

CONTINUOUS IMPROVEMENT AS A FUNDAMENTAL FACTOR OF ENTREPRENEURSHIP AS A INTERNAL MARKETING PROCESS IN THE INDUSTRY OF BAJA CALIFORNIA, MEXICO AT THE COVID 19 PERIOD

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ABSTRACT

An investigation of the positive effect of entrepreneurship in the processes of continuous improvement of manufacturing, where was applied the internal marketing as a strategic process to improve the attitude and effort of workers of the manufacturing areas of ten industrial companies installed in three cities of the state of Baja California, Mexico (Ensenada, Mexicali, and Tijuana), located in the northwest the Mexican Republic was made. With this, was observed the benefits of the application of the internal marketing, with the increase of the productivity and quality levels. It was determined that the entrepreneurship factor is very important in the development of continuous improvement because based on this factor was created innovative new materials to be used in the industrial processes of the ten industries where was made the investigation. Also was created new methods and systems in the manufacturing areas of the industrial plants were evaluated, which were very relevant to support the increases in productivity and quality indices. The information obtained was provided to the specialized personnel of the entrepreneurship team, as well as to the managers and executive personnel of the industrial companies where the scientific study was carried out, to increase the levels of productivity and quality and thus obtain a greater number of sales and clients and thereby increasing their economic profits. The research was carried out from 2019 to 2021, in periods with the Covid 19 pandemic, observing the need for the entrepreneurship factor, especially during this period of the Covid 19 pandemic. This investigation was relevant to improve the technology and methods in the industrial process of the industries evaluated, and to avoid a certain number of workers being laid off in this difficult period of the Covid19 pandemic.

1. INTRODUCTION

Worldwide, in any type of industry, continuous improvement actions are developed as part of the industrial enterprise, which can be simple or complex, depending on the situation that arises. The application of the internal marketing in industries has reach great benefits, because has improved the attitude and the effort of workers of the manufacturing areas in the world. This type of process is of great support to manufacturing areas, because manufacturing times can be reduced, safety is increased in the development of industrial operations, and the well-being of workers in manufacturing areas (Thompson, 2009). Based on this type of aspect of improvement, better customer satisfaction is achieved, assuring the quality of manufactured products and reducing the activities of distribution and delivery of products manufactured with customers. The continuous improvement related to industrial entrepreneurship focus on ensuring that all activities in the manufacturing areas can have better operational performance, and can develop each stage of the manufactured products appropriately, avoiding the generation of errors in equipment, systems, and industrial machinery, and with it the presence of the defective product (Nabi et al, 2017).

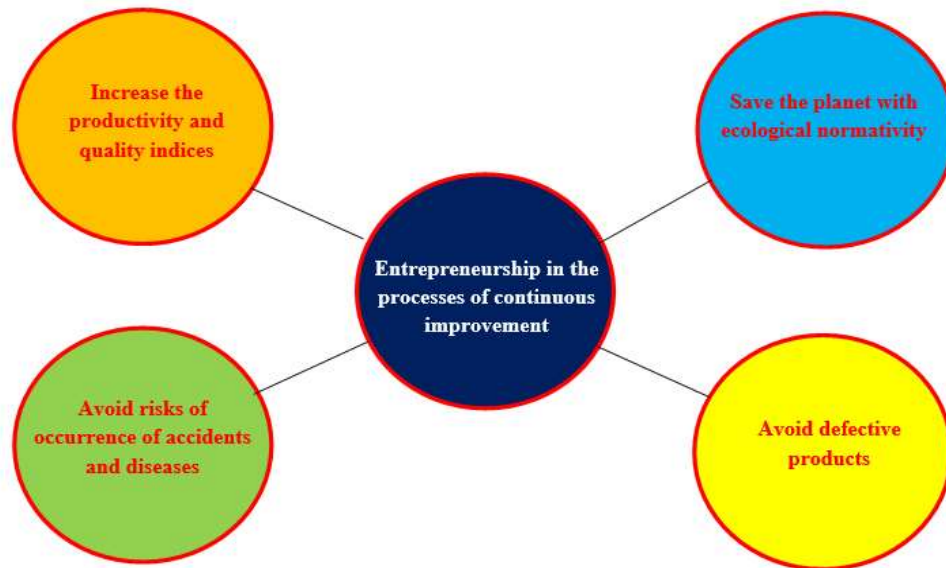


Figure 1. Factors of the industrial entrepreneurship

Source. Analysis of the investigation

Figure 1 shows the principal factors of industrial entrepreneurship, representing the 4 aspects were observing when is applied this relevant improvement continues, could increase the economic gains and avoid any type of complicated situation of the occurrence of accidents and diseases in the operative personnel of the manufacturing areas (Loi et al, 2016).

Relationship of industrial entrepreneurship with innovation

This type of relationship is of great relevance in industrial plants around the world, where based on creative ideas, innovation projects are developed, focused mainly on increasing production rates and improving the quality of manufactured products, in each type of industry (Byrne et al, 2014). Usually, the word entrepreneurship is attributed to the area of services such as the development of online pages for marketing activities with which sales can be improved, as well as other types of actions that do not involve the manufacturing processes of all types of industrial companies. To achieve substantial sales of any product, it is necessary to manufacture a said product, and for this, manufacturing processes are required (Kailer, 2009). When is united the word entrepreneurship with industry, relevant products have been developed that are currently used in all regions of the world, being constantly improved, as a factor of competitiveness among industries, whether they are small, medium, or large industrial plants, and any type process or development of any product (Rideout et al, 2013). It is for the rest, the relevance of this relationship, to achieve the objectives and goals of industrial companies in the shortest possible time and with the largest number of manufactured products, with optimal quality and at low cost, as well as the conservation of the welfare of all workers in each industry, whether in the manufacturing and administrative areas (Bae et al, 2014).

Industrial entrepreneurship as an innovation process

According to experts on the subject of technology, the word industrial entrepreneurship is part of the continuous improvement in manufacturing processes, representing the capacity of the people involved in industrial processes, generating new methods, systems, tools, and equipment for manufacturing areas (Fretschner et al, 2013). Said capacity indicates being a pioneer in any activity that is desired to be carried out, obtaining optimal results in the generation of effort, and managing to relate these terms to innovation. To achieve the generation of innovative and relevant projects, experts in industrial entrepreneurship must have the ability to develop the creative idea and carry it out immediately with an entrepreneurial spirit, as well as be able to train the operational staff where it is needed. develop continuous improvement as innovation. In addition, it is necessary to have innovative support to convince the directors of industrial companies to support them with the financing required for each innovation (Kauffman, 2013).

The industry in northwest Mexico

According to an industrial report from the Secretary of Economy of the state of Baja California, whose state of the Mexican Republic is located in the northwest of the Mexican Republic, there are around 500 national and foreign companies in this region, which is a border area with the state of California, United States (López B. Gustavo et al, 2010). This region is in the border zone with the United States neighboring country of Mexico in the northwest, is

very important at a commercial level, due to the relationship of the Free Trade Agreement between Mexico, States and Canada, and the state of California, has an important trade relationship with various countries in the world, including our country (Gustavo Lopez Badilla, 2012). Most of these industrial companies installed in the state of Baja California, which manufacture products for sale in the United States and other countries in the world, are from Mexico, the United States, as well as from Japan, China, Germany, Italy, Canada, and South Korea. South, England, and Holland. In all these industrial plants, it is necessary to apply industrial entrepreneurship, to improve their manufacturing processes and thereby be one of the most competitive industrial companies worldwide, whose sales increase rapidly (AME, 2021; AMM, 2021; AMT, 2021). The main types of industries in this northwestern region of the Mexican Republic are the aerospace, agricultural, biomedical, electronic, metallic, paper, plastics, and textile areas, as shown in Figure 1 (López B. Gustavo et al, 2010).



Figure 2. Types of industry in the northwest of the Mexican Republic

Source. Analysis of the investigation

Continuous improvement as part of industrial entrepreneurship and innovation

The continuous improvement process in an industrial company has the main objective of achieving the perfection of the manufacturing activities, obtaining the knowledge in the school learning phases, and the work experience to quickly and efficiently achieve the desired improvements (Rideout et al, 2013). Because there are simple and complex industrial processes, each continuous improvement action must be carefully evaluated to generate the best option for the innovation process. The desire to achieve perfection in the manufacturing areas of industrial plants is part of the generation of innovation projects in the industry of the state of Baja California, with a diversity of experts in the areas of automation and control, ergonomics (health occupational), lean manufacturing, optimal management of operational personnel and industrial creativity (Nabi et al, 2017).

The occurrence of the Covid 19 pandemic

At the beginning of 2019, a complicated situation occurred worldwide, regarding the health of the habitats, where in individual regions of the world, the Covid 19 pandemic, which was also called the Coronavirus pandemic, was presented (Bager et al, 2021). The presence of this pandemic generated economic and health security instability, where it was necessary to generate isolation in society (WHO, 2022). This caused the closure of government centers, educational institutions, shopping centers, and businesses, as well as micro, small, medium, and macro-level industries. When this complicated situation was generated, several companies from all over the world and especially from the state of Baja California, had to close for a few days as a technical strike, for which processes had to be carried out remotely, motivating the development of continuous improvement by continuing to work some industrial plants in the northwestern region of the Mexican Republic (SEDECO, 2020), where the manufacturing processes were carried out by only specialists, without the operational personnel of the production processes; Therefore, it was necessary to apply continuous improvement as part of industrial entrepreneurship and innovation, designing and developing new processes, especially remotely or without operating personnel from the manufacturing areas (Pijls et al, 2021). Based on this, it was necessary to apply continuous improvement as part of industrial entrepreneurship and innovation, without exposing the operating personnel of the production processes to the complex health situation caused by the Covid 19 pandemic. In addition, certain companies in the northwest region of the Mexican Republic, they worked only with specialists and without manufacturing and administrative personnel, for which it was necessary to carry out some new methods, systems, tools and industrial machinery; with the aim of operating remotely and without operating personnel (WHO, 2022). Once the period of the pandemic passed, the workers in the manufacturing area returned to work with certain continuous improvements based on industrial entrepreneurship and technological innovation, being a development of wholesale opportunities.

Internal marketing in industrial plants

To control the problematic situations in the ten industries evaluated, was used the method of the internal marketing to convince the few workers that remained in the ten companies evaluated, to carry out their activities with great effort, dedication and attitude, and sometimes they operated up to two industrial machines, causing great fatigue (Grande, 2014; Figueroa, 2020). This was done because many workers in the ten industrial companies where this scientific study was carried out were discouraged and tired and did not want to work (Al-Borie, 2012). Figure 3 shows how an internal marketing process in each industry evaluated, the way in which a person from the operational area elaborated his activities and supplied his operational successor with the by-product with an efficient quality and quantity (Tang et al, 2020). In the next paragraphs are explained the actions as vendor and customer as operative workers (Vera et al 2018):

Level 1 (red color). Represents an ineffective and unpleasant situation, being represented for both cases as the vendor and customer of industrial operative actions between workers of manufacturing areas.

Level 2 (orange color). Indicates an effective and unpleasant situation, illustrated both cases as the vendor and customer of industrial operative actions between workers of manufacturing areas.

Level 3 (yellow color). Shows an ineffective and pleasant situation, being the real situations both cases as the vendor and customer of industrial operative actions between workers of manufacturing areas.

Level 4 (green color). Illustrates an effective and pleasant situation, being the best event, which can consider a success of both cases as the vendor and customer of industrial operative actions between workers of manufacturing areas.

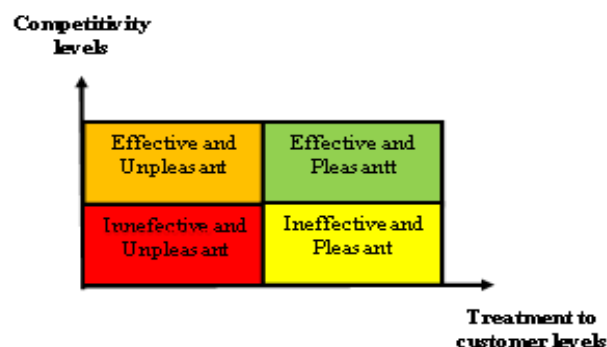


Figure 3. Analysis of actions of vendor and customer as operative works in industrial process of the industries evaluated

2. METHODOLOGY

An analysis was carried out in ten companies in the state of Baja California, of the eight types of industrial business, distributed in the three main cities of this northwestern region of the Mexican Republic, considered an industrial zone and the distribution is shown immediately:

- Ensenada. Two companies of metallic and textile industries were evaluated.
- Mexicali. Four companies of agricultural, aerospace, metallic and paper industries were evaluated.
- Tijuana. Four companies of aerospace, biomedical, electronic and plastics were evaluated.

The cities of Ensenada and Tijuana were considered to be a marine environment with average annual temperature levels from 25 °C to 30 °C and humidity greater than 60% indoors in the evaluated industries. In contrast, the city of Mexicali was represented as an arid zone with average annual temperature levels of 35 °C to 40 °C and humidity of 50% to 60% maximum in the industrial plants where the research was made. Based on this, analysis activities, new designs and developments, and control of industrial operations were carried out, as mentioned below:

- Evaluation of industrial processes to improve productivity and quality indices.
- Development of improvements in each industry.
- Correlation analysis of the application of internal marketing and the productivity and quality indices.

In both cases, were made evaluations to improve the characteristics of the industrial processes.

3. RESULTS

An investigation was made to evaluate the generate the necessary improvements in the Covid 19 period, by the sanitary emergency, having a negative effect in the industry in each region of the world. By this reason, was made this scientific study to determine with the entrepreneurship and using the continuous improvement, the basic elements to work at distance or work the strict sanitary rules. This was necessary because in the world, was closed industries definitively by around a period of 9 months (from October 2020 to July 2021), and government institutions were closed from the begin of the pandemic in march of 2019 to the begin of the 2022 year. With this information was made this investigation to evaluate in ten industries of the Baja California State located in the northwest of Mexico, to determine the importance of the application of the entrepreneurship with the continuous improvement in some types of industries of three cities of this state of the Mexican Republic.

Analysis of the productivity and quality indices at the begin of the pandemic

This analysis shows the productivity and quality indices at the period of the begin of the pandemic (from January to June of 2019), observing that both parameters were increased or it kept, avoiding economic loses. The evaluation of this relevant factors to the industry, is represented in the table 1 of the ten industries, showing the type of industry.

Table 1. Analysis of productivity and quality indices (from January to June of 2019)

Parameters	Type of Industry	Productivity, %		Quality, %	
Industries		LLRHT	HLRHT	LLRHT	HLRHT
Industry 1-Ensenada	Metallic	74	67	76	64
Industry 2-Ensenada	Textile	71	65	75	66
Industry 1-Mexicali	Agricultural	75	64	74	68
Industry 2-Mexicali	Aerospace	77	68	78	65
Industry 3-Mexicali	Metallic	75	66	75	69
Industry 4-Mexicali	Paper	74	60	74	63
Industry 1-Tijuana	Aerospace	78	62	76	66
Industry 2-Tijuana	Biomedical	73	65	74	68
Industry 3-Tijuana	Electronics	76	63	77	65
Industry 4-Tijuana	Plastics	72	60	79	68

LLRHT. Low Level of Relative Humidity (RH) and Temperature (T) - (20% to 50% of RH and 20°C to 35°C of T) in indoors of the industries

HLRHT. High Level of Relative Humidity (RH) and Temperature (T) - (> 50% of RH and > 35°C of T) in indoors of the industries

Table 1 illustrates the productivity and quality indices when were evaluated both parameters in two climatic conditions represented in the lower section of the table with the standard values. In this table, was observed that in the periods with low level of relative humidity and temperature with the standard values; the productivity and quality levels were from 70% to 80%, and when the relative humidity and temperature were higher with the standard values; the productivity and quality levels were from 60% to 70% in the both parameters. Also was made an evaluation of the improvements considered to improve the productivity and quality levels, as is showed in table 2.

Table 2. Evaluation of productivity and quality indices (from July to December of 2019)

Parameters	Type of Industry	Type of Improvement	Productivity, %		Quality, %	
Industries			LLRHT	HLRHT	LLRHT	HLRHT
Industry 1-Ensenada	Metallic	IFSZ	85	70	86	77
Industry 2-Ensenada	Textile	IFSZ	83	73	85	78
Industry 1-Mexicali	Agricultural	CCCC, IFSZ	82	75	84	76
Industry 2-Mexicali	Aerospace	CCCC, IFSZ	89	79	87	79
Industry 3-Mexicali	Metallic	CCCC, IFSZ	86	77	86	75
Industry 4-Mexicali	Paper	CCCC, IFSZ	84	7	89	78
Industry 1-Tijuana	Aerospace	CCCC	85	74	88	77
Industry 2-Tijuana	Biomedical	CCCC	87	73	85	74
Industry 3-Tijuana	Electronics	CCCC	80	77	86	79
Industry 4-Tijuana	Plastics	CCCC	85	74	88	76

CCCC. Automatic Control at Distance of the Climatic Conditions by Computer Systems with Humidity and Temperature Sensors.

IFSZ. Installation of Fans in Strategic Zones with Control at Distance with Automatic Power on and off Control.

LLRHT. Low Level of Relative Humidity (RH) and Temperature (T) - (20% to 50% of RH and 20°C to 35°C of T) in indoors of the industries

HLRHT. High Level of Relative Humidity (RH) and Temperature (T) - (> 50% of RH and > 35°C of T) in indoors of the industries

Table 2 shows the productivity and quality indices whit the two climatic conditions mentioned above, where was observed after developed the improvement as an entrepreneurship, the productivity and quality parameters increased around in 10%, being illustrated in the periods with low level of relative humidity and temperature; with the productivity and quality levels were from 80% to 90%, and when the relative humidity and temperature were higher with; the productivity and quality levels were from 70% to 80% in the both parameters.

Evaluation of the improvements

In each industry, was made improvements in according to the necessity and was implemented some automatic systems with basic electronic components as transistor 2N2222, resistor 9.1 K Ω (Ohms) 1/4Watt, relay of 12 Volts-DC converted to 120 Volts AC and a rectifier diode 1N5560 with the sensor included in each improvement. This automatic system was designed and developed by the researchers of this investigation. The automatic system is showed now in figure 4, with the four steps, observing the process in each activity of the automatic system:



Figure 4. Steps of the automatic system

As is observed in figure 3, is illustrated the steps of the automatic system, where is represented the way to control some industrial process in the was made the investigation. The first step presents the power supply of 12 volts, where is provided to the transistor and resistor, which are provided to the relay and diode and function together the sensor that is activated in each action of any industrial processes. Also was made an analysis of the correlation of the productivity and quality indices with the climatic factors as relative humidity and temperature, which were presented low levels

before apply the improvements, and where was applied the improvements increased. This relation is illustrated is represented in figures 5 and 6; where was observed with the color levels, in according to the relative humidity levels. These analyses were made with the MATLAB software.

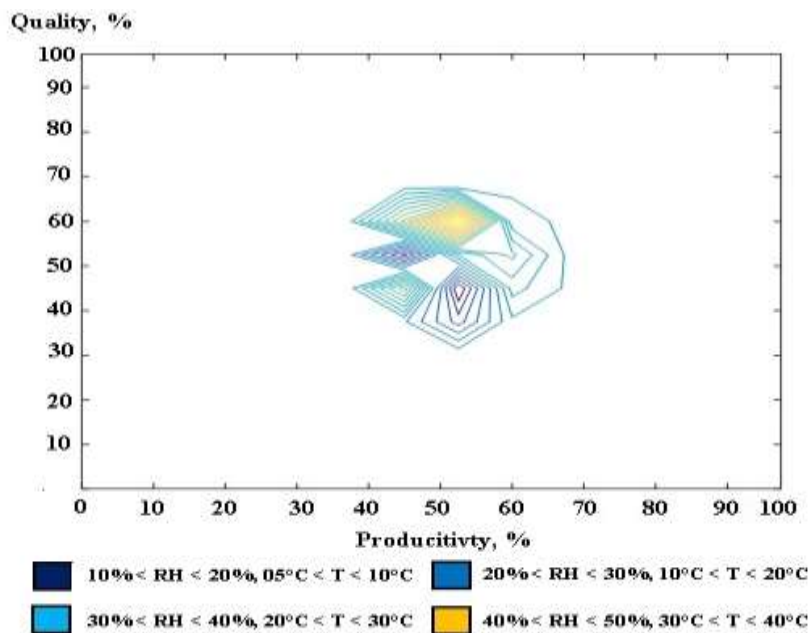


Figure 5. Correlation analysis of climatic factors and productivity and quality levels before the investigation

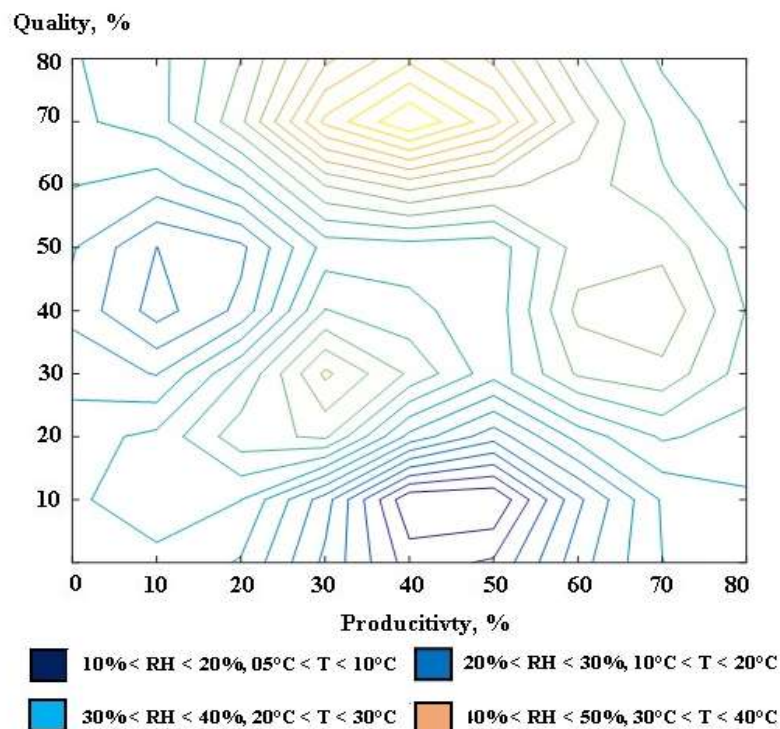


Figure 5. Correlation analysis of climatic factors and productivity and quality levels after the investigation

This analysis shows that in the different levels of the climatic factors mentioned, is the different color as diverse types of blue and orange in figure 5, represented the analysis before the investigation and figure 6 the analysis after the investigation, and the same colors of blue and light brown. In each figure is represented as lines the colors and interrelated between it, and illustrated the relation to understand the effect that have the climatic factors in the productivity and quality levels.

Correlation analysis of the internal marketing and productivity and quality indices

Was made an evaluation of the parameters mentioned to determine the impact of the application of the internal marketing strategies to convince to workers of manufacturing areas to make his operations with high quality and it

was reflected in the increase of the productivity and quality indices, as is mention in tables 3 and 4 as a comparative evaluation.

Table 3. Correlation analysis of the internal marketing and the productivity and quality indices, before the investigation

Parameters	Productivity, %		Quality, %	
Industries	LAP	LEP	LAQ	LEQ
Industry 1-Ensenada	68	69	60	60
Industry 2-Ensenada	66	63	68	66
Industry 1-Mexicali	69	62	69	63
Industry 2-Mexicali	66	60	66	66
Industry 3-Mexicali	67	66	67	62
Industry 4-Mexicali	65	64	63	63
Industry 1-Tijuana	66	65	66	64
Industry 2-Tijuana	68	66	64	66
Industry 3-Tijuana	69	66	66	66
Industry 4-Tijuana	64	64	65	67

LAP Level of Attitude of the workers of manufacturing areas of the ten industries related with the productivity

LEP Level of Effort of the workers of manufacturing areas of the ten industries related with the productivity

LAP Level of Attitude of the workers of manufacturing areas of the ten industries related with the quality

LEP Level of Effort of the workers of manufacturing areas of the ten industries related with the quality

Table 4. Correlation analysis of the internal marketing and the productivity and quality indices, after the investigation

Parameters	Productivity, %		Quality, %	
Industries	LAP	LEP	LAQ	LEQ
Industry 1-Ensenada	88	88	89	88
Industry 2-Ensenada	89	86	88	85
Industry 1-Mexicali	91	88	86	86
Industry 2-Mexicali	90	85	88	84
Industry 3-Mexicali	92	84	87	88
Industry 4-Mexicali	89	86	89	89
Industry 1-Tijuana	90	88	90	90
Industry 2-Tijuana	94	89	86	86
Industry 3-Tijuana	87	90	88	88
Industry 4-Tijuana	88	88	85	85

LAP Level of Attitude of the workers of manufacturing areas of the ten industries related with the productivity

LEP Level of Effort of the workers of manufacturing areas of the ten industries related with the productivity

LAP Level of Attitude of the workers of manufacturing areas of the ten industries related with the quality

LEP Level of Effort of the workers of manufacturing areas of the ten industries related with the quality

Tables 3 and 4 show the difference of work without the application of the internal marketing strategies and with the application, illustrating an increase in the attitude and effort of the workers of the manufacturing areas and with this the increase of the productivity and quality levels, obtaining economic gains.

4. CONCLUSIONS

The entrepreneurship is a relevant topic inspired in the continuous improvement in each industry of the world, where the analysis in every area o the manufacturing processes can be developed an improvement to increase the

productivity and quality indices. This is basic in the periods where is necessary take strict measures when occurs a complex event that was occurred with the Covid19 pandemic in the world, and the majorly of the industries was closed. The specialists of the continuous improvement, were inspired to create and developed each improvement in according to the necessity of each industrial operation in the manufacturing areas. This is very relevant the figures represent the way to understand if the climatic factors as relative humidity and temperature have a low- and high-level effect in the productivity and quality levels and the automatic system designed and developed by the researchers of this investigation, was have the control of this situation and others complicated situations in the industrial process. With this, is concluded entrepreneurship as continuous improvement in the manufacturing aeras of the industries evaluated in all type of industries in the world. The use of the internal marketing improved the attitude and effort of workers of the manufacturing areas and with this was increased the productivity and quality levels.

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