activity, as it is one of the main parts of the total performance effort within the preventive system. Objectives include reducing critical equipment disintegration, prolonging the productive life of equipment, improving the planning of programs and activities such as: equipment maintenance schedules, reducing production losses due to failures, and promoting the health and safety of maintenance personnel (Dhillon, 2002; Duffua-Salih, Raoluf and Dixon, 2000).

This type of maintenance process has advantages such as equipment availability, good performance capability, good workload balance, reduction of overtime, increase in production profits, among other benefits. Among the disadvantages are exposure to possible failures, use of a greater number of parts, increase in initial costs, failures in new parts and greater frequency in demand for equipment and parts for repair (Dhillon, 2002).

In a study conducted on the implementation of a preventive maintenance program for palm oil extraction in Malaysia by Ahmad-Rasdan, Rafis-Suizwam, Rozli, Nor-Kamilah (2009), it was shown that the implementation of the preventive maintenance program can provide greater equipment availability and reduce the equipment failure rate. This is because it is possible to classify the main processes from reception and classification of oil palm fruits, sterilization, threshing, digestion, pressing, clarification and almond production, resulting in the organization, scheduling, inspection, and frequency of maintenance work.

Predictive Maintenance (PdM)

Predictive maintenance (PdM), is one of the maintenance measures which has revolutionized the industry, because through these measures, it is possible to improve the safety, quality and availability of equipment in industrial plants. It is considered as a program that enables establishing strategic decisions, analysis plans, and strategies related to the management and supervision of equipment permanently or intermittently. It also works as an indicator of quality control, as it facilitates the early detection of

anomalies during the operation of equipment, in addition to avoiding failures in the process programs (Dhillon, 2002).

This type of process has a tool technology that enables knowing the operating status of the equipment in operation through non-destructive measurements such as: thermographic analysis, amplitude, speed and acceleration measurements; lubrication analysis and ultrasound tests for thickness measurement. Among the benefits of this type of maintenance are improvements in product quality, both in maintenance, and in the quantity and quality obtained on the information of industrial machinery, the ability to schedule maintenance activities, optimization when handling spare parts, support and design of industrial machinery, cost reduction and the ability to identify the root cause of the problem (Carnero, 2003).

In a study conducted by Kumar-Srivastava, Mondal (2014), it was demonstrated that by developing a modified failure mode and effect analysis (FMEA) model for predictive maintenance, competitive advantages and additional benefits can be obtained that minimize the use of costly technology and monitoring systems in processing technology for coconut palm oil extraction. Other studies, such as the ones conducted by Mendel, Rauber, Varejao and Batista (2009), present the method of diagnosis by marking the detection of faults in bearing machinery for oil extraction, which provides a characteristic vector for the identification of faults.

Corrective Maintenance

Corrective maintenance is an important activity, defined as a remedial action taken due to a failure or deficiency that occurs as part of or during preventive maintenance, either to repair equipment or to keep it in operation. The actions required are immediate, and are intended to avoid deficiencies in operation, and incidents or accidents caused by poor performance of repair actions and are classified as follows: breakdown repair, salvage, reconstruction, repair and maintenance (Dhillon, 2002).

Corrective maintenance is crucial to ensure that assets have good maintenance capacity, availability and reliability during plant operation; any failure means reduced profits for the company and reflects a negative impact on its performance (Salleh-Intan, Mohd-Yusof and Zahedi, 2012).

Corrective maintenance is a primitive maintenance model or the most basic version. Its objective is to speed up the operation of the equipment quickly and with minimum maintenance costs. However, it presents disadvantages such as parts disposition, which generates delays in repairs, production stoppages and affects in the operational quality of the equipment due to progressive wear (Duffua-Salih, Raoluf and Dixon, 2000).

Criticality

The planning and control of maintenance systems is complex and has been tested for the solution and operational improvement of facilities and components associated with fundamental aspects such as human reliability, process, design, maintenance and Criticality. The Criticality theory is a model that carries out the hierarchization of processes, systems and equipment, enabling the creation of a structure that facilitates effective decision making in terms of types of maintenance. Criticism focuses on the operational reliability of processes and even when it is a theory that is not so new, its scopes do solve current realities in the industry. It makes use of

contextualized mathematical models that can lead to results that are not necessarily representative of the case to be analyzed, but in most cases they are.

Criticality Analysis is mainly based on the qualification of two corresponding attributes: the first one has to be with the origin of the failure, and the second one is related to the critical level that prevails in the fault However, although the appraisals of these qualification components are quantitative in nature, they also have a qualitative part (Visual), since the experience of the operators of the teams and the maintenance manager is applied to have a qualification closer to reality. The engineering part of this methodology is associated with the components of safety, environment, production, operating costs, maintenance, number of failures and repair time of the equipment. As presented below in some study cases where this methodology has been applied. For example, in a study presented by Díaz-Concepción, Pérez-Rodríguez, Del Castillo-Serpa & Brito-Vallina (2012), an analysis of Criticality and complexity in a production process of a plant of biological products was carried out. Therefore, a hierarchical list of the equipment was obtained from the comparison, through the Criticality matrix and other criteria that intervene in the criticality index and the complexity of each asset.

In the research developed by Aguilar-Otero, Torres-Arcique, Magaña-Jiménez (2010), in which they presented an analysis of failure modes, effects and Criticality, also known as FMEAC methodology, for maintenance planning, risk and reliability criteria were used for maintenance planning. It was concluded that the degree of Criticality of the risk in equipment is normally used for maintenance planning focused on reliability, since it enables achieving a global understanding of the system, as well as the operation and the way in which the failures of the equipment that compose the analyzed system may occur.

Furthermore, focused Criticism provides relevant results, as opposed to specific maintenance plans for equipment, increasing the expectations of efficiency and reliability in production. When all these components are integrated, the results have a positive impact on the industry, since the classification and reduction of maintenance operations depends on it. That is why this study has the purpose of generating a control system that intervenes in an adequate and effective way in the processes of preventive, predictive and corrective maintenance for equipment such as: Mechanical scales, winches, hoppers and sterilizers. Through the analysis and the current evaluation of the equipment of extraction of palm oil from coconut seed in a particular company, it is possible to submit them to maintenance directed to determine actions, routes and days that enable sustaining the production from a reliable park of machinery and available in most of the processing time.

Method

Problem to be Solved

It has been recognized that the diagnosis raises management's awareness about the problems and the fulfillment of the area's tasks and the repercussions that can result from the lack of organization and planning of both predictive and corrective maintenance processes (Wang, Ye, Yin, 2016; Duffua-Salih, Raoluf and Dixon, 2000; Bohórquez, 2004). When analyzing the current state of the machinery performance of the maintenance department, it was found that there is no adequate maintenance program for the plant equipment and parameters that lead to a real and future projection

towards the planning and programming on the equipment. For this reason, the technification and organization of the maintenance department is required.

For this purpose, a study was carried out by means of the 7-steps-systematic application that are presented below, which have a constant relationship with the control of mechanical and electrical maintenance, in favor of the improvement of the operating conditions of the machinery.

- Equipment data sheet. It presents the relevant information to the general characteristics of the equipment; brand, reference, pieces and capacity.
- Resume In which the activities carried out on the machines are presented consecutively and chronologically.
- Plans. They allow to visualize the pieces that include special designs and in certain case to be manufactured by the department.
- Pictures. Most of the plant equipment to quickly reference its location.
- Work order. It is evaluated and implemented as a field document that allows to review and evaluate time and tools used to develop a programmed or emergency function on the equipment.
- Alarms. They show the main operations planned and established according to maintenance routes, dates and days analyzed for the convenience of the equipment; and communicate in a timely manner the time of intervention as well as materials and necessary spare parts.
- Company. That links the general information of the company, its representatives, its employees, headquarters, and suppliers.

The developed sections and scoring values for each topic were assigned according to parameters obtained directly from production equipment, cost limits for spare parts or repairs, as well as the reliability of each machine based on the resume.

Criticality Theory

The implementation of the Criticality Theory is based on the operation of equipment and logs. The qualification of the equipment is made through visual and auditory inspection of each of the components of the system, considering the contribution of life time and duration, as well as the work environment to which they are subjected, thus ensuring the availability and reliability of the operations through optimal maintenance (Bohórquez, 2004; Grall, Berenguer, Dieulle, 2002).

In accordance with the project objective, a sustainable maintenance plan was implemented in order to devise an improvement in production from the maintenance department and its actions. For this reason, a specialized technique (Criticality study) is proposed to help solve this problem (Grall, Berenguer, Dieulle, 2002; Duffua-Salih, Raoluf and Dixon, 2000).

The scope of this research according to the objective of the work focused on the design, development and implementation of a system that facilitates the actions and maintenance days, forming a performance and operational efficiency of the teams to have databases that provide criteria necessary to make opportune investment on them. In addition to obtaining the maintenance routines analyzed, established and recommended to promote in the operators and maintenance personnel a culture of care and continuous review of the equipment. The system will allow results to be obtained

from simple, easy and comfortable language formats based on Criticality analysis (Kyiakidis, Dimitrakos, 2006).

The limitations of this work are related to the lack of an adequate computer support system, as it is presented in tables assigned by simple spreadsheets for each piece of equipment where data are recorded such as: machine specifications, resume distributed in the last actions performed, and missing data described in an unclear manner (Kenne, Nkeungoue, 2008). The disadvantages presented occur when trying to define exactly the operations carried out and the implements employed. The lack of documentation on the necessary parts, as well as some drawings on relevant parts of the machines; that is to say, that there is no technical record of equipment or that it is incomplete (Swamson, 2001; Fore and Msipha, 2010; Grall, Berenguer, Dieulle, 2002; Kenne, Nkeungoue, 2008). Therefore, the Criticality study could be affected by the lack of information. Based on the abovementioned, it was observed that there is a direct influence between the production teams, cost limits in spare parts and repairs, as well as in the reliability of each team. Below, in table 1, the general information of Criticality variables used for this study is presented.

Table 1
Variables used in the Criticality Study

Type of variable	Assessed variable	Score
Failure frequency, (FF)	Poor, 4 failures per year:	4
	Average of 2-3 failures per year:	3
	Good of 1-2 failures per year:	2
	Excellent, less than one failure per year:	1
Maintenance cost (MC)	Greater than or equal to $60,000	2
	Less than $20,000	1
Operational Impact (OI)	The factory stops working	10
	The system or section stops working and impacts other systems.	7
	Impacts inventory-wise	4
	Does not have any significant effect on operations or production	1
Impact on environment, health and safety (EHS)	It affects both internal and external human security and requires reporting by internal and external agents of the organization.	8
	It affects the environment and facilities.	7
	It affects facilities causing severe damages.	5
	It causes minor damages.	3
	It does not cause any damage to persons, environment and facilities.	1
Operational Flexibility, (OF)	There is no production option or spare part available for Purchase.	4
	There is an option to manufacture the spare part.	2
	Spare part available in stock.	1

Note: information taken from the thesis "Variable aplicada en el estudio de criticidad" (*Variable Applied in the Study of Criticality*), from the Industrial University of Santander, Engineering School, Colombia, (2004).

For the calculation of Criticality, the following operations given by the equations (1 and 2) were used, which are shown below:

Total criticality (***TC***) = Frequency (***FF***) x Cost consequences (***CC***) (1)

Where the consequences are calculated as follows, equation (2):

Consequences (***CC***) = ***IO*** x ***FO*** + ***CM*** + ***ISAH*** (2)

Where: ***FF***, is the frequency; ***CC***, are the consequences; ***IO***, is the operational impact; ***FO***, is the operational flexibility; ***CM***, is the cost of maintenance and ***ISAH***, Environment, health and safety impact.

Maintenance Matrix Calculation

Each of the teams to be studied was assigned a rating corresponding to each factor, and the final Criticality value was calculated using equations 1 and 2. Frequency and consequence columns were used for the development of the Criticality Matrix, which helps determine the applicable maintenance trend for each piece of equipment. Table 2 shows the model for the construction of the Criticality Matrix to be used. This Criticality Matrix indicates the dependence of the Frequency (***FF***) as a function of the Consequences (***CC***) and in it the degree of Criticality of the maintenance is reflected.

Table 2
*Medium Critical Maintenance Matrix (**MC**), Critical Maintenance (**C**) and Non-Critical Maintenance (**NC**)*

Frequency, FF	*4*	*MC*	*MC*	*C*	*C*	*C*
	3	*MC*	*MC*	*MC*	*C*	*C*
	2	*NC*	*NC*	*MC*	*C*	*C*
	1	*NC*	*NC*	*NC*	*MC*	*C*
		10	*20*	*30*	*40*	*50*
		Consequence, CC.				

Note: Authors' own creation, 2019.

The colored areas designate the application of operations with certain trends; the area in pink represents predictive maintenance, the color yellow denotes preventive maintenance and the color green symbolizes corrective maintenance. This methodology is appropriate for the development of maintenance programs, reflecting the real performance of the equipment, which means that it is possible to obtain positive productivity results from this model.

Integral Maintenance Plan

The comprehensive maintenance plan is based on the concept of Criticality, through which a maintenance program was designed capable of operating, storing, processing and presenting data in advance for the operation of maintenance processes, with the aim of optimizing them and allowing adequate decisions to be made, in equipment such as: Mechanical scales, Winches, Hoppers and Sterilizers that are key in the extraction of oil.

As a first step, each of the equipment was physically inspected, along with the analysis of the data captured from the operation logs of each equipment, as well as the recovery of data from the plates. In the analysis, the grades of the items indicated in table 1 were obtained, as: Failure Frequency (***FF***), Maintenance Cost (***MC***), Operational Impact (***OI***), Impact on environment, health and safety (***EHS***) y Operational Flexibility (***OF***). From these estimates, the Consequences (***CC***), Equation 2, were calculated and the Criticality Matrix ***FF*** vs ***CC*** from table 2 was plotted, which allowed classifying the type of maintenance in each of the equipment. The types of maintenance are described below:

Corrective Maintenance

Corrective maintenance consists of total repair until the defect is fixed to the point where the equipment operates efficiently (Duffa-Salih, Raouf and Dixon, 2000). This type of process implies a high degree of analysis and responsibility on the equipment, due to the fact that it is necessary to have a wide knowledge of the possible failures, availability of parts for a quick and effective execution in the face of unforeseen events, which is why corrective maintenance is justified in the following factors:

- Offline equipment or Critical Point of the process: does not cause serious disruption to production or maintenance.
- Equipment out of use or obsolete.
- Existence of the same equipment.
- Easily replaceable by new equipment.

These factors should be evaluated periodically based on the concept of Criticality, so that it can be established that corrective maintenance is adequate.

Preventive Maintenance

Preventive maintenance is planned, and scheduled maintenance based on the condition of the equipment (NASA, 2008). The condition is determined by monitoring variables such as: Temperature, Pressure, Humidity, Tension, Deformation, Mechanical Motion, Cyclic Action, Displacement, Degree of Change, Time, Acidity/PH, Discharges, Concentration, Composition, Electrical Function, Mechanical Function and Sequence, Electrical Sequence, Acceleration, Deceleration, Electrical, Magnetic and Electromagnetic Characteristics, Condition of Oils and Other Fluids (NASA, 2008; Chang, Young, 1986).

The study was carried out for each piece of equipment by means of frequency control (cycle, month and year) of maintenance provided to the equipment to avoid continuous delays in the production processes (Duffa-Salih, Raouf and Dixon 2000; NASA, 2008; Domínguez-Giraldo, 1998; Zho, Xi, Lee, 2007). Table 3 below presents the comprehensive programming plan for each piece of equipment, frequency, cycle and estimated day for the respective maintenance.

Table 3
Comprehensive programming plan for equipment for corrective and preventive maintenance: Mechanical Scale, Sterilizer, Winch and Hoppers

Mechanical scale	Frequency	Cycle	Day
Calibrate sensors from kilos to tones	Weekly	1	Saturday
General electrical system overhaul	Daily	1	Saturday
Weighting area overhaul	Daily	1	Saturday
Sterilizer			
Check steam leaks through lids and covers	Daily	1	Daily
General cleaning	Every 6 days	1	Saturday
Safety Valve Verification and Calibration	Daily	1	Daily
Condensate and steam piping inspection	Every 6 days	1	Saturday
Inspection of wear rails and sleeves	Every 6 days	1	Saturday
Inspection of moving parts of tracks	Monthly	1	Saturday
Steam Trap Cleaning	Monthly	1	Saturday
Safety valve trip	Monthly	1	Saturday
Steam Tray Overhaul	Monthly	1	Saturday
Steam inlet valve seal check	Monthly	1	Saturday
Discharge and condensate valve seal check	Monthly	1	Saturday
Winch			
Cylindrical drum overhaul	Daily	1	Monday
Gearbox status overhaul	Monthly	1	Monday
General overhaul of the electrical system	Weekly	1	Monday
Hopper			
Chain and harrow overhaul	Monthly	1	Monday
Sprocket overhaul	Monthly	1	Monday
General overhaul of the electrical system	Daily	1	Monday
Transmission chain overhaul	Monthly	1	Monday
Bearings overhaul	Quarterly	1	Monday

Note: Author's own creation, 2019.

The procedure of the activities carried out was performed through the systematic application of the 7 steps mentioned above whose constant relationship with the control of electrical and mechanical maintenance was necessary to achieve the objective of the work.

Results

Equipment Qualification

The obtained results of Criticality *FF, OI, OF, MC, EHS* and *TC* show the maintenance tendency through the *CC* and *FF* columns (table 4), for each of the equipment; Mechanical Scales, Winches, Hoppers and Sterilizers. The data enables classifying the maintenance, based on the visual and auditory inspection of each one of the components of the equipment classification system, considering its life time, duration and environment to which it is submitted; evaluated by means of the Criticality scale applied to each one of the items mentioned in table 1. The results obtained enable medium and long term maintenance projects to be programmed with actions that direct the good functioning of the equipment in the industries.

Table 4
Estimated Criticality Values for the equipment studied

EQUIPMENT	**FF**	**IO**	**FO**	**CM**	**ISAH**	**CT**	**CC**	**FF**
Mechanical scale	1	4	4	2	1	19	**19**	**1**
Winch	2	7	1	2	1	20	**10**	**2**
Hopper	3	7	2	1	1	48	**16**	**3**
Sterilizer	3	7	1	2	7	48	**16**	**3**

Note: Authors' own creation, 2019.

Based on the data obtained, the Criticality Matrix was plotted (table 5) for the aforementioned equipment (Mechanical scales, Winches, Hoppers and Sterilizers). According to the Criticality Matrix, equipment such as Mechanical scales and Winches must be subjected to predictive maintenance while Hoppers and Sterilizers must be subjected to preventive maintenance, thus it was also observed that no equipment indicates its application in corrective maintenance.

Table 5
Criticality Matrix for the equipment; mechanical scales, Hoppers, Winches, and Sterilizers

	4	*MC*	*MC*	*C*	*C*	*C*
	3	*MC*	***Sterilizer Hopper***	*MC*	*C*	*C*
Frequency, FF	*2*	***Winch***	*NC*	*MC*	*C*	*C*
	1	*NC*	***Mechanical Scales***	*NC*	*MC*	*C*
		10	*20*	*30*	*40*	*50*
		Consequence, CC.				

Note: Authors' own creation, 2019.

According to the results obtained from the inspections carried out on the equipment, preventive procedures were programmed in Hoppers and Sterilizers, as shown in table 6.

Table 6
Scheduled inspections for Hopper-and-Sterilizer-based equipment preventive actions

Equipment	***Preventive actions***
Hoppers	*Tubing hoses* *Rigid tube hoses* *Hopper Fittings* *Hopper Gate Bearing*

Sterilizers	*Door gaskets* *Wear sleeves* *Warrick electrodes* *Level sensor* *Pressure sensor* *Steam trap* *Compressor Belts*

Note: Author's own creation, 2019.

As previously discussed, the application of good maintenance planning generates benefits such as: reduction of operating hours, downtime, production cost savings and improved productivity (Efficiency x Effectiveness) thus avoiding hidden failures, unexpected damages and corrective maintenance (Swamson, 2001; Fluke, 2005; NASA, 2008; Gonzalez, 2001). Based on the analysis performed and the visual and auditory results, it is established that the information system for each equipment (EIS) should be modified under the following recommendations (table7).

Table 7
Recommended modifications to the maintenance equipment information system

Equipment information system	Recommended Modifications
Technical data	It must present relevant information on the general characteristics of the equipment: brand, reference, parts and capacity.
Resume	That they present the activities carried out on the machines in chronological order and in consecutive form.
Blueprints	That allow to visualize the pieces and include special designs and in certain case to be manufactured by the department.
Pictures	Plant equipment to reference its location.
Work order	Evaluated and implemented as a field document to review and evaluate the time and tools used to develop a programmed or emergency function on the equipment.
Alarm system	That show the main operations planned and established according to: maintenance routes, dates and days analyzed, for the equipment's benefit; that communicate in a timely manner the time of intervention, as well as materials and spare parts.
Company	That links the general information of the company, with its representatives, employees, headquarters, and suppliers.

Note: Authors' own creation, 2019.

Conclusions

A Criticality Matrix was obtained based on the visual observations of each of the equipment (Mechanical scales, Winches, Hoppers and Sterilizers) studied. Based on the Criticality analysis, preventive and predictive maintenance trends were determined for the pairs of Mechanical Scales, Winches and Hoppers, Sterilizers, respectively. A preventive maintenance planning system was established for Hoppers and Sterilizers. Finally, an information system was designed, elaborated and fed that anticipates the predictive control over the actions of the maintenance and production department. These actions generate benefits such as the availability and safety of the equipment plant, improvement in the quality of the products, a better register with capacity of first-hand information on the conditions of the machinery, a good capacity in quantity and quality of maintenance activities, optimization in the handling of repair parts,

improvements in the design of equipment which leads to reduction of costs for maintenance. The implementation of maintenance systems reduces reprocessing, and constant practice and training facilitates diagnostics and control, improving maintenance operations.

Criticality analysis is recommended as a tool for continuous improvement of the industry. Based on the Criticality analysis, the standardization of the maintenance procedures that are executed, putting emphasis on those that are classified as preventive, since this type of maintenance results in greater savings by reducing failures and production stoppages due to flaws in equipment is recommended. It should be noted that procedures for preventive maintenance should be subject to adequate timing so as not to interfere with production. In addition, take into account that the maintenance derived from the Criticality model is not inflexible, since it must be adjusted through the continuous supervision inspections that must be carried out by the maintenance personnel. Should it be necessary to stop equipment for corrective maintenance and generate downtime greater than those established in the maintenance plan, they must be adequately justified, because otherwise it would be understood that the deliberated values of the equipment ratings shown in Table 1 were incorrectly selected. For these cases one recommends making the Criticality analysis again considering the deliberations of each equipment to obtain the correct consequence that gives place to the Criticality Matrix.

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DIAGNOSTIC OF SELF-ASSESSMENT OF STUDENTS OF THE DESIGN MODULE FROM THE PROJECTS AREA OF FUNIBER ABOUT IPMA 4.0 COMPETENCES CERTIFICATION

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Abstract. This contribution is presented into the framework of the project for Updating the Design Module of FUNIBER based on the IPMA 4.0 certification. The aim of this proposal is to describe the diagnostic of students at the starting point of the course, based on a sample of 36 students from the total population. The methodology employed is of non-experimental design, exploratory with mixed perspective, and involved the application of a survey of 29 questions. Each question was related to one of the 28 IPMA competences in the main 3 areas (Perspective, Persons and Practice), except by Team work, which was related to 2 questions. The results have been analysed using Main Components Analysis and scattering plots. The main conclusion from statistical analysis is that the studied sample of students follows a trend with maximum frequency of answers in the level Medium, in a 92% of the competences considered. For the competence of Personal Integrity and Confidence a distribution with maximum in the level High was found, and for Results Orientation an equal distribution between Low and High levels was described. Finally, an optimization of the measurement instrument is proposed, based on statistical tools and the perspective described by Tobón in 2008.

Keywords: Diagnostic, project management, self-assessment, competences, IPMA 4.0

DIAGNÓSTICO DEL NIVEL DE AUTOEVALUACIÓN DE LOS ALUMNOS DEL MÓDULO DE DISEÑO-ÁREA DE PROYECTOS DE FUNIBER 2018, RESPECTO A LAS COMPETENCIAS DE CERTIFICACIÓN IPMA 4.0

Resumen. En el marco del proyecto de actualización del Módulo de Diseño de FUNIBER respecto a la certificación IPMA 4.0, este aporte presenta el diagnóstico inicial de una muestra de alumnos que aún no han cursado el Módulo de Diseño actualmente disponible. Esta propuesta está basada en la metodología de investigación-acción enfocada a la educación, y tiene el objetivo de describir la autoevaluación del nivel de competencias IPMA 4.0 de 36 alumnos del módulo mencionado. La metodología utilizada es de

diseño no experimental, de tipo exploratorio y con enfoque mixto, en la cual se utilizó un instrumento de medición de 29 preguntas, asociadas a las 28 competencias que señala IPMA en sus tres áreas (Perspectiva, Personas y Práctica), excepto en el caso de Trabajo en Equipo en que se plantearon 2 preguntas para evaluar una misma competencia. Los resultados obtenidos se presentan en una proyección de Análisis de Componentes Principales y gráficos de dispersión, a partir de los cuales es posible concluir que los alumnos del Módulo de Diseño en el área de proyectos que comenzaron el curso transversal en mayo 2018 siguen una tendencia de distribución de frecuencia de respuestas con máximo en el nivel Medio para un 92% de las competencias estudiadas. Para la competencia Integridad y Confianza se encontró una distribución con máximo en el nivel Alto y para Orientación a Resultados una distribución equivalente entre los niveles Bajo y Alto. Finalmente, se recomienda la optimización del instrumento de evaluación considerando herramientas estadísticas y el enfoque desde 6 elementos propuesto por Tobón en 2008.

Palabras clave: Diagnóstico, gestión de proyectos, autoevaluación, competencias, IPMA 4.0

Introduction

This work is part of the project to update the Design Module of the Ibero-American University Foundation from now on, FUNIBER, based on the International Project Management Association certification, IPMA 4.0. The final objective of this study is the proposal of a new version of the teaching materials used in the Design Module for the Creation of Projects provided by FUNIBER, that contemplates in an integral way the competences described by IPMA 4.0. In this first part of the work, the initial diagnosis of the students who have not yet completed the module is presented. The goal of this section is to establish a baseline reference point for the subsequent comparison of the performance of this same sample of students once the module in question has been completed, using the measurement instrument in order to identify the required modifications in the contents of the teaching material. This proposal is based on the action-research methodology, focused on education, which "is based on the fact that theory is developed through practice and modified through new actions". (Latorre, 2003, p.10).

The main objective of this research was to produce a self-evaluation diagnosis of the level of competences of student from the Design Module in the Projects area of FUNIBER 2018, taking as reference the competences of IPMA 4.0, in order to meet part of the objectives of the broader research mentioned above.

This first diagnosis will allow the comparison of the level of competencies of the students who begin and complete the Design Module in the FUNIBER 2018 project area, in order to validate and update the quality of the course in terms of contents and educational methodology.

Definition of Competence

According to the Real Academia Española competence means "expertise, aptitude or suitability to do something or intervene in a particular matter".

> The first use of the concept is in Plato's work (Lysis 215 A, 380 DC). The root of the word is "ikano", a derivative of "iknoumai", which means to arrive. The ancient Greek had an equivalent for competition, which is ikanótis (ικανοτης). It is translated as the quality of being ikanos (capable), having the ability to achieve something, dexterity Epangelmatikes ikanotita

> means capacity or professional/vocational competence (Mulder, Weigel, & Collings, 2008, p.2).

They also mention:

> Even earlier in time, the Code of Hammurabi (1792-1750 BC) mentions a comparable concept. In the Epilogue, a text translated into French can be read: "Telles sont les décisions e justice que Hammurabi, le roi compétent, a établies pour engager le pays conformément à la vérité et à l'ordre équitable." Competition even appeared in Latin in the form of competens which was conceived as being able and allowed by law/regulation, and in the form of *competentia*, understood as capacity and permission. In the 16th century the concept was already recognized in English, French and Dutch; at the same time the use of the words competence and competency is dated in Western Europe. So, it is clear that the concept of competence has a long history, so it is not surprising that being professionally competent, sufficiently capable and able to perform certain tasks has been an aspiration throughout the ages. (Mulder, Weigel, & Collings, 2008, p. 4).

We can see that the concept of competence has a long history and that in order to achieve the great works of humanity it has been required that people be able to perform or perform certain tasks, even if the concept was not defined within a framework such as that currently envisaged.

Some definitions of competition highlighted by Mulder et al. (2008) and considered appropriate for this research are the following: *"aptitude to face effectively a family of analogous situations, mobilizing consciously and in a fast, pertinent and creative way, multiple cognitive resources: knowledge, capacities, micro-competences, information, values, attitudes, schemes of perception of evaluation and reasoning" (Perrenoud, 2004 quoted by Mulder et al., 2008). "A set of knowledge, procedures and attitudes combined, coordinated and integrated into action, acquired through experience (formative and non-formative) that allows the individual to solve specific problems autonomously and flexibly in singular contexts"* (ILO, 2008 quoted by Mulder, et al., 2008). Highlighting the main idea about the concept of competence studied by Mulder et al. (2008), it can then be defined that being competent refers to being able, having the ability to perform certain tasks, having the ability to perform a certain activity.

Competencies in Higher Education

Considering that the context in which the concept of competence in the educational environment is defined is relevant to justify the competency-based approach in the Design Module in the FUNIBER project area. In this sense, the proposals for competencies are based on a set of skills, knowledge and attitudes of a different nature, which include talents and intelligences (Cano-García, 2008).

It is important to contextualize that the term competence in the educational environment has been developed during the last decades, even though it is a concept that has been used since the 1970s. The use of the term competence responds to the need to overcome a teaching model based on the memorization of contents, which makes it difficult for such contents to be applied to real life. (Zabala & Arnau, 2008).

It is important to mention that Goal 8 of the 2030 agenda developed by the International Labour Organization (ILO) states that it is necessary to "reduce skills mismatches through training programs that respond to the needs of the labor market and

the introduction of work experience components in technical and vocational education and training". (OIT, 2017, p. 13). As well as within its objective 4 oriented to Quality Education, it indicates that "by 2030, to substantially increase the number of young people and adults who have the necessary skills, in particular technical and professional, to access employment, decent work and entrepreneurship". (OIT, 2017, p.23) These guidelines justify and frame the work of this research.

It can be analyzed that the capacity for critical analysis and the application of knowledge are different actions and involve a much broader dedication than just the acquisition of theoretical concepts. "*For this reason, it is more necessary than ever to revise the pedagogies and didactic methodologies used, so that they are not focused on the transmission of information, but on the promotion of competences in individuals"*. (Romero, 2010, p.90).

Mulder et al. (2008) then cite and analyze three approaches for the competencies studied by other authors such as Norris, (1991); Eraut, (1994); Wesselink, (2005); these approaches are the behavioralist approach, the generic approach and the cognitive approach.

The behavioral approach refers to competencies acquired through training and development, according to McClelland (1998), quoted by Mulder et al., (2008) are based on the description of observable behaviors or performances in situ. The characteristics of this approach are the demonstration, observation and evaluation of behaviors or behaviors. (Mulder et al., 2008)

The generic approach identifies common skills that explain variations in performance.

In this approach, statistical analyses can be performed to highlight the main and generic characteristics of the people who are most effective. (Mulder et al., 2008)

The cognitive approach focuses on competencies that include psychometric models of human intelligence, associated with the processing of everyone's information. *"These specialized competencies refer to a group of cognitive prerequisites that individuals must possess in order to perform well in a given area."* (Mulder et al., 2008, p. 4).

On the other hand, Tobón (2008) proposes to interpret the term competencies as *"Complex processes of performance with suitability in certain contexts, integrating different knowledges"* (p.5). When he refers to "knowledge" he highlights it as: "know how to be, know how to do, know how to know and know how to live together" focused on carrying out activities or solving problems.

Based on this vision, Tobón (2008) proposes the analysis of competencies based on six aspects associated with the concept from a complex approach applied to an educational environment: processes, complexity, performance, suitability, metacognition and ethics. *"This means that in each competency there is an analysis of each of these six central aspects to guide learning and evaluation, with implications for didactics, as well as for evaluation strategies and instruments."* (Tobón, 2008, p.5).

Although the approach proposed by Tobón (2008) has not been taken into account for this research, it is considered relevant to present it as an antecedent and also to leave it as a future indicator for the comparative effects that will be carried out in the next section of the research.

Considering these descriptions, it is considered that within these three concepts this research focuses on the generic approach, as the variations in the different competencies will be analyzed through the study and analysis of the main and generic characteristics of the sample studied.

IPMA 4.0 Certification for Project Management

A project is the only result that is limited by the scope of time, cost and quality, involves a temporary effort and must be continuously adapted to the context in which they are carried out. (López-Paredes et al., 2010).

(IPMA, 2015) describes project management at the professional level as the discipline that should have standards and guidelines to define the work. It is essential to develop and standardize the skills associated with these requirements and that are used in project management by people. The ideal situation to carry out a project is that all people, teams and suppliers are competent to carry out their work.

A competency is a compendium of knowledge, skills, abilities and relevant experiences necessary to be successful in a given function. (IPMA, 2015). According to ISO/IEC 17.024, *"a certification is the culmination of the process of formal recognition of workers' competences; it implies the issuance by an authorized institution of an accreditation about the competence possessed by the worker"* (Márquez & Arzola, 2008, p.8).

Project Management Institute (2017) defines at a general level the competencies associated with the project manager, referring to the skills that must be used through the talent triangle proposed by PMI®, which focuses on technical project management, leadership and strategic and business management. These three axes are broadened and defined more specifically, addressing specific issues in the IPMA 4.0 certification, focuses on the development of personal, technical and contextual skills that allow the project manager to face a comprehensive view of the problem. Considering that this research is based on the evaluation of the level of competences defined by IPMA 4.0 for a project manager, in the students who take the Design Module in the FUNIBER project area, it is appropriate to briefly mention the competences defined by IPMA and the structure of the Design Module followed by the students of this program.

IPMA (2015) points out that a project manager should have an overview of all components of the project, program or portfolio. He has therefore divided the skills associated with project management into three groups: skills associated with people, skills associated with perspective and skills associated with practice.

The competencies associated with people include: personal integrity and trustworthiness, personal communication, motivation and commitment, leadership, teamwork, conflict and crisis, initiative, self-confidence, negotiation and results orientation.

- Personal integrity and reliability: consistency of values, emotions, actions and results of a person, using ethical standards and moral principles to support actions and decisions.
- Personal communication: effective communication both for the media as well as for the concretion of information and target audience, promoting open and sincere communication, knowing how to use various means of communication.
- Motivation and commitment: show genuine interest in people, know how to build personal relationships, creates support in social networks, interact with

others, commitment in their actions and words.

- Leadership: providing direction and motivating others to achieve individual and team goals.
- Teamwork: knowing how to select members for a team, knowing how to support, motivate and lead a team, recognizing one's own weaknesses and strengths and those of others.
- Conflict and crisis: rapid response to conflict and crisis situations, assessing and defining scenarios for conflict resolution, making decisions for problem solving.
- Initiative: to make optimal and creative use of what we work with, to use resources in an efficient and timely manner, to evaluate and propose ideas that can benefit processes, creativity and innovation.
- Self-confidence: handling emotions, reflection and self-analysis on behaviors and decisions, personal values, knowing limits and own motivations.
- Negotiation: recognizing one's own and others' interests, needs and expectations, knowing negotiation techniques, proposing negotiation options, using different techniques, tactics and strategies to negotiate.
- Results orientation: obtain optimal results for all stakeholders, define objectives and goals to achieve objectives, seek solutions to problems depending on the desired results (PEI, 2015).

The competencies associated with the perspective include: strategy, governance, structure and processes, standards and regulations, power and interests, and culture and values.

- Strategy: achieve beneficial changes in the organizational culture, align project objectives and goals with the mission and vision of the organization, define and pursue strategic objectives, effectively inform the strategic parts of the organization about changes in objectives and goals, promote continuous improvement in all aspects related to the project.
- Governance, Structure and Processes: to understand and know the structures, systems and processes that are at the strategic, core and support levels in the organization and the project.
- Standards and regulations: recognize, interpret and implement on the project and organization the national and international norms, regulations and standards that can positively and negatively impact the objectives and goals of the organization and project.
- Power and interests: to recognize and understand the interests and level of influence of the different actors on the organization and project, to know how to influence the behavior of others, to recognize personal and third party ambitions and interests.
- Culture and values: recognize the internal and external influence on the culture and values of the organization and society in which the project takes place, identify shared values, visions, norms, symbols, beliefs, habits, goals of the cultural context. (IPMA, 2015)

The competences associated to the practice include: project designs, programs and portfolios, goals, objectives and benefits, scope, time, organization and information, quality, finances, resources, provisions, planning and control, risks and opportunities, interested parties and change and transformation.

- Design of projects: knowledge about development, implementation and maintenance of projects, recognition of formal and informal factors which define the success or failure of a project, rules, cultural aspects which affect the design of projects.
- Programs and portfolios: Goals, objectives and benefits: know to define and recognize goals, objectives, benefits, effects, results and requirements, know how to relate all the previous points, know how to define the purpose of the project and the parts at an organization and structural level involved, know to recognize the impact of the benefits over the organization and the structure.
- Scope: understanding process, definition and management of needs and limitations of the project for taking decisions and approaches about the project.
- Time: know to define and program the time for the activities carried out to develop the project, know to relate and make activity sequences to optimize time and resources, use efficiently the available resources, monitor and control the activities to know the scope of the project.
- Organization and information: definition, implementation and management of the temporary organization of the project, definition of functions and responsibilities required by the project, creation and storage of documentation and communication flows.
- Quality: quality of the processes which describe the project, development, implementation and revision of quality standards related with projects, check the quality control of the production and the results of the project.
- Finances: estimate, plan, earn, waste and control the financial resources in the project, output and input of financial resources.
- Resources: define, acquire, control and manage the necessary resources to achieve the objectives of the project.
- Provisions: define, know and manage the buying processes and obtaining of goods and services needed to achieve the objectives of the project.
- Planning and control: know to plan a project and manage the monitoring and control of the planning.
- Risk and opportunities: know to identify, assess, make a response plan, implement and control the risks and opportunities related to the project.
- Interested parties: know to identify, analyze and involve, manage the attitudes and expectations of all the parties involved in the project.
- Change and transformation: know to recognize the opportunities for change and transformation in processes, activities, structures which allow to improve actual and future projects, be forward-looking (IPMA, 2015).

In total, they are 28 competences in which IPMA points out that a project manager must have knowledge, abilities and skills to ensure the success of a project.

About the Design Module in the Projects Area

Tobón (2008) mentions that the most relevant strategies to implement a module at an educational level are: the project method, the simulation, the learning based on problems, the maps method and the Kolb constructivist method. It presents the modules as plans which integrate learning and assessment with the aim that the student develop competences, enabling in this way to ensure that the student's profile is in line with the competences needed in the field in the program they are enrolled in. The analysis, the understanding and resolution of a problem which is detected and associated with the thematic the program proposes is necessary to establish the module. It is pertinent for this research to mention that for Tobon (2008), the module has not only the purpose of learning of the students but the permanent reflection and improvement by the teachers when facing real cases which might require new strategies or views.

The methodology used by FUNIBER in the Module for the Master in Project Design, Administration and Management is focused on the integration of theory and practice, considering that it must connect activities focused on both a theoretical and practical level around real problems previously detected to develop, through theory and practice, the development of competences associated to project management.

The contents of the teaching materials of FUNIBER's Design Module is divided into nine exercises which are developed progressively. Each exercise is revised and assessed by a tutor which orients the progress of work. Work is made in teams formed by groups of between 4 and 6 students from different nationalities which work in a virtual collaborative working environment to develop the Design Module. All the exercises have theoretical material which supports the contents, theories and units associated to each exercise. Below we are going to describe briefly the area which address each exercise developed in the module.

In exercise one (1), the objectives which are pursued are aimed at the understanding and definition of the problem and conflict, introduction to the concept of project and the presentation of the problem-solving process (FUNIBER, 2017a).

In exercise two (2), the aims pursued are aimed at identifying the final product and the operative unity in the project, recognizing the different kinds of plaintiffs involved in the project and their relationship in the system to be implemented (FUNIBER, 2017b).

In exercise three (3), the objectives are to identify the requirements of the relevant involved parties, identify the constrictions and restrictions of the project and relate them with the parties involved; and finally to describe the characteristics of the service to be provided to meet the needs of the involved parties, considering the existing limitations (FUNIBER, 2017c).

In exercise four (4), the objectives are to learn the methodology to carry out the identification and organization of the processes which take place in a project and to know the useful tools to formally document a process map and a working organizational chart (FUNIBER, 2017d).

In exercise five (5), the objectives are to identify the variables which influence the working conditions in order to consider them in the creation of jobs, to know the relationships between the jobs and the efficiency of the system, as well as the relationship at a satisfaction level of the person who becomes employed. To think about the characteristics related to the people which will be employed and recognize the

relationship between the working conditions and the human reliability presented by the person who becomes employed in a certain work (FUNIBER, 2017e).

In exercise six (6), the techniques of analysis and identification of risks for the project are made known, knowing to quantify the risks and plan responses to them, introducing the concept of sensibility and tolerance of risks and recognizing the appropriate tools for taking decisions facing risks (FUNIBER, 2017f).

In exercise seven (7), some basic concepts about economic assessment of projects and tools to formulate a budget framework and an inversion schedule are introduced (FUNIBER, 2017g).

In exercise eight (8), the basic concepts about the phases of the life cycle of a project and the essential characteristics of each phase are recognized, and the importance of the organization between the formulation and management of the project phases are assessed (FUNIBER, 2017h).

In exercise nine (9), a summary and presentation of all the work made in the previous exercises are made.

The development of the Design Module is carried out meeting a delivery and revision agenda by the students and tutors respectively, in which there is a feedback about the development of the proposal of a project, following the structure which as previously described.

Method

In this research, the design is non-experimental, because the study variables have not been manipulated intentionally, it is exploratory in its initial approach because it pretends to know the level of self-assessment which the sample selected has about a specific theme, without deepening in the relation between variables, with a mixed approach because, although the indicators of the competences are described qualitatively, a quantitative interpretation of them is made.

The sample analyzed for this work is 36 students selected randomly within a population of 200 students which started the Design Module in the projects area in May 2018.

The measurement tool has 29 questions validated internally with the Index of Cronbach´s Alpha and externally validated by experts in the field. Each one of the 28 competences which IPMA points out in its 3 areas are associated to a question, except the teamwork competence which was associated to 2 questions, considering that making this question about virtual environments of ream work is appropriate in the online context in which the Design Module is developed.

In the application of the survey, the tool Google Forms was used to distribute the tool and collect the data. In the statistic projection of the results, Unscramble 10.3 was used to analyze the main components, and Excel 2010 for the dispersion graphics.

Results

The results obtained are represented in two formats. In both cases the self-assessment levels described in the surveys were synthesized at only 3 levels. For this purpose, in the cases in which there were 5 or more self-assessment levels, the values are grouped as seen in the table 1.

Table 1.
Description of the criteria used for reducing the answer variability to only 3 levels.

Answer options	Interpretation for analysis of results
Assessments between 1 and 10, being 1 Deficient and 10 Excellent	For this case, answers between numbers 5 and 10 were only obtained. The values of the sum of the percentages obtained 5 and 6 at Low level, 7 and 8 at Intermediate Level and 9 and 10 at High Level.
Perfectly Capable, Very Capable and Averagely Capable	Averagely Capable Low Level, Very Capable Intermediate Level and Totally Capable were considered as High Level.
Always, Many Times and Sometimes	Sometimes was considered as Low Level, Many Times was considered as Intermediate Level and Always was considered as High Level.

Note: Source: Author's creation, 2018.

The first results format is a projection of all the competences included in the three areas proposed by IPMA regarding the distribution of levels of answers with a greater frequency in the sample studied (Figure 1).

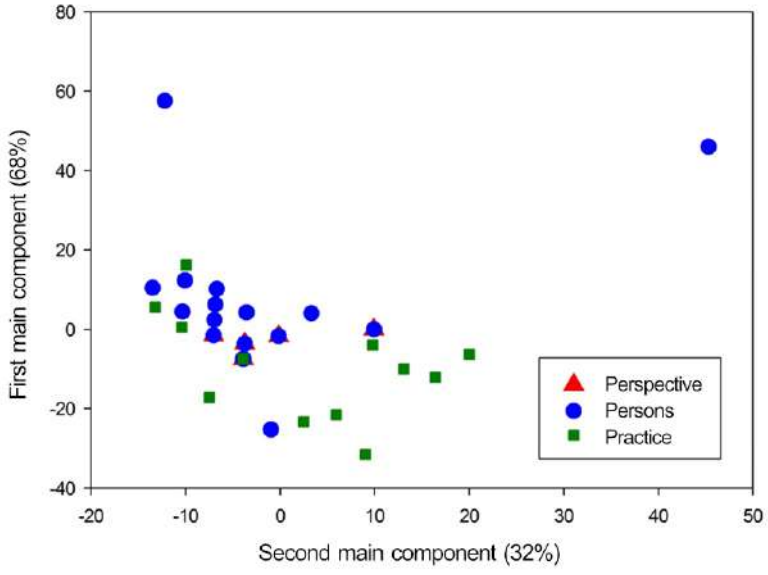

Figure 1. Projection of the competences per area based on the distribution of answers.

Note: Source: Author's creation, 2018.

In Figure 1, the results of an analysis of Main Components (PCA) (Abascal & Grande, 2005) regarding the distribution of answers with maximum frequency on Intermediate Level is shown, provided that the tendency which explained the greater

variability percentage in the competences studied (68%). The remaining percentage is explained by distributions which have high frequencies for the self-assessment levels Low and High. This graphic shows that, for the sample studied, most of students assessed themselves with an Intermediate Level in 92% of the considered competences. The other 8%of competences correspond to two competences in the area of people: Integrity and Results Orientation. For Integrity, a distribution with a greater results frequency in the High Level was found (projection in blue located at -9 units from the second main component and at 59 unities from the first main component), and for the Results Orientation, an almost equitable distribution between Low and High Levels (projection in blue located at 46 unities from the second main component and at 45 unities from the first main component).

The second format in which results of this study are presented is scatter charts, specific for each one of the areas described by IPMA (Perspective, People and Practice). The percentages of answers obtained in each self-assessment level are detailed for each considered competence (Figures 2 to 4).

In the case of the Perspective area (Figure 2), it is seen that, for the sample studied, the greater answer percentages are located in the Intermediate Level, with values over 50% and the tendency in the 5 competences is the same in all cases.

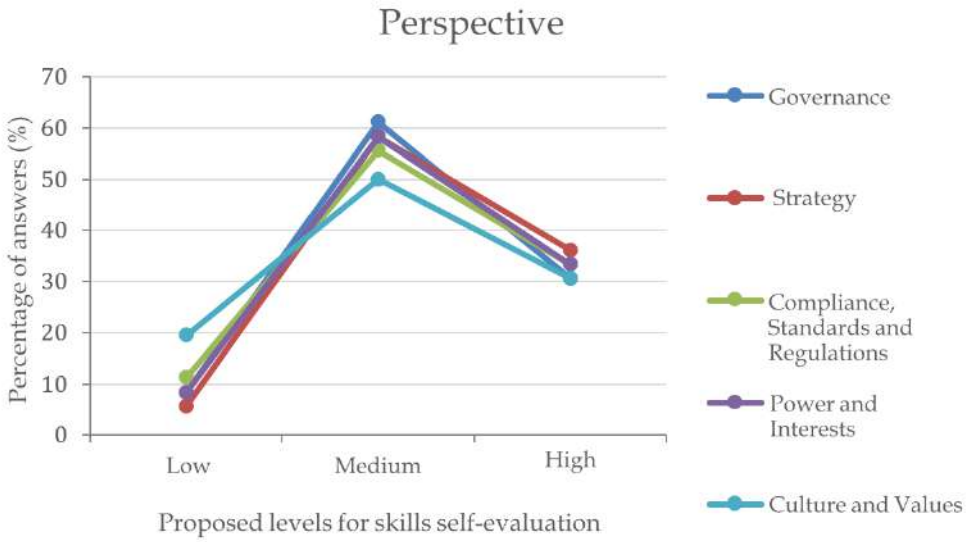

Figure 2. Distribution of answer percentages for the competences in Perspective area.

Note: Source: Author's creation, 2018.

In the case of the area of People (Figure 3), for the sample studied, a similar tendency to the one found in Perspective for 4 competences was found: Initiative and Inventiveness, Negotiation, Teamwork and Leadership. The competence of Personal Communication had an answer percentage of High Assessment level inferior to the one observed for the tendency previously described. On the other hand, the answer percentage of Intermediate self-assessment is superior to 70% in this case. Finally, the two extreme cases found in this are Integrity and Confidence, whose answer frequency was over 80% and the Results Orientation, whose percentages were distributed almost equitably between Low and High levels (48% and 505 respectively).

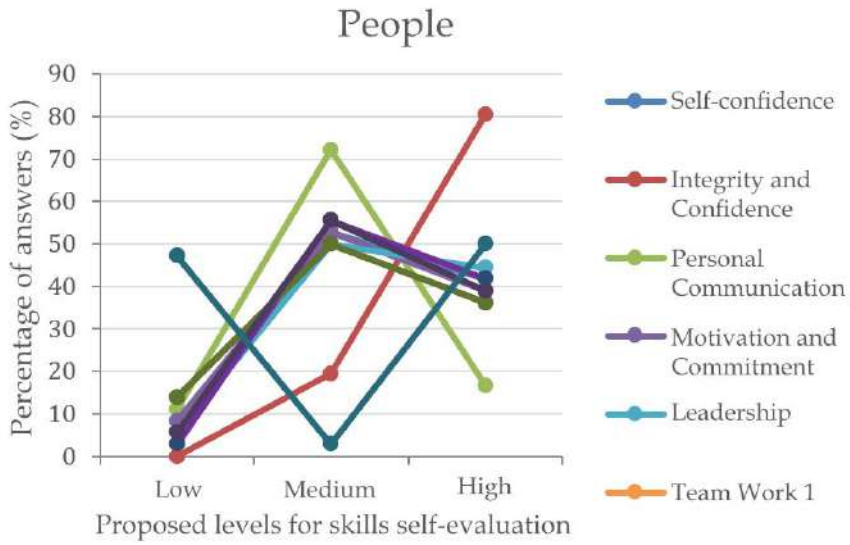

Figure 3. Distribution of answer percentages for the competences in People area.

Note: Source: Author's creation, 2018.

In the Practice area, the formation challenge (the goal or the greater difficulty for the professor) is evident is the competence of Change and Transformation, where the self-assessment answer percentage in High level was the lowest of all the studied competences (inferior to 10%). Simultaneously, it can be seen that the Project Design competence has the greatest frequency of assessment in High level in this amount of data. The other competences follow the tendency previously observed, with a maximum answer frequency in the Intermediate level, with percentages between 40% and 80% of the answers collected.

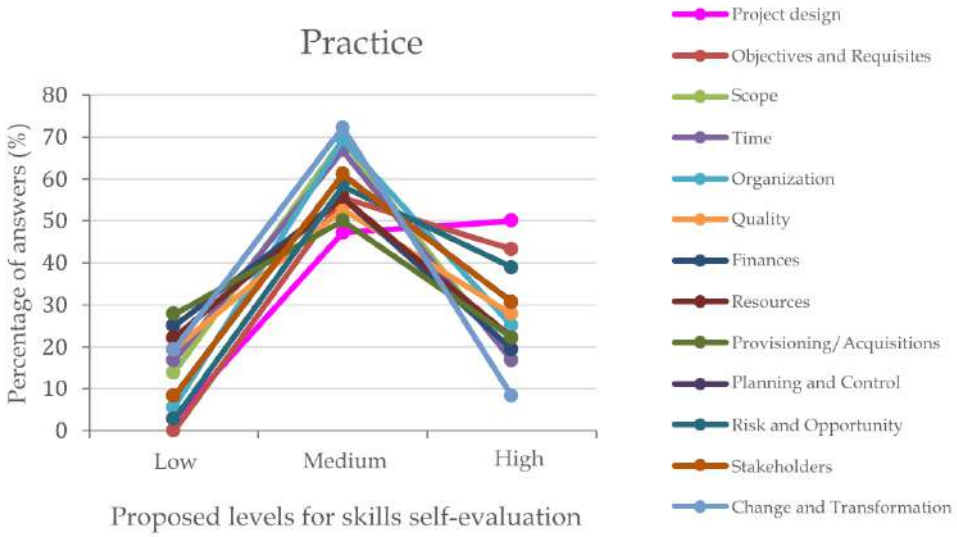

Figure 4. Distribution of answer percentages for the competences in Practice area.

Note: Source: Author's creation, 2018.

Discussion and conclusions

Providing response to the objective explained in this work, the students of the Design Module in project area which started the transversal course in May 2018 assess themselves with an answer frequency distribution with maximum in Intermediate Level with 92% of the competences studied, as well as a distribution with maximum in High level for the competence of Integrity and Confidence and the equivalent Low and High in Results Orientation.

To complete a low diagnosis, IPMA perspective recommends optimizing the measurement tool with competence self-assessment tools under different approaches. The optimization of this tool might be additionally taken into account from the perspective of complex approach proposed by Tobón (2008), who considers six assessment tools for each competence. In addition, for future diagnosis activities of the students´ level, it is proposed to use statistic told both for the selection of the sample to be studied and the preparation of the assessment levels of the questions included in the surveys (use of techniques of Experiment Design). However, to complete this work with data obtained at the end of the module, it is suggested to use the same measurement tool, the same student sample, as well as the same statistical analysis tools in this first diagnosis for the description of the results for comparative purposes. Obtain the data through this mean will be essential. However, this fact does not restrict the possibility to use simultaneously a new optimized tool on the basis of the criteria described in the previous paragraph. By this way, two objectives might be reached: to assess the actual state of the Module of Design and to optimize the competences measurement tool.

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DRIVERS FOR SUCCESS AND FAILURE IN PROJECT MANAGEMENT: A FOCUS ON BEST PRACTICES

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Abstract. Organizations face an ever-increasing need to execute projects given the changes in the environment in which they operate in order to minimize risks and seize business opportunities. This context demands that Project Management Offices (PMOs) and Project Managers (PMs) employ best practices and lead projects or project portfolios to success. Project success is achieved when the deliverables are presented according to the initial plans, in time and within budget. The complex setting that projects face and the systemic nature that they have make their management a difficult task. This derives in a high failure rate that causes massive losses to organizations. In recent years several studies were conducted to follow up on the results of the projects, the actions of the Project Management Offices and the Project Managers in order to establish the correlation between drivers (best practices and elements from the projects' environment) and results (success or failure). The most relevant drivers that contribute to projects' success are: an effective high-level sponsor capable of effectively influence on the organization's decision-making process in favor of the project; a scope control plan capable of maintaining the project within the initial parameters and avoid modifications on scope that would impact the schedule and budget; an alignment of the organization's and project's strategies through the generation of value for key stakeholders; the investment in talent focused on forming professionals with leadership and technical skills in business and project management; and the existence of an enterprise-wide Project Management Office capable of managing shared resources in an efficient and integrated fashion.

Keywords: Project success, Project failure, best practices, project scope, schedule, budget

FACTORES DE ÉXITO Y FRACASO EN LA GESTIÓN DE PROYECTOS: UN ENFOQUE EN LAS MEJORES PRÁCTICAS

Resumen. Las organizaciones requieren implementar proyectos cada vez con más frecuencia para poder adaptarse a los cambios del entorno en el que operan, minimizando riesgos y aprovechando oportunidades. Este contexto exige que las Oficinas en Gestión de Proyectos (PMO) y los Gerentes de Proyectos (PM) empleen mejores prácticas para encaminar al éxito el proyecto o la cartera de proyectos.

Este éxito se logrará cuando el proyecto logre presentar los entregables de acuerdo a lo establecido en la planificación inicial, de acuerdo al cronograma y presupuesto dispuestos. El ámbito tan complejo de los proyectos y su naturaleza sistémica hacen que su gestión no sea una tarea fácil. Esto lleva a una tasa de fracaso bastante alta y pérdidas muy grandes para las organizaciones. En años recientes se ha realizado un cercano seguimiento a los resultados de los proyectos, las acciones de las Oficinas de Proyectos y los Gerentes de Proyectos con el objetivo de establecer la correlación entre variables (factores del entorno de proyectos y mejores prácticas) y resultados (éxito o fracaso). Los factores más destacados que contribuyen al éxito de un proyecto son: un efectivo patrocino de alto nivel que influya de forma efectiva en la organización para la toma de decisiones a favor del proyecto; un control de alcance que permita al proyecto mantenerse dentro de lo planificado y no modifique los entregables impactando el cronograma y el presupuesto; la alineación estratégica entre el proyecto y la organización a través de la generación de valor para los usuarios clave; la inversión en talento humano enfocada en generación de profesionales con capacidad de liderazgo y conocimientos técnicos en gestión empresarial y proyectos; y la presencia de una Oficina de Proyectos que tenga un alcance amplio en la organización que sea capaz de gestionar los recursos compartidos de forma eficiente e integrada.

Palabras clave: éxito en proyectos, fracaso en proyectos, mejores prácticas, alcance, cronograma, presupuesto

Introduction

Organizations are faced with a reality in which the management of transformations through projects is becoming increasingly important to achieve their strategic objectives. Changes in the dynamics and environment of the organizations force them to undergo a constant transformation in order to minimize risks and seize opportunities. They do this through project management. Moreover, organizations often face more than one project at a time. This represents a challenge to them as each project's management scope, budget and schedule becomes more complex. This level of complexity requires Project Management Offices (PMOs) and Project Managers (PMs) to fully develop their capacities and to employ the best possible practices to achieve the objectives established. PMOs must be more agile, flexible, predictive and efficient; while PMs must be better leaders and have more technical knowledge in business and project management. This article explores some factors that contribute to the success of a project.

Method

This research's objective is to analyze recent studies focused on the organizations' performance in the implementation of projects in order to identify the best practices and the critical factors that lead to a successful project. As a natural extension of this objective, we studied those factors that create high risk for the project and can lead to its failure.

First, evaluation parameters were used to establish whether a project has been successfully implemented. A project is deemed as successful if it meets the following four main factors (Turner & Grude, 1996):

- its fulfillment serves the organization's strategic objectives,
- it was completed on schedule,
- the budget allocated was not exceeded,

- and it fully meets the planned scope of the activities.

Secondly, to establish whether an organization was considered successful, it was assessed whether it achieved a success rate in at least 80% of the executed projects. On the other hand, a low performing organization had a less than 60% success rate. The results between both values were discarded for the purposes of this study.

Lastly, after obtaining a success and failure factors list, it was evaluated which of them were most frequently found among successful and unsuccessful organizations, and which ones seemed to have a greater impact on project implementation.

Results

The study revealed an extensive list of good practices in project management. Successful organizations in project implementation showed compliance with several of these practices. The list was refined after assessing which practices were most common in successful projects and which had the greatest impact on positive outcomes in project implementation. Likewise, the most common practices in the implementation of unsuccessful projects were identified. The most relevant results are presented in this article.

Factors that Contribute to the Success of a Project

There are an infinite number of factors that contribute to the successful implementation of a project. Their presence does not guarantee a successful outcome, but they contribute to obtaining positive and significantly better results than in those projects where they are absent. However, it is worth noting that just as there are projects that achieve success without implementing the practices highlighted in this article, there are projects that fail despite doing so. This is because project management is not an exact science in which there is a formula for success that can be employed in all projects. These depend on an infinity of variables that can condemn a project to failure from its very beginning: unfavorable economic conditions, political insecurity, lack of monetary resources, unattainable deadlines, user requirements beyond the real possibilities of the project, etc.

Next, the most notable success factors are described:

High-Level Sponsorship

There is no more important factor in the success of a project than an effective high-level sponsorship. A well-planned project regarding scope, schedule and budget, but without a high level sponsor has a very high probability of not being successful. This sponsor must be genuinely convinced of the project's importance for the achievement of the organization's strategic objectives as they will act as advocates of the project to other higher-level users with decision-making power over it as a whole or any of its components. Sponsors have three main functions: they make strategic decisions for the project in an effective and timely manner, they influence other users with risk positions towards the project, and they eliminate technical and human obstacles that may hinder the implementation of the plans (Turner, Grude, & Thurloway, 1999).

The Project Manager must invest time and effort in securing the sponsor’s commitment to the project objectives. A successful relationship and an effective communication channel can demand a change in the organization’s culture. Some

executives do not understand that projects play an important role within organizations. Thus, they manage major changes not with the methodology that a project requires, but as something operational. In this case, it should be explained why the project is important at a specific moment and how its implementation will help the organization to achieve its strategic objectives. Sponsors must find a value for themselves, that is, they must gain some benefit from supporting and implementing the project. This may require the creation of a training plan, professional development or even some responsibility over specific activities. This will allow them to feel valued and to act proactively. The project success will help them to get something for themselves.

Projects without a suitable high-level sponsorship usually fail because they encounter several obstacles that interrupt the activities' implementation in time, cost and quality; or even have to modify the activities' scope. Non-sponsored projects are left orphaned. In other words, Project Managers are left to their own devices and, therefore, the project progresses as far as the leader's energy allows. The lack of high-level support means that the decisions taken are ineffective and inappropriate; leadership is weakened; tension and frustration within the team increase; and, therefore, the projects almost inevitably falls in downward spiral. If the leader somehow manages to carry out the project, it is highly probable that the project will be delivered out of schedule and at a higher cost than budgeted. Therefore, the proposed objectives are not achieved. This has an impact, first, on the ongoing project and, second, on the Project Office (PMO) and/or the Project Manager (PM) reputation. The organization will consider that both fail to meet its expectations and requirements. Thus, it will take a reluctant approach towards the implementation of new projects.

A study conducted worldwide by the Project Management Institute (PMI, 2018), and whose results are updated every year since 2006, shows that 41% of Project Managers who failed to achieve the project objectives attribute the failure to a lack of sponsorship. This same study concludes that organizations that were successful with their projects assigned a high-level sponsor 83% of the times.

Project Scope Control

A project suffers from corruption or dragging of its scope if requirements are constantly increasing; and the deliverables' budget, schedule and quality are not proportionally adjusted. This phenomenon happens when a client, sponsor or someone with decision-making power over the project increases the project' qualities, that is, if they extend the scope of the project' requirement. This can happen more than once and in an unpredictable way.

When there is corruption of scope, the schedule and/or the budget are not reasonably suited to the changes required. Misunderstanding and compiling client needs are the main reason for this problem. This can be due either to an inability of the Project Manager to understand what the client needs at the time of drafting the articles of incorporation or because the project principal does not know well what he needs at the time he presents the requirements. Other times, the organization changes priorities and the project loses relevance and alignment with the new strategic objectives.

It can also happen that the project objectives change due to external factors. Therefore, the project must be adapted in order not to end it and declare the resources lost. It is very common to see uncontrollable changes in scope in technology-based projects as changes in this industry happen very fast and the adaptation-adoption cycle of the organization must keep the pace. Likewise, this problem is very common in

public management projects where changes in policy guidelines affect decision-making processes and budget allocation.

The Project Manager must be very careful when faced with the scope's corruption. Any deliverable not begun can be modified without having a major impact on the project results if its cost and schedule are below the initial ones. It is important that the director and Project Manager modify the articles of incorporation, since the results will be compared with the plans and objectives agreed between the parties. The risk factors for the manifestation of changes in scopes are a weak PM, an immature PMO or a sponsor not committed to the project. If there is no control system for changes that can manage them in a timely and effective manner, those changes can even lead to the failure of the project.

It is considered that more than half of the projects experience corruption in their scope. In low performing organizations, this phenomenon occurs in almost 70% of projects, against 33% in organizations that manage them successfully (PMI, 2018).

Ability to Create Value

Organizations have changed drastically in recent decades, adapting to changes in the economy, technology, politics and other external factors. Those that failed to change disappeared. Project management is intimately related to, and vulnerable to, the same variables, and thus must comply with the same prerogative. Innovation has ceased to be an element of differentiation and has become an implicit element in any organization that is serious about being sustainable over time. The approaches used by organizations to manage their projects have evolved. The product-focused waterfall methodology used to manage all projects a few decades ago has given way to more flexible, agile and predictive methodologies.

As the slow process of reformulation that any change in the project represented became evident, it was necessary to create a model that does not require reformulating all the project's stages and allows working in more controllable, short and flexible areas. These agile methodologies focus on efficient, collaborative work and the generation of value for users (Rothman, 2016). In conclusion, the way projects are managed has changed, and will continue to change. The best practices will no longer prevail in the industry, and new tools and skills will be needed. Methodologies will also have to be more predictive, agile and controlled.

Project Managers have the difficult task of adapting each management model to the organization's specific requirements and culture. Because each organization is different, the same solution cannot be used for all. Some projects must focus on strict compliance with the scope and quality of deliverables, while others focus on the delivery of results in a short period of time or with a reduced budget. Some projects will have highly trained professionals at their disposal, while others will have to work from the basics. The important thing is to understand what users need, what they expect from the project, and to deliver value to them through project implementation (Augustine, 2005).

Recent studies have shown conclusively that organizations that use formal, agile, predictive and adapted methodologies achieve better results. Those organizations are able to meet project objectives in 73% of cases, complete activities within budget 63% of the time and on time 59% (versus 58%, 48% and 43%, respectively, in organizations that do not adopt these methodologies) (PMI, 2018).

Investment in Human Talent

The most valuable resource of a project, as in any organization, is its people. The project team will shape the future of a project more than any other factor. Globalized markets' increasing competitiveness, rapid technological changes and the complexity of the macroeconomic scenario create a complex environment for projects. In turn, these need a more competent team. A project team member must not only have technical knowledge of the specific field in which the project is implemented but must also have knowledge of a series of tools and best practices in strategic business and project management. In addition, this team member will need some soft skills to lead, motivate, communicate assertively, work as a team and be goal-oriented (PMI, 2017). This combination of talents among the team members will provide a competitive advantage to the project and the organization.

It is important to invest in human talent development because an organization with highly qualified personnel will achieve a higher success rate in projects. This can be verified by the statistics that show that three out of four organizations considered successful in project implementation invest in human talent development in the fields of leadership, strategic business skills and technical project skills. Only one in six low performing organizations does so (PMI, 2018). As Jeff Zircher, Manager of the Global Program Management at Caterpillar, says, "It's important to get the right people with the right skills and capabilities well-positioned from the start."

It is estimated that there are currently about 66 million project professionals worldwide. There is approximately a 33% gap between the demand of qualified project personnel and the number of professionals in the market for these positions (PMI, 2017). This gap is constantly growing as organizations are experiencing a "projectification" of their activities in nearly every industry, from construction and manufacturing to financial services, and in both profit-seeking and social development projects.

Large, fast-growing economies such as China and India lead the demand for project professionals because they have a huge number of mega-projects. The technification of industries and the consumerist maelstrom create a much greater demand for products and services than expected a decade ago.

Competitiveness in manufacturing costs in developing countries has attracted large projects to these countries, where higher education levels are substandard and professional availability did not meet the required conditions. It is believed that, worldwide, by 2027, almost 90 million professionals will be needed to work, directly or indirectly, in roles oriented to project management. Organizations should begin to train professionals in projects and offer careers that include development programs in that area. Failure to fill this gap would result in a loss of about $207 billion over the next 10 years (PMI, 2017).

Presence of a Project Management Office

Taking into account that organizations experience an ever-growing demand to implement changes, it is essential to rely on an area exclusively destined to manage them and that has an area of influence that covers the whole organization. Typically, an organization keeps a portfolio with projects of diverse nature and in diverse areas. Usually, they must share resources due to structural, budgetary, geographical and other restrictions. A Project Management Office (PMO) must work on planning the different projects in such a way that their goals are aligned with each other and with the

organization's strategy. Daniel Zvoboda, president of Key Bank states: 'I do not find the difference between strategy implementation and the success of a project'. This statement highlights the importance of achieving a correct alignment between them, implying that as the project delivers the expected products in its reach it adds value to the organization. This is an imperative condition in order to achieve an actual compromise and support from the higher spheres of the organization.

However, the Director of the PMO must manage benefits for the key users of the project portfolio. This is necessary, as the people that feel identified with the purpose of the project and perceive its value will be more likely to support it efficiently.

Additionally, a PMO allows the efficient management of shared resources through the correct programming of activities and the allocation of human, monetary and material resources. If this is complied with, each project will use only the amount of resources it needs and will not generate waste derived from their sub-utilization (PMI. 2017).

The Project Management Office will be responsible for originating the strategic transformations in the company, being the agent that identifies, studies and seizes opportunities for growth and development. If the structure of the organization is responsible for the maintenance of its operations, the PMO is responsible for making it grow through initiatives aligned with its strategy.

The value of having a PMO is gradually more evident. It is estimated that around 80% of the successful organizations in project implementation have a PMO in place. Three out of four PMO have a global scope in the organization and are aligned with its strategy. When this office is localized or has a delimited reach, its range of action and influence is limited, the risk of finding blockages to the activities increases and the ability to generate value for the whole organization is restricted.

Factors that Contribute to the Failure of a Project

Mark Langley, President and CEO of PMI states that 'if his organization is not good in project management, he is risking too much in terms of strategic compliance' (PMI, 2017).

Success does not come only from the implementation of good practices and the presence of favorable factors. It is also necessary to suppress - or at least mitigate - the impact and the probability of occurrence of risk factors that could lead to the failure of the project. The impact of some risk factors is sometimes greater than the positive effect generated by some of the good practices that can be implemented. When this happens, the chances of success for the project are low.

It is estimated that only 70% of the projects meet the goals they were designed for, and at least 10% of the organizations' resources are irretrievably lost because of the incorrect management of their projects (PMI, 2018).

As Kendrik (2015) explains, the projects increase their risk of failure as they become complex or present time, budget or technical capacities restrictions. The unique nature of each project impairs the transference of tools, information and knowledge from one project to another: what worked for a project might not work for another one.

Some non-recommended or bad practices have been identified, as opposed to the good practices described above. These practices do not guarantee the failure of the

project, but they do contribute to the project not meeting the required scope or not delivering the products within the required time and quality.

Next, the most notable and recurrent risk factors are described:

Loss of Project Significance

When the organization decides that, for some reason, the project does not play an important role for it, the project is bound to termination. The project's goals must be drafted based on the organization's strategic guidelines. They are, therefore, an extension of them.

If the organization decides to change its general strategy towards a direction that differs from the project goals, a strategic gap is generated. This implies that the project would be using resources in activities that do not generate any value for the company, in strategic terms. When this happens, the organization shall try to modify the project's scope and to reformulate its goals and deliverables. If this happens, the schedule and budget must be adjusted to respond to the new requirements of the projected system.

When this adjustment is not feasible, the organization usually makes the decision of canceling the project. This is a very hard decision for the organization, since it implies that a great part, if not the totality, of the invested resources in the project will be lost. This monetary loss is not the only cost when a project is canceled: the project team can be morally very affected, especially if it was a big, complex project or if the people were very committed to it. It is the PM's task to restore the team's motivation and to prepare them for a new initiative.

In organizations without a stable PMO or without a big project portfolio, the termination of a project means the cancellation of contract for most or all members of the team.

Changes in Scope

Changes in Scope are present in 35% to 40% of projects that failed (PMI, 2018). A project is initially planned based on the transformation that we want to achieve and the resource limitations to achieve them (cost, time, quality). That is when the scope is determined. It will define what deliverables or products will be presented in the different stages of the project. This is reflected in the project charter, approved by the project principal and the PM.

When this scope is modified, the change in what the project requires should imply a change in the time, cost and quality variables. The problem is that sometimes this does not happen, and then the effort to comply with one of the limitations sacrifices the rest. This results in projects that are concluded but not under the planned parameters. A project with this trait cannot be considered successful. There are procedures that help with the control and management of changes. They allow to reject changes that affect the projected system in a way that prevents its compliance under acceptable conditions. The changes that increase the scope but do not represent a significant increase in cost and time can be analyzed and approved by both the director and the PM. In the absence of a system able to control changes in an effective way, it might trigger a corruption of the scope, as explained above.

Incorrect Estimation of Activities, Costs and Time

"Once the project is started, controlling the schedule and the costs is the most difficult aspect of the PM's role" (Taylor, 2007). According to Taylor, 80% of the

projects that start underestimating costs and schedules are bound to exceed projections and fail.

Since the success of the project is measured depending on the presentation of deliverables (scope) within the established parameters of cost and time, it is natural that miscalculating them leads to the impossibility to fulfill them. Any action or decision made about the schedule affects the budget and the scope; additionally, the cost affects the schedule and the scope, and, therefore, the scope affects the cost and the schedule. This great complexity derives in a miscalculation of budget and cost in one out of four projects (PMI, 2018).

Managing this interdependence of variables is a very complex task that demands a lot of technical knowledge, experience, hard work, information availability and, occasionally, some luck, hoping that the project's environment remains unaltered. It is very difficult for a PM to combine these qualities to a such level that the whole budget and schedule planning can be carried out by a single person.

A PM should rely on a high performance, multidisciplinary work team. Carrying out the planning as a team reduces the risk of time and cost underestimation or overestimation. This is not an easy task, since planning each activity of the project, as well as the times and costs related to its execution, is affected by a set of variables.

The project may fail even if the team manages to accurately estimate the duration of each task and their priority and dependence, and even if they design a serious, reliable budget based on market values and budgetary execution task history for similar projects. External variables may impose changes and restrictions to any of the variables, modifying the project deliverables' quantity and/or quality, altering the execution schedule and/or altering the budget.

There are four highlighted aspects in which the PM must work in order to effectively control the mismatches in the project (Taylor, 2007). Leading the progress of the project is the first and, maybe, the most important one. A PM must be constantly comparing project execution rates to identify mismatches in due time.

Secondly, the PM must take corrective actions to return the project to the execution plan it had. There are several tools to perform the adjustments to schedule and budget. In some cases, more resources can be assigned to some activities to accelerate their execution. In other cases, it might be necessary to negotiate a reduction in the quality of the deliverables in order to reduce costs. The third aspect is result control, which implies the assessment of the corrective actions that must be taken depending on the goals of the project. If the actions contravene the strategy of the project or the organization, then they should not be executed, and it might be necessary to revise and amend the project charter.

Finally, the PM must always try to preserve the available resources. An efficient utilization of resources - material, human, monetary - without sacrificing the deliverables' scope or quality will imply saving money for the project. This translates into an advance in the activities, a budget release for the project (or for other projects or activities of the organization) and a minimization in project risk, in general.

Poor Risk Assessment

Risk is inherent to every project. This risk can be derived from conditions that are internal to the project, such as wrong decisions, team inefficiency or inadequate planning. Additionally, there are exogenous variables that affect the project, conditions

out of the PM's control but that affect its execution. Changes in the market conditions or in the economy, natural events and even changes in the organization's strategy. While it is almost imminent that the project is affected by some risk factor at some point, it is possible to take actions in order to counter most of them.

Time and effort must not be skimped on for the correct assessment of the project risks, which would result in a management plan that proposes actions to mitigate them having to be designed. Around 30% of the projects that failed were not able to correctly identify the risks, and almost the same proportion were unable to efficiently manage the changes when they materialized (PMI, 2018).

A correct risk management must, at least, include four processes. The first one is the identification of the factors that imply a risk for the project in terms of scope, cost and time. Then, the impact of this risks for the project in the case they materialize must be estimated. This impact can imply a delay in activities, initially unexpected outlays, modification in goals and/or deliverables or the appearance of conflicts in the work team. It is advisable to categorize the expected impact in order to identify the most critical ones. Concurrently, the possibility of each risk occurring must be estimated. The same way it happens with the impact, a high occurrence index implies that the risk is critical.

Finally, the combination of both factors - impact and occurrence probability - will help the PM identify the most critical factors on which the risk plan or the contingency plan shall be focused on. These risks should not be neglected, since their materialization can greatly contribute to the project's failure.

In this analysis it is critical to understand that the project is a system with several interrelated components. This implies that the effect of the materialization of risk has an immediate impact on a component of the project, but a delayed effect on other components and on the whole system.

Discussion and Conclusions

It is estimated that only 70% of the projects meet the goals that they were designed for, and at least 10% of the organizations' resources are irretrievably lost because of the incorrect management of their projects.

It is imperative that the Project Management Office (PMO) and the Project Managers (PM) implement better practices that contribute to a better management and lead the project to a successful conclusion, with a timely presentation of deliverables within the budget.

Recent studies allow us to establish a positive connection between the implementation of said practices and greater success rates. Even if they do not guarantee that the project is successful, since projects are exposed to external risks, they maximize the probability of meeting the goals within the planned parameters. Taking in account that the environment of projects and organizations are in continuous transformation and that projects are highly complex systems, the PM must be very qualified to lead the project team, provide them with knowledge and experience and apply the necessary tools to manage the different elements of the project, contributing value to the organization.

The projects must be aligned with the organization's strategic goals to genuinely support it. Efficient management enables saving valuable resources that the organization will be able to employ for other projects or to return to its assets. An adequate planning shall help with the efficient resource assignment for each activity and it shall include contingency plans that allow it to anticipate and correct the effects of the coming risks that threaten achieving the objectives.

In conclusion, the correct implementation of better practices will channel the projects to the achievement of their goals and will contribute value to the organizations. It is important to periodically review these practices so as to update them according to the changes within the domain of projects. In a world with an ever-growing demand of better project professionals, elevating the knowledge and performance level is indispensable.

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THEORETICAL PERSPECTIVE OF EARLY STIMULATION PROJECTS: AN APPROACH BASED ON THE META-ANALYTICAL POINT

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Abstract. This research work develops the main theories about early stimulation, as well as the analysis that leads to the structuring of four constructs in order to be able to design project models related to such stimulation. The methodology developed was based on a qualitative and quantitative (mixed) approach, through the bibliographic modality, in which the information search strategies were evaluated, the inclusion and exclusion criteria of the respective information to each construct, the quality of the same and the quantitative analysis of the thirty (30) studies examined. In this way, it was possible to establish the use of articles from a reliable database, sources with an age not older than five years and in Spanish and English. It was possible to conclude the foundation of the constructs related to the study criteria for the model of early stimulation projects, by means of the systematic method of information management called Metanalysis. The defined constructs showed a great binding relationship to the early stimulation projects, since they identified the strategic functions and the guidelines that contribute to the quality of the information. Finally, the Homogeneity and Heterogeneity analysis was carried out through a frequency table, Homogeneity being the fundamental element in the research and the theoretical analysis, since it allows specifying the validity of the information obtained throughout the course of the research.

Keywords: early stimulation, constructs, Metaanalysis, theoretical model

PERSPECTIVA TEÓRICA DE LOS PROYECTOS DE ESTIMULACIÓN TEMPRANA: UN ACERCAMIENTO A PARTIR DEL PUNTO METAANALÍTICO

Resumen. Este trabajo de investigación desarrolla las principales teorías sobre estimulación temprana, así como también, el análisis que conlleva a la estructuración de cuatro constructos con la finalidad de poder diseñar modelos de proyectos referidos a dicha estimulación. La metodología desarrollada se basó en un enfoque cualitativo y cuantitativo (mixto), a través de la modalidad bibliográfica, en la que se valoraron las estrategias de búsqueda de información, los criterios de inclusión y exclusión de la información respectiva a cada constructo, la calidad de la misma y el análisis cuantitativo de los treinta (30) estudios examinados. De esta manera, se pudo establecer el uso de los artículos de una base de datos confiable, fuentes con una antigüedad no mayor a cinco años y en idioma español e inglés. Se logró concluir la fundamentación de los constructos relacionados a los criterios de estudio para el modelo de proyectos de estimulación temprana, por medio del método sistemático de gestión de información denominado Metaanálisis. Los constructos definidos mostraron una gran relación vinculante a los proyectos de estimulación temprana, ya que identificaron las funciones estratégicas y los elementos directrices que contribuyen a la calidad de la información. Finalmente, se realizó el análisis de Homogeneidad y Heterogeneidad a través de una tabla de frecuencias, siendo la Homogeneidad el elemento fundamental en la investigación y el análisis teórico, ya que permite especificar la validez de la información obtenida en el transcurso de la investigación.

Palabras clave: estimulación temprana, constructos, Metaanálisis, modelo teórico.

Introduction

The issue of child language acquisition is a subject that has been of great interest to specialists in different branches, understanding it from understandably different perspectives (Salguero, Álvarez, Verane and Santelices, 2012). The first serious considerations on the subject of language acquisition are due to Aristotle who, in addition to distinguishing three moments in language acquisition, asserts that the child's linguistic apparatus and his ability to understand language develop independently (Campos, 2010). However, we cannot speak of a true beginning of studies on children's language until the 18th century, where the spirit of observation lays the foundations for research based on facts, even if they are occasional (Cué, Díaz Alonso, Díaz Martínez and Valdés, 2008)

Different authors have pointed out the great importance that these studies on children's language could have for the development of linguistics. In them, we find the need to insist on the idea that the study of children's language is indispensable in the field of general linguistics; and above all in the new principles of phonology in the research of children's language. (Talento and Perdomo-González, 2011)

Thus, at the end of the 18th century, the Diarist approach began with the observation of isolated cases made by the parents themselves. They took notes from the time the child began to say their first words until they were four or five years old. One of the most outstanding contributions was made by Stern in 1907, when he published a series of detailed observations he had made about his children's progress (Down, Darezzo, Nunes and Dupas, 2011).

On the other hand, in terms of evolutionary processes, physical development is found in the first years of life, was well as the basis on which psychological development is instituted, although this is quite independent of physical characteristics.

Thus, motor development occupies an intermediate place between physical and psychological development, depending not only on the development of related muscles and nerves but also on sensory capacities of perception (Martínez-Cruz, García Alonso. Poblano and Madlen, 2010).

Conceptualization of Early Stimulation

Different terms have been used to select the actions that have been addressed to avoid the difficulties of children with clear impairments or simply of groups included as vulnerable. Such is the case with the term early stimulation, as this term seems to evoke a desire to accelerate the normal process for the individual's development. In this way, the aim is to push the physical and intellectual possibilities of the child to the limit, through regulated and continuous stimulation, carried out in all sensory areas, but without forcing the logical process of maturation of the central nervous system in any sense (Cuevas, 2012).

Early stimulation plays a very important role in the first years of life, because at this stage, essential abilities are developed and matured, such as: the area of language, sensory, physical and psychological.

Bolaños (2006) establishes that early stimulation leads to significant learning, trying to awaken, in parents and teachers, the sensitivity of discovering their child's interest and motivation. Likewise, it is based on cerebral flexibility, sensory union and the educational process as presented through games and activities so that children can enjoy the teaching and learning process in a fun way.

On the other hand, Téllez (2003) states that in psychomotor stimulation the child acquires normal muscle tone, correct posture, position and movements, good body balance, stability of behavior and attention, control elements to keep silent, listen, learn and collaborate. Likewise, the learning process is promoted in the organization of space, sharpness of visual and auditory knowledge, visual memory, and related motor coordination, adaptations to time, behavior in their environment and progressive reasoning, since early stimulation seeks to favor and promote the integral environment of the child, guide the maturation process of the child's 4 areas, strengthen the bond between mother and child, attach the father to the family nucleus, and facilitate the child's placement and their family nucleus to the social environment.

On the other hand, Quezada (2013) points out that early stimulation is an important technique in the psychomotor area of children. It expresses that one of the main problems is that many teachers do not know how to face and submit activities due to lack of training and knowledge of the area, so that early stimulation is indispensable in the process of teaching children's learning and a great help since it acts in adequate quantity and quality for each child's moment of maturation.

Based on the above and prior to the metanalysis, a theoretical model was obtained (Figure 1), where constructs were analyzed that facilitated the literature's review, in addition to reviewing the model, according to previous research.

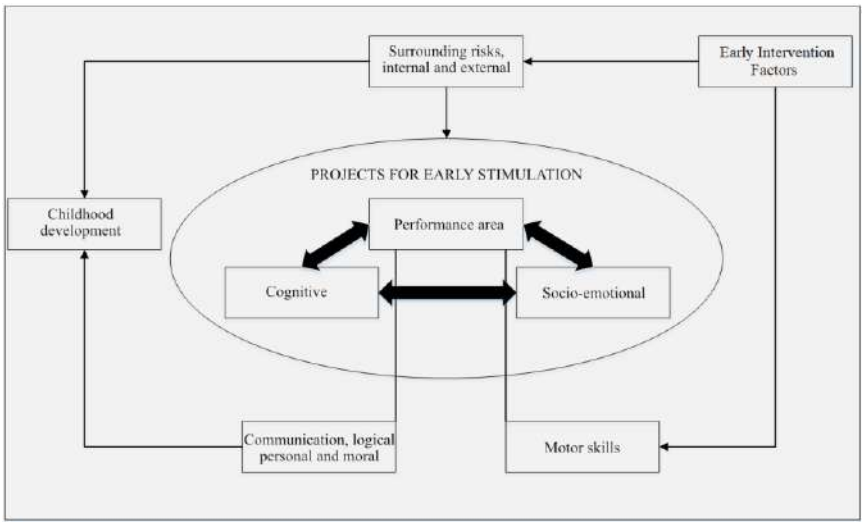

Figure 1. Theoretical Model of Early Stimulation Projects.
Note: Source: Author's creation (2017)

The following is the bibliographic review development for said model

Motor Development of Language and Hearing

The study of human development has become one of the main sources of knowledge, which has enabled the construction of important tools. In the course of childhood, motor and sensory-perceptual capacities are transformed reciprocally, parallel to the very process of maturation of the nervous system, which structures are organized, differentiated and specialized (Navarro, 2005).

Cognitive Development in Language Learning

Cognition is understood as the set of processes from which information is obtained through the senses. This is why memory is analyzed and sent to the appropriate cortical centers for future consultation and used in problem solving. In this way, cognition is interrelated with higher mental processes, in relation to the acquisition of new behavioral processes (Campo, 2011).

The Language and the Socialization Process

The conquest of language originates in socialization, understood as the facilitating process provided by culture for the child to potentially interact with meanings, people, values and practices, which can then be internalized, adapted and executed by the child in his or her usual context (Berger and Luckmann, 1998). This environment in which the child develops (lives, grows and plays) has an essential role in the development and acquisition of communication and oral language. Language is shaped by the exposure of correct linguistic models and by determining situations that favor its consolidation, improvement and generalization (Ibáñez, Mudarra and Alfonso, 2004).

On the other hand, Vicenty (2003) points out that the socialization process basically consists of social learning, that behavior is learned based in the surrounding reality. However, although psychologically, the learning of behaviors has been explained by diverse theories, this author indicates that one of the most significant theories for explaining the phenomenon of socialization is the theory of Bandura, elaborated in 1977. This theory presents two important aspects, since, on the one hand,

it establishes a difference between what the learning of a behavior (set of stimuli) is, and its execution. For example, when observing a behavior, people can store the information in their memory, being able or not to reproduce it later. On the other hand, the next important aspect of the theory is that the realization will depend on the success or failure achieved by the person being observed, rather than on the reinforcement received from the observer.

In this way, the family and the school can be considered as agents of socialization, although there are other agents such as mass media (Frederic, 1982)

Acting Towards Communicative Needs

The feeling of language functions makes sense with the intentional strategy and attitude with which children respond (Ardila, 2013). The basic linguistic functions established by Halliday (1975) include: i) the ideative function, which represents the relationship between the speaker and the real world around them, including their own being as a part of it. This function expresses the speaker's experience, but also the structure and determines the way in which the world is observed; ii) the intrapersonal function, which allows the establishment and maintaining social relationships. It is an interactive function and serves to express the different social roles including the roles that each one assumes in communication; and finally, iii) the textual function, through which language establishes correspondence between itself and the situation in which it is used. This function makes it possible to establish cohesive relationships between the parts of a text and their adaptation to the specific situation in which they are involved.

In particular, the ideative function and the interpersonal function manifest the objectives that people pursue using language: to understand the world and act in it, while the textual function is necessary to make the ideative and interpersonal components work; it is instrumental to them.

Development Areas

In order to organize the activities that will be developed with the families and their children, it is important to have divided areas that must be addressed in relation to the child's need to achieve early stimulation (Quinteros, 2011).

Cognitive Area

This term refers to the child's ability to become aware of himself or herself and his or her environment, to start giving order to the intended reality, through mental structures and associations that allow him or her to explore, compare, choose, ask questions, classify, etc. (Manley et al, 2013). The child in this area begins to analyze and understand their environment through the interaction they have with their environment, having experiences that can be developed in a better way, with their levels of thinking being effectively developed. It is in this way that the areas of development perfect a thought, memory and perception (Gordillo, 2013).

Motor Skills

The word motor refers to the function by which a child moves a part of their body, being that conjugated stimuli from the outside world are in the actions of motor skills, intrinsic factors of each child and a sequence of vital organic processes.

On the one hand, motor development will depend on the maturation of the basic neurophysiological system, as well as the neuroendocrine system, metabolic processes (fundamental for energy intake) and enzymatic processes (synthesis of proteins, vitamins, etc.). While environmental factors such as proper nutrition, restful sleep, warmth, hygiene, etc., will be of vital importance for a healthy and adequate life (Schwartzmann, 2006). In this way, the timely and adequate satisfaction of the aforementioned factors will make a good development and a better relationship within the human environment possible, where interrelations constitute aspects that define and condition the great possibilities of expression of the child's genetic information. Therefore, the way in which the motor response is expressed, and the possibilities of expanding these psychomotor responds, will depend, to a large extent, on the favorable conditions provided by the environment.

Psychomotor development is different for each child. Therefore, it is present in the same order as each of them. Likewise, development is created from the head to the feet, which is why we see that the functional development of head and hands is first and foremost the development of legs and feet (Gordillo, 2013; Rodríguez & Iglesias, 2009).

Fine Motor Skills

Its reference is to the process of refining the gross motor control point, determined after a skill that is the result of the maturation of the neurological system (Marzal, Parra and Colmenero, 2011). The control of fine motor skills in infants is a developmental cycle and is taken as a relevant event to estimate their developmental age. It is in this way, with the passing of time, that it is based on experience and acquired knowledge and requires normal intelligence (creating ease of planning and executing a task), muscular strength, coordination and normal sensibility (Pinango and Vega, 2018).

Gross Motor Skills

Unlike fine motor skills, gross motor skills exert greater energy, but this in turn requires patience (Mulas, 2007). In this way, reference is made to the control of the general muscular movements of the body, which lead the child from absolute dependence to independent movement. From the moment gross motor skills control is obtained, fine motor skills control is developed, thus perfecting small and precise movements (Marzal, Parra, Colmenero, 2011).

Early Intervention Factors

There are a series of factors that influence the development of a child's motor skills, and they are classified as follows: a) endogenous factor, which is related to the maturation and genetics of the child, including disorders and their characteristics that tend to be inherited; b) exogenous factor, which intervenes in the development that is generated from outside; c) physical factor, considered as food, sanitary conditions, among others; d) social factor, which is related to the relational environment and, in turn, is associated with the infant (Grande, 2011).

In this way it is possible to skimp the formation and evolution of the motor progresses, stimulating its evolution (Grande, 2011). The professional in this branch of health sciences must recognize the different behaviors that appear in children, and once their strengths and weaknesses are known, their growth and development can be reinforced and intervene in (Rodríguez, Gomez and Prieto, 2017).

Method

The research has a qualitative and quantitative (mixed) focus with a descriptive range. In this same way, the research modality has great relevance as the contribution made was bibliographic. According to the studies found in databases and documentary sources, the analysis method used for confirming the information's quality was the Metaanalysis. This method identifies a set of processes in which computer tools such as Forest Plot Generator were used. This helps representing information through forest plots. The huge amount of information built by the results was classified in the Excel v.2016, used for representing the results obtained around the world through natural sciences focused journals (psychology, early stimulation and others). For this reason, automatic databases were used as they provided all the available and updated information about early stimulation researches to the researchers.

It is important to mention that the databases used were a secondary source of resource, which helped obtaining information in a homogeneous and heterogeneous way, and that can be retrievable through systematic networks of scientific information. They have complete records or bibliographic references, organized in fields that cover all the information's aspects (title, author, abstract, etc.)

Metanalysis

Sandoya (2008) points out that metanalysis is a technique replacing descriptive review as an evidence analyzing method. He also states the type of review sought by topic-related studies; establishing who guaranteed it and who didn't, with a recommendation based on the author's opinion being formulated. However, as there were no formal rules for its fulfillment, the review was classic and subjective and, therefore, biases or errors were very likely. Disagreement between reviewers went from basic aspects, as the type of studies to be included or the sample size, to specific aspects, as each of the study type's value. As such, metanalysis provided exactitude in the search, selection and analysis process, and the structural evidence integration, granting a more objective outlook for it.

However, there are three main methodological problems with this type of analysis which are i) Heterogeneity of the studies included; ii) The publication's biasness; iii) The selection's biasness. It is highly recommended to implement heterogeneity in the metanalysis, as explained further on.

Regarding the publication's biasness, it is mentioned according to the published scientific articles that do not faithfully reflect the totality of the studies. This is because, in many cases, when the obtained results are positive, they are more likely to be sent to wider impact journals. Whereas those with a non-significant result or contrary to the established hypothesis are simply, most of the time, not published. In this way, results are made conditional on the biographical search and can provide biased results.

On the other hand, the selection's biasness delimits the inclusion and exclusion criteria, which is why they must be clearly defined in the analysis and be as objective as possible. Sometimes, the author them self is in charge of biasing the results based on their own inclusion and exclusion criteria, which can benefit some publications.

In conclusion, regardless of the metanalyses' limitations, they must be planned and organized to reach a more objective analysis. Especially, because they help detecting false negatives and can detect areas that must be explored. However,

metanalyses can produce the wrong results when ignoring the presence of a possible significant Heterogeneity between the studies, when including the biases and also when introducing other biases in the search process for the studies.

Strategy for Obtaining Bibliographic Resources

Once the databases are selected, some constructs, descriptors or key words are established. These constructs are considered the main concepts or variables of the study's problem in the research topic (Day and Gastel, 2008). These main ideas act as key descriptors when beginning the search and, thus, obtain the bibliographical sources needed to carry out this work.

Bibliographical Selection Criteria

The selection criteria were delimited through the review objectives, meaning the main question this work seeks to answer. Other aspects used for defining the relevance of the bibliographical sources are: a) reliability of the results; b) obtained results; c) applicability of the results obtained in the work's study (Vera, 2009).

The Information's Organization

The systematization of the obtained information simplifies a complex topic and makes its objectivity easily achievable through a reasonable reduction. This methodology can be applied to the creation of an information's segmentation process, with Excel v.2016. as the office system program for this activity. This organization system is a cognitive tool that consist of representing knowledge in a graphical and synthetic way, focused on effective and meaningful learning as seen in Table 1. Different indicators for each article were selected. They classify the dimension through diversely reviewed sources at the global level.

Table 1.
Analysis of Theoretical Constructs.

DIMENSIONS	INDICATORS	USA	SPAIN	CHILE	BOLIVIA	COLOMBIA	MEXICO	AUSTRALIA
PERFORMANCE AREA	Cognitive	32	4	17	15	12	66	2
	Socio-emotional	21	117	75	1	12	69	3
	Language and Hearing	58	97	34	5	15	122	59
MOTOR SKILLS	Fine motor skills	3	73	59	3	28	31	9
	Gross motor skills	8	47	110	2	32	41	2
EARLY INTERVENTION FACTORS	Prenatal risks	162	95	76	76	12	14	122
	Perinatal risks	2	10	3	2	1	12	44
	Postnatal risks	9	112	124	10	20	204	2
	Environmental risks	53	35	20	28	17	47	29
CHILD DEVELOPMENT	Communative development	56	35	34	0	3	1	2
	Logical thinking	2	63	78	0	12	14	1
	Personal development	4	6	3	0	21	145	2
	Moral development	23	65	130	34	193	120	22

Note: Authors' creation (2017).

The creation over a previously mentioned precise theoretical model was obtained through the constructs' organization system, by means of an adjustment of the contrast indicators and each article's dimension. For this reason, it was possible to

specify which country has developed more researches related to the research line considered in this study. The system corroborating the organization of the information and the constructs is defined as descriptor's counter. It identifies the origin of the article and, as previously mentioned, can reflect which country has more scientific contributions regarding the study's topic.

Results

Based on the literature's revision, it was possible to obtain the structuring of the constructs in which a research's theoretical model was determined. The descriptors of this constructs analysis helped adjusting and contrasting the literature's revision. This way, four dimensions were established: a) Performance Area, b) Mobility, c) Early Intervention Factors, d) Child Development.

Figure 2 shows the levels of the study according to the corresponding Performance Area of the construct, Cognitive, Socio-emotional, and Language and Hearing. As seen in this figure, the origin of the literature related to the Performance Area dimension shows that the U.S. has a larger analysis in the Cognitivism area. In the same way, Spain shows predominance in the Socio-emotional indicator while, again, the U.S. has a bigger range of studies in the Language and Hearing studies.

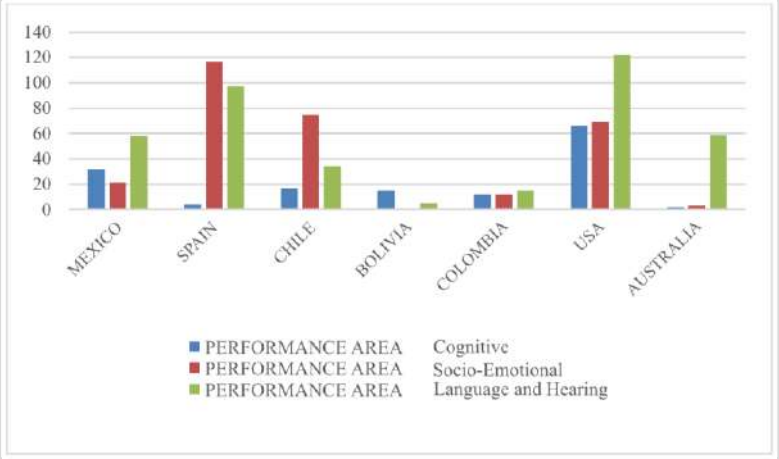

Figure 2. Construct, Performance Area.
Note: Source: Authors' creation (2017).

As shown in the analysis of the Mobility dimension, Figure 3 shows that Spain has made relevant studies according to the Fine motor skill indicator, while Chile equally stands out in the Gross motor skill studies, according to the different context each population faces.

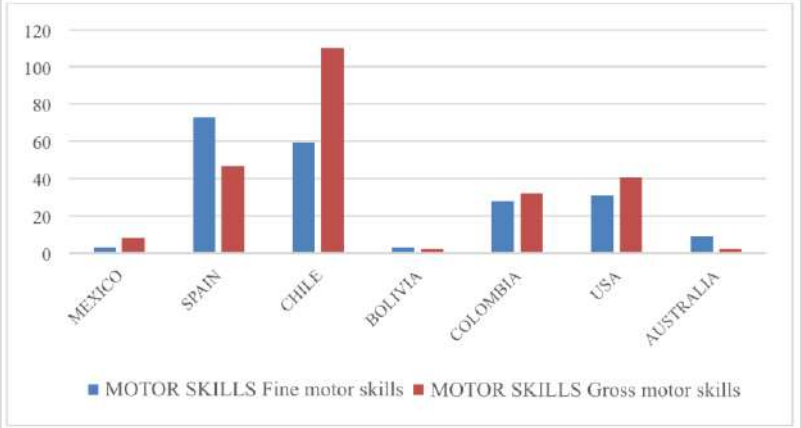

Figure 3. Construct, Mobility
Note: Source: Authors' creation (2017)

Continuing with the results, Figure 4 shows an analysis made according to the Early Intervention Factors dimension, which determines that Mexico has a higher tendency of Prenatal Risks and Perinatal Risks indicator studies. Additionally, it is also noticeable that Australia has studies in the area, however, it highlights that the results for these indicators are weak. Besides that, the U.S. shows a great quantity of studies related to the Postnatal Risks indicator, and Colombia is the country that out stands the least in this dimension. This determines that there are no relevant studies concerning this indicator. Lastly, few studies have been carried out in Mexico regarding the Environmental Risks indicator, which suggests that this indicator has not had relevance in former studies.

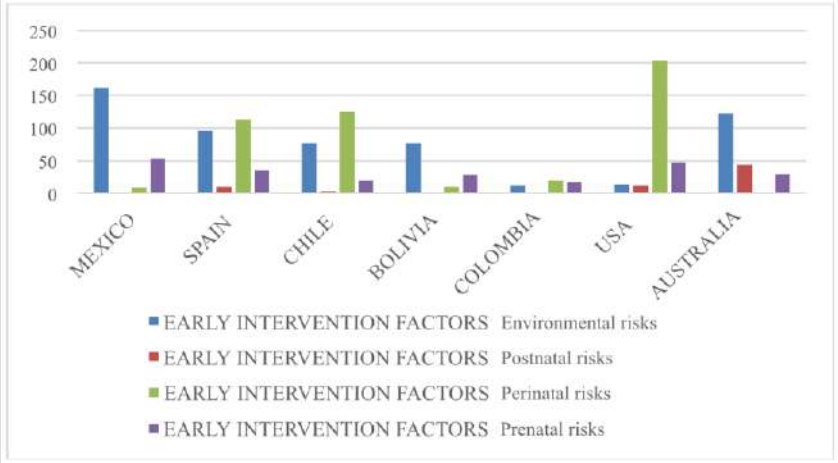

Figure 4. Construct, Early Intervention Factors
Note: Source: Authors' creation (2017)

Figure 5 determines the analysis results of the Child Development dimension. We can observe that Mexico has relevant studies regarding the Communicative Development indicator, as well as Chile showing latent studies regarding Logical Thinking. For said reason, an approach to a bibliographical analysis of the region must be made. With these permanent studies, the US shows a predominance in the Personal Child Development indicator, while Colombia shows that, in recent years, it has been

focused on research related to the features of the Moral Development indicator, making it predominant in these studies for this research line.

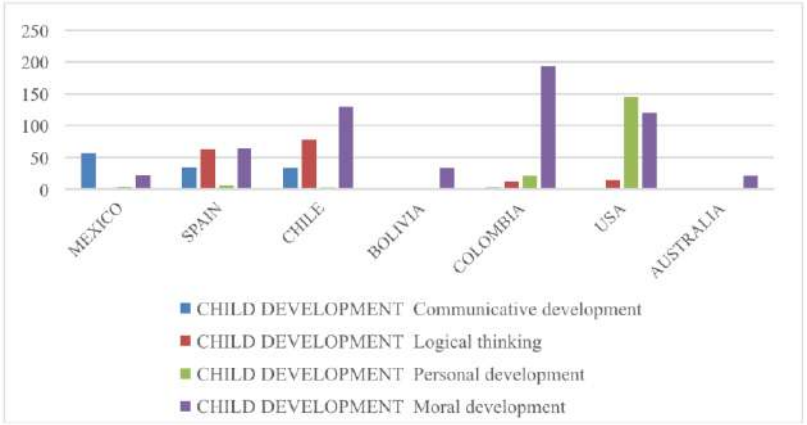

Figure 5. Construct, Child Development
Note: Source: Authors' creation (2017)

Consequently, a Homogeneity and Heterogeneity analysis through a frequency table has been made. In this sense, Homogeneity is considered a basic element in research and in theoretical analysis as it helped specify the obtained information's validity in the research's development. Table 2 describes this analysis, where the four established dimensions can be seen, as well as the Homogeneity and Heterogeneity percentages, and the study's population.

Table 2.
Population frequencies in the study.

	Homogeneity	Homogeneity %	Heterogeneity	Heterogeneity %	Study population	Study total sample %
Performance Area	25	83%	5	17%	30	100%
Motor Skills	26	87%	4	13%	30	100%
Early Intervention Factors	22	73%	8	27%	30	100%
Child Development	13	43%	17	57%	30	100%

Note: Authors' creation (2017).

The values obtained were also represented in the Forest Plots which, as previously mentioned, help connect and contrast the obtained results through the different qualitative assessment scales used in the examined studies.

In Figure 6, Forest Plot, Heterogeneity values are presented from 1 to 2, while Homogeneity values are displayed from 0 or 1 through values in the X axis. Horizontal lines crossing the charts show the size of the trust interval. The longer the lines, the bigger the trust interval, so results from the study are considered less replicable.

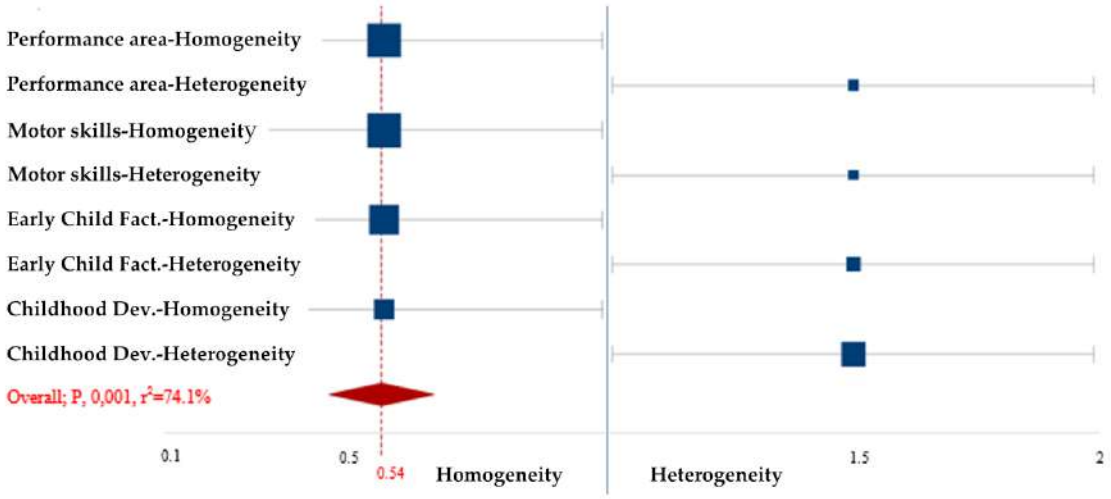

Figure 6. Forest Diagram – Constructs' Validation.
Note: Source: Authors' creation (2017)

Besides that, in the middle of the forest plot, a vertical line symbolizes the void effect of the studies. Which means that it does not represent a significant value so as to determine the information's quality.

The global effect is calculated by the average value of the Homogeneity and Heterogeneity impact for each of the function's studies. The value is 0.54, presented as a red rhombus, which location indicates a bigger Homogeneity in the research, as it is located in the left side of the void effect line (vertical line). It's important to notice that, if the diamond touches the vertical line, the aggregated results establish that the factor does not provide protection nor risk.

Discussion and conclusions

To conclude the research, it managed to establish the grounds for the constructs based on the different study criteria for the project model's early stimulation through a systematic and information management method called Metanalysis. The assessment of the following aspects was also made: information searching strategies; inclusion and exclusion criteria of each construct respective information; the information's quality; the examined studies quantitative analysis. The obtained result proved that mainly trustworthy database articles and sources of less than five years in Spanish and English were used. The Homogeneity of the study was established with a determinant average of 0.54, based on the analytic criteria of the researchers, presenting preeminence over the Heterogeneity.

In this way, constructs show a big relation linking to early stimulation projects as it identifies strategic functions and driving elements that contribute to the information's quality. That is how, through a thirty (30) bibliographical sources study population, a model referred to the projects of society linking the early area stimulation was obtained. This model should be directed by the higher education institutions as it shows the main factors taken into account when stipulating a plan and executing it.

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