RESEARCH ARTICLE

THE RESULT OF THE USE OF PROBLEM SOLVING METHODOLOGIES IN ORGANIZATIONS THIS ARTICLE IS BASED ON THE RESULTS OBTAINED IN THE DOCTORAL THESIS OF THE SAME AUTHOR ENTITLED "HOW DO THE INDICATORS OF THE ADMINISTRATIVE AREAS OF COMPANIES EVOLVE DUE TO THE USE OF PROBLEM-SOLVING METHODOLOGIES?"

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Manuscript Info	*Abstract*
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	This article deals with the use of problem solving methodologies and how these positively affect the performance of KPI (Key Process Indicator) of organizations, clearly showing that those organizations that use these methodologies obtain better results over those who do not use them. With this work, what is sought is to question the myth, and put an end to the axiom that it was something taken for granted and confirm with statistical data the truth that methodologies work to improve the performance of organizations, as long as they are applied by teams trained in them. Leaving aside that the use of these methodologies is somewhat punctual to solve quality or production problems and that they must be used in the entire spectrum of organizations.

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Introduction:-

The use of problem solving methodologies is an administrative tool that is used very commonly in organizations to solve specific problems, especially in the areas of quality, production engineering, etc... and its use has been fully accepted not only in recent times, speaking of the 20th century with the use of the first methodologies such as Deming's PDCA [1]which was a variant of the learning and improvement cycle created by Shewhart as Lohr tells us: "In the 1950 lectures, Deming taught what later became known as the Plan-Do-Study-Act (PDSA) cycle, based on the Shewhart's learning and improvement cycle[two]. If not, it was also used since ancient times, as different authors tell us, such as: Sigarreta[3], Crescenzo[4], Claros Molina[5]among others when talking about how problems were solved in ancient times.

But and despite the continuous fact that these methodologies are being used continuously since the 50s of the last century, and having reviewed a lot of information and bibliography, this topic has always been considered an axiom, which was that the use of problem-solving methodologies gave good results. Is this true or false? It was not known, it was only taken for granted that the use of methodologies works.

Therefore, the objective of this work has to answer a hypothesis that tells us: companies improve their key process indicators through the use of problem-solving methodologies.

For this, what is carried out is a formulation of the quantitative methodology, which will be non-experimental since a certain number of people belonging to a certain group were surveyed in search of a cause-effect relationship. Which

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leads to a transectional design of the correlational-causal type. The correlation between cause and effect has already occurred and the only thing that is sought is to verify the hypothesis created around it. As Bisquerra tells us:

There is not any independent experimental variable that can be manipulated. There is no selection of equivalent groups of subjects. It is based on observation. Galton advocated this method. Data analysis is based on correlational techniques, fundamentally Pearson's correlation. This topic is developed in "Correlational Studies" on page 139.[6]

The objective of this analysis, as has been mentioned, is to verify the study hypothesis, and above all to convert the axiom into a fully validated theory with the data obtained from the statistical sample defined in this research work.

Materials and Methods:-
Design
As mentioned in the introduction, what is done is a formulation of the quantitative methodology, which will be non-experimental since a certain number of people belonging to a certain group were surveyed in search of a cause-effect relationship. Which leads to a transectional design of the correlational-causal type. The correlation between cause and effect has already occurred and the only thing that is sought is to verify the hypothesis created around it.

Population
To calculate the sample size, several points were determined.
1. Population size. A population is a well-defined collection of objects or individuals that have similar characteristics. We speak of two types: target population, which usually has various characteristics and is known as the theoretical population. The accessible population is the population to which the researchers will apply their conclusions.
2. Margin of error (confidence interval). The margin of error is a statistic that expresses the amount of random sampling error in the results of a survey, that is, it is the statistical measure of the number of times out of 100 that the results are expected to fall within a specific range. .
3. Confidence level. They are random intervals that are used to constrain a value with a certain high probability. For example, a 95% confidence interval means that the results of a stock are likely to meet expectations 95% of the time.
4. The standard deviation. It is a numerical index of the dispersion of a data set (or population). The larger the standard deviation, the larger the population spread.

As in the case under study, the size of the population was unknown; we applied the formula to calculate the sample size when the size of the population is unknown, which is as follows:

$$n = \frac{Z^2 * p * Q}{D^2}$$

Where: Z = confidence level; P = probability of success, or expected proportion; Q = probability of failure; D = precision (maximum admissible error in terms of proportion).

In addition, the following information was used: Z = 99%; P = 99%; Q = 1%; D = 1%. Being the sample size of 98 individuals.

Environment
How was the information obtained for the analysis?

The one in this study was obtained through the LinkedIn social network, because in it the vast majority of users are related to different activities within companies, government, education, etc... Moreover, the intention was to do it without being directed to any specific group to avoid bias by group, so that the analysis was as open as possible.

The survey itself is detailed and limited enough for the analysis to be effective; in short, the questions only have closed answers.

As López-Roldán & Fachelli say
The survey is located in the first dimension at the extreme of maximum directionality since ideally the survey questionnaire is built with previously determined questions and closed answers. The freedom of the interviewee is

limited, in addition to the possibility of refusing to answer, to choose only among the response options offered. In relation to the second dimension, the survey implies a low degree of depth of information, allowing the most superficial aspects of facts and evaluations of social life to be captured.[7]

Statistical analysis
The survey is based on qualitative answers, so the main system to analyse them correctly is the statistical analysis of Pearson's Chi-square or also known as Chi Square.

To determine the association or independence of two qualitative variables, the Chi-square ($\chi2$) test is a widely used statistical tool in research with qualitative data. This test contrasts two hypotheses, a null hypothesis or hypothesis of independence of the variables (A) and an alternative hypothesis or hypothesis of association of the variables (B). In simple terms, the $\chi2$ test compares the observed results with theoretical results, the latter calculated under the assumption that the variables were independent of each other, that is, under the assumption that (A) were true. If the observed results differ significantly from the theoretical results, that is, they differ from (A), it is possible to reject (A) and affirm that (B) is true, concluding that the variables are associated. On the contrary,

Variables
Any correlation study needs both dependent and independent variables.

Dependent
The dependent variable of this study is the trend of its KPIs in recent years

Independent
In this analysis they are:
1. Executive level within the company.
2. Size of the company.
3. Type of company or organization.
4. Know whether they use problem-solving methodologies.
5. Type of problem solving methodologies.
6. Know if they have received training in the use of the methodologies.
7. Above all, we must define the study in a period.

Limitations
We have already seen part of the existing literature on the use of problem-solving methodology for business management, as can be seen, there is a lot available, but not at the level that is being sought, so, in this In this case, the result of the investigation is influenced in the statistical data in a very different way, as Mehta[8]lets us know:
- •Qualitative aspect ignored:
  o Statistical methods do not study the nature of the phenomenon that cannot be expressed in quantitative terms.
  o Such phenomena cannot be part of the study of statistics. These include health, wealth, intelligence, etc.
  o You need the conversion of qualitative data into quantitative data.
- It does not represent the complete history of the phenomenon:
  o Even when phenomena occur, that is due to many causes, but not all these causes can be expressed in terms of data. Therefore, we cannot come to the right conclusions. The development of a group depends on many social factors such as the economic condition of the parents, education, culture, region, administration by the government, etc. However,not all these factors can be included in the data. Therefore, we analyse only the data that we find quantitatively and not qualitatively. Therefore, the results or the conclusions are not 100% correct because many aspects are ignored.

Results:-
Chi-square analysis
In checking the Hi or research hypothesis, the hypothesis "the use of problem-solving methodologies does influence the improvement of KPIs in companies" is true, when verifying that the dependent variable has dependence on the independent variables, which would validate the Hi per se.

The answers to the question:
- In the years 2016 to 2020, have your KPIs (Key Process Indicators) in Safety, People, Quality, Cost had a positive trend?

In your Chi-square analysis with the answers to the following questions, you have a p value of less than 0.001. If p is less than 0.01 or 0.001, you can assume that the result is statistically significant, that is, there is a relationship between "A" and "B". A statistically significant difference may not necessarily be significant in practice.
   In the following cases, p was less than 0.001:
1. Do you use any problem-solving methodology in the administration of the company?
2. What industrial sector does your company belong to?
3. Do you think that the problem solving methodology is useful in the administrative management of a company?
4. Have you received training in problem solving?
5. Do I use any problem-solving methodology in the administration of the company between the years 2016 and 2020?

With the data available, it can be confirmed that the Research Hypothesis (Hi) is true, because there is more than one statistically significant relationship between the dependent variable and the independent variables; in fact, there are five significant relationships between the dependent variable and the independent variables as seen in the previous lines.

Interpretive analysis
The answers to the question:
- In the years 2016 to 2020, have your KPIs (Key Process Indicators) in Safety, People, Quality, Cost had a positive trend?
   With the questions that are the dependent variables, we get the following results
- Do you use any problem-solving methodology in the administration of the company?
o Those who do use methodologies have an 85% chance of having good results in their KPIs.
o Those who do not use have a 69% chance of having a bad result in their KPI.
- What industrial sector does your company belong to?
o The productive sectors are the ones that have the best results when using problem-solving methodologies.
o The administrative and public sectors are the ones that have worse results by not using problem-solving methodologies
- •Do you think that the problem solving methodology is useful in the administrative management of a company?
o Those who do create methodologies have an 82% chance of having good results in their KPIs.
o Those who do not believe have a 75% chance of having a bad result in their KPI.
- •Have you received training in problem solving?
o Those who have received training have an 87% chance of having good results on their KPIs.
o Those who have not received training have a 57% chance of having a bad result in their KPI.
- •Do I use any problem-solving methodology in the administration of the company between the years 2016 and 2020?
o Those who have used methodologies have an 87% chance of having good results in their KPIs.
o Those who have not used have a 60% chance of having a bad result in their KPI.

Conclusions:-
The specific objective of this work was to be able to demonstrate that the hypothesis "The use of problem solving methodologies in the management of a company improves the key process indicators" is correct and can be demonstrated through a statistical analysis with a quantitative statistical approach".

In addition, through all the analyses that have been carried out during the presentation of the results of the hypothesis, it is proven that the use of problem-solving methodologies is a highly effective tool in organizations to improve their key process indicators, which must be linked to your specific objectives defined during the strategic planning process.

If the whole process is correct, it is much easier for these organizations to improve these indicators and always have positive trends towards obtaining better results.

As an additional handicap, it must be said that the study is based on the years from 2016 to 2020, which implies that 2019 was a year of moderate growth, and even with signs of a negative trend in all industrial sectors and the year 2020 It was undoubtedly one of the most difficult years since the end of the Second World War, with a global recession caused by the pandemic caused by the SARS-CoV-2 virus that has kept the world on edge since then until the writing of this work.

Under all these circumstances, it can be said, or rather affirmed, that if you want to have a successful organization, the use of problem-solving methodologies is mandatory and, to be more specific, at all levels.

Until now, the information that has been handled in the more than twenty years of work in the industry of the author of this work and especially in the automotive industry, was the mantra of using the different methodologies to solve existing problems: mainly quality and of production. In addition, what was sought with this work was to be able to defend this theory of which did not exist, or no study could be found on how companies improved by using these procedures. Now that "axiom" that everyone gives or gave as an undeniable reality, changes its concept to be a theory proven in a scientific way through this research work [9].

Another of the conclusions that are underpinned in this work is that in order to obtain good results in the implementation and use of problem methodologies, there must be training in them, as observed during the analysis of the result, the vast majority of that they apply them is because they have received training in them, which in turn leads to great confidence that if they use problem-solving methodologies with a ρ of 0.007 in their Chi-square relationship, which is a very strong correlation, will perform well on your key process indicators.

Therefore, this work considers that with all of the above, the research hypothesis is perfectly demonstrated in a clear and definitive way and the following syllogism is created, when there is a problem, we need a solution consisting of developing a new tool, therefore, when there is a problem a new tool is developed and this is the problem solving methodology as the best option to solve problems in organizations

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