Strategic Job Families of the Textile Industry

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Abstract

Textile enterprises have complex production processes, where technical maintenance departments play a key role in order to achieve the optimal functioning of equipment and machinery. However, as industrial processes, they generate failures that affect production and have an impact on organizational performance. This paper is aimed at presenting a procedure for applying the Failure Mode and Effect Analysis FMEA, by specialized technicians, grouped under the principle of "strategic job families" in the industrial maintenance area of a textile enterprise. It is structured into three parts: a) a theoretical framework that deal with the concepts of critical processes, failure mode, and strategic jobs families; b) the peculiarities of the developed research methodology; and c) the exposition of the main results, which show the pertinence of the employed solution. The results achieved in the investigation showed that, applying the integration of sub-perspectives: Failure Mode and Strategic Jobs Families on the strategic map of the company, resultant hours of dea time in 2015 were 40% lower than in 2012.

Key Words: *Organizational Development, Strategic Maps, Critical Processes, Failure Mode, Balanced Scorecard.*

Introduction

Technical maintenance areas play a key role in industrial processes because, keeping the equipment and machinery available, improves productivity and efficiency to reach planned objectives, costs are reduced and dead time eliminated, resulting ultimately to an improvement in product quality. Troffe (2007: 12) states that:

"Overall, the importance of measuring results, as well as centralized data registration and management is not recognized in technical maintenance. The lack of continued use of records, makes it impossible to establish mechanisms for comparison of indicators with those of world class procedures. Hence lack of rigor in the collection and recording of data to feed these calculations is perceived; key elements for management and decision making. "

Industries employ the most advanced process management procedures identified as Failure Mode and Effect Analysis (FMEA), for the planning and execution of maintenance. This is a procedure that by risk analysis, predicts a possible failure in the production environment, it can be eliminated through proper maintenance with a corrective, preventive, and even predictive as certain situations generally require complementary actions.

The grouping of specialized personnel under the concept of Strategic Job Families (SJF) is a relatively extensive approach, and to apply the FMEA to SJF, is so far, poorly referenced in scientific research. That is why the combination of both methods opens an alternative for obtaining more effective critical incidents that often occur in industry solutions. For these reasons, the aim of this paper is to present a method for applying the FMEA by specialized technicians, grouped under the principles of "strategic jobs families" in the area of industrial management, specifically the textile industry.

The theoretical analysis of this study addresses the key issues related to the concepts of fault mode, the families of strategic jobs and processes and critical incidents that are generated in industrial processes. This enabled the basis of the partial result of developing a strategy and implementing a comprehensive organizational system for maintenance management, in order to improve profitability and organizational performance in the textile industry.

This work is divided into three parts. It starts with the theoretical framework that supports the main concepts and approaches associated with the problem investigated. Then the methodology of the research, which is characterized by a mixed qualitative and quantitative approach, with the participation of experts from the Mexican textile industry, and the application of the Delphi method is presented. Finally, fundamental research results are presented where the solution used are geared towards the alignment of processes and critical failures with the families of strategic jobs and their influences in reducing dead time.

Literature Review

Processes and Critical Incidents

The perspective of internal processes in the Strategic Map of the Balanced Scorecard. Kaplan and Norton, (2004: 438), identifies the few critical processes that are expected to have the greatest impact on the strategy and urges the need to pay close attention to these processes of teamwork and learning. These critical processes, once aligned with financial and customer goals are those which generate the greatest impact on the organization.

Huxley (2003: 140), defines critical processes as those "which make the greatest impact on achieving the strategic objectives of the organization." Meanwhile, the Business Dictionary (2016), defines critical process as a "business process that must be restored immediately after an interruption to ensure the ability of the affected company as well as protect its assets, essential needs to meet the requirements and mandatory rules.

Maldonado (2007), presents a case study in the meat products industry, which concerns the use of various quality tools, among those which the FMEA addresses the problems of tolerance in order to identify the causes of failures and its relationship with the most critical components and processes that generate deviations.

In a comprehensive study on critical processes in SMEs in Colombia, Aguirre (2008) notes that the most critical processes are those related to the functions of Production/Operations, Financial/Accounting, Marketing and Sales, Post Sales Service and Quality Management.

Although in another setting, but with a close critical process approach, Flanagan (1954) introduced the concept of critical incident as another way to focus on the determination of requirements and customer needs. This approach has been used by Latham & Saari (1980) to assess the dimensions of the performance, when they say that situational interview is based on a systematic analysis of the job known as 'critical-incident technique', and is not only applicable to the development of questionnaires for customer satisfaction, but it is also valuable for any analysis of the business process, where companies pursue to define and understand the demands and needs of their customers.

According to Benatuil (2005), the critical incident describes a behavior and its consequences, it places it as the setting in which this occurs and detects it based on work situations whether behaviors are effective or not. Thus, the critical incident approach identifies specific examples of actions that illustrate the organizational action in relation to the services or products provided. It is however, consequent that these incidents tend to define specific performance of staff in service companies, while in the case of industrial enterprises, they define product quality, which is the area in which this study is developed.

Failure Generated in Critical Processes.

Failure Modes, Effects and Criticality Analysis (FMECA) was developed by NASA (Jordan, 1972), who explains that this procedure is a means to ensure that the equipment built for space applications possesses the desired characteristics of reliability. Failure Mode and Effect Analysis (FMEA) is a qualitative technique of reliability, designed to analyze every possible mode of failure within the system of an equipment and identify its effect on the system, its function and staff responsible. The criticality analysis is a quantitative method that classifies critical failure modes according to their probability of occurrence.

The basis of this procedure is on the topic of technology management, identified as Failure Mode and Effect Analysis (FMEA) for maintenance planning. It consists of a risk analysis that predicts a possible failure, which can be eliminated through proper maintenance process with a corrective, preventive and even predictive approach since certain faults generally require complementary actions.

Aguilar-Otero (2010: 15), defines a failure mode as "the way in which an asset loses its ability to perform its function", stating the state of failure as "functional failure". This failure may have two categories: the equipment simply stops working or the manufacturing team does not perform greatly. Failure modes defined in ISO 14224: 2006, updated in 2010, can be used as a "reliable reference" for various applications, both quantitative and qualitative. About the referred norm, Troffe (2007: 14) states that:

"If the standard failure mode is identified from the beginning for each type of equipment defined under a specific operational criterion, where systems and subsystems are listed as well as components (maintainable items), causes of failures and failure descriptors, and they go through systematically in this sequence, there can hardly be any alleged failure affecting the functions of the team."

The procedure Failure Mode and Effect Analysis (FMEA) in this study is expanded into the procedure identified as Failure Modes, Effects and Criticality Analysis (FMECA), incorporating critical analysis that can predict the probability of failure and relate it to the severity of the consequences; should such failure occur.

Aguilar-Otero (2010: 15) further notes:

"The FMECA also allows the optimization of resources, as maintenance planning is now focused on the failure modes derived from a functional analysis and not focused on equipment, i.e., the plan is realized by failure mode, not due to equipment. The incorporation of risk criteria and reliability maintenance planning is a global trend, which not only requires the incorporation of new technologies in the maintenance process itself but in planning it. "

Therefore, the act of technicians from the recommendations derived from FMECA, are included as components and activities of the maintenance plan that takes into account, the effects that can occur in people, production, installation processes and the environment.

Braglia (2000) addresses the topic of Failure Analysis, explaining that its aim is to develop a new tool for the analysis of reliability and failure mode, integrating conventional aspects of the procedure Failure Modes, Effects and Criticality Analysis (FMECA) with economic considerations. Here, the FMECA is approached as an art-making multicriteria decisions that integrates four different factors: Possibility of failures, Opportunity detection, severity and expected cost. Supporting this integration perspective, Krishnasamy (2005), referring to the Risk Based Monitoring (RBM), said that the dead time associated with lost production generates failures and high maintenance costs and causes major problems in any part of the process.

To help the analyst to formulate a ranking of efficient and effective priority of the possible causes of the failure, Braglia (2000) adopts the technique of analytic hierarchy process. On this technique, factors and alternative fault causes are arranged in hierarchical structures, evaluated only by using a series of peer reviews.

Hayakawa (2015), reports that although the FMEA is a useful and powerful method to assess the level of risk of failure modes, it also has the weakness of not taking into account, the three factors (Severity "S"; Occurrence "O" and Opportunity of detection "D"); having different levels of importance and therefore it is wrong to calculate Risk Priority Number (RPN) by the product of these three factors (NPR = S x O x D). According to the author, this is its greatest weakness, since failure is as indispensable as the consistency analysis, and therefore proposes a method using weighted sums from expert opinion, that weighs each of the three factors of the fault, using the analytic hierarchy process and warns that, like any process that support decision-making, they only point out options, but the final decision always rests with the decision maker.

Braglia (2003) uses the theory of fuzzy logic for evaluating values of concise failures in terms of three parameters of FMECA, e.g. chances of failure, probability of undetection and severity. Meanwhile, Hernandez (2015: 8) also applies fuzzy logic to analyze failures in a steam boiler, taking as data, the values for normal operation variables of the plant and used as a source of information; failures historical data, informal interviews with experts, brainstorming and video conferences, concluding that this would "increase profits through accurate selection of reliability studies."

The authors of this article believe that the process of capturing information about failures from only the expert judgment without analyzing other sources of information, can lead to lack of reliability and validity of data input to apply procedures of fuzzy logic. Instead, it supports Hernandez (2015) on the use of multiple sources of information to evaluate the failure, especially data values from operating in a real environment.

Strategic Job Families

The first use of the term "professional family" is at the National Employment Institute of Spain (INEM, 1995), during job analysis, the first thing you should do is to "establish the occupational structure of the professional family." Tejada (2005: 31) recommends the need to" know the business organization and labor relations that occur in each professional family. "

Meanwhile, CONOCER (2010), analyzes that the various methods of occupational analysis "are intended to identify occupational contents and facilitate the description of the skills required to perform an occupation". It realizes also that many of the activities of human resource management (recruitment, promotion, compensation, training, certification, evaluation) should be made based on this analysis. In this regard, it is noted that "the breaking of the traditional tendency to develop occupational level job descriptions, has provided a new option to classify and describe occupations from occupational areas. These are general groupings of related occupations that share technical and scientific principles or sectoral areas where the work is done "(CONOCER, 1997).

Kaplan and Norton (2004:263) defined the requirements of these positions in some details, noting that it is "a task that is often referred to as the determination of the job profile or competence profile. This profile describes the knowledge, skills and values that people need to successfully occupy a certain job. "The authors referred to the company 'Williams-Sonoma' and estimated that people of only five families of jobs determined 80 percent of the strategic priorities of the company. They also noted that in UNICCO, with 6,000 workers, "families of jobs for project managers, operations managers and executives from business development have 215 employees representing 4% of the workforce" (Kaplan & Norton, 2004: 270). Another illustrative case of interest mentioned by the authors is the company Chemico, Inc., which in its Strategic Map reflects a direct relationship between the families of strategic jobs and perspective of internal processes. This company created eight families of strategic positions shaped jobs for about 100 people (7 percent of the total of more than 1000 employees).

Guitar (2009), who worked for ten years with Norton and Kaplan and currently has a consulting firm for the Balanced Scorecard (BSC), analyzes the process of creation of the Strategic Job Family based on drawn a strategic goal: "Develop strategic skills, starting with identifying strategic job families ", while" strategic job families are identified by focusing on strategic issues of internal processes. "

Another approach is provided by Job Evaluation Manager (JEM), that integrates the best practices developed by Hay Group (2008) into a web solution. This solution helps the evaluation process and job classification to be agile and efficient. It works by following a procedure that involves several steps: Describe positions; assess and classify positions; Saving and sharing information; manage all related processes; and produce the final report. This procedure has the limitation -for this particular study- that has not explicitly defined the concept of "job family", although the process for the description therefore is appropriate according to the authors of this work.

Kaplan and Norton (2004: 245) noted that "the availability of the intangible asset of human capital is a necessary condition, but not sufficient, for strategic success." Consequently, it is understood that it is not enough to have a good team if it is not aligned with the strategies of the organization and have the ability to identify critical processes (within the perspective of internal processes of the Balanced Scorecard), whose solution allows the company to achieve the results committed to customers and shareholders. Thus, they reinforced the need for intangible assets to align with the internal processes of the organization. One of the solutions found by Kaplan and Norton (2004: 249) to "connect" or establish a bridge between the strategic map and intangible assets, involves the identification of "families of strategic jobs" from the perspective of internal processes, since to create them the company achieves a greater impact on their results. This is a very significant contribution of Kaplan and Norton's theory, which in the opinion of the authors of this paper, represents the base on the way this research is addressed.

Research Questions

The following null hypotheses were formulated based on the review of related lierature

H_{01} There are no significant differences between the hours of dead time in the mechanical maintenance of 2012 and 2015 in the ring spinning process.

H_{02} There are no significant differences between the hours of dead time in electrical maintenance in 2012 and 2015 in the ring spinning process.

Methodology

The first objective of the research was to determine the critical processes of the textile industry. An investigation of qualitative and quantitative nature was carried out with the participation of experts, six Plant Engineers in the Textile Industries of Mexico as well as direct engineers in the production unit of a large Mexican textile plant, all of them with over 20 years of work experience, making a total of eleven experts. For data collection, we created an instrument following the design proposed by Velez-Pareja (2003), while the procedure for processing used was the one developed by Cuesta (2001), both based on the Delphi method of several rounds.

The second objective of the study was to describe the procedure for determining the failures that occur in critical processes. For the analysis of information, the historical data of failures were collected from the measurement processes designed by the Quality Management System of the companies used. This approach is compatible with the ISO / TS 16949: 2002 standard. A similar method applied is contained in Hernandez (2015: 8).

The third objective was the establishment of a procedure to create Strategic Job Families (SJF), based mainly on the history of failures and the opinion of experts in the area of industrial processes, following the approach of Kaplan and Norton (2004), where more specialized personnel is responsible for making more complex decisions.

The fourth objective the study was to evaluate the influence of the alignment of processes and critical failures with the families of strategic jobs. We decided to use the method of comparing the hours of dead time lost in the mechanical and electrical maintenance on Open End Yarn during 2012, before the implementation of these results, in 2015, after putting them into practice. For this, the assumptions were made:

To test the hypothesis t-test for independent samples with equal variances, Levene statistic and the "t" test of equality of means was employed. It was assumed that if the value of "p" (statistical significance) is greater than 0.05 there is sufficient evidence to reject the hypothesis H_0 and therefore no significant differences when comparing the results of dead time of the year 2012 with 2015.

Analysis

To fulfill the first objective of this research a list of processes in the textile industry were sent to the experts, asking them to identify those which were considered critical in areas directly linked to the production process. Consequently, it was beginning an exercise following the procedures of Delphi method. From the responses of the first round, the processes with a 70% of coincidences were selected, in the second round the experts expressed their decision.

For the final selection of critical processes, Coefficient of Concordance was calculated between experts following the proposal of Cuesta (2001):

$$Cc = (1-Vn/Vt)*100,$$

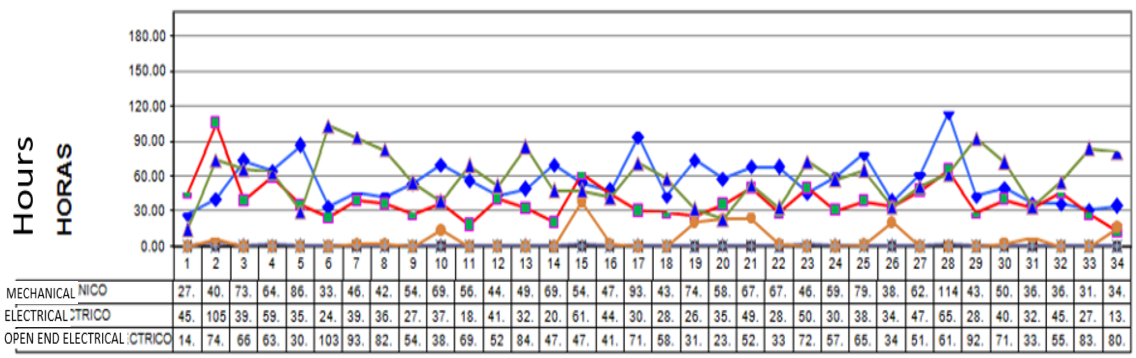
Where:

CC= Coefficient of concordance
Vn= Number of experts disagree with the prevailing view.
Vt= Total number of experts

At the final consensus, the experts identified seven critical processes in the Textile Industry, as 1.Ring Spinning, Open End. 2. Warping. 3. Dyeing. 4. Fold. 5. Gumming. 6. Looms. 7. Finishing.

To fulfil the second objective, we set the measuring process which records the type of failure and dead hours, which are generated every week of the year. Figure 1 shows, as an illustrative example of hours of dead time over 34 weeks of the year 2015, in the critical area called Ring Spinning Process, Open End, were produced by electrical and mechanical failures. The industry employs for this control the Minitab statistical software, which provides graphical range, point clouds, bias and repeatability analysis, among other factors.

Figure (1) Hours of dead time



Source: MINITAB Graphics employing Textile taken as a basis for this work

From this database, a record (see table 1) containing the key aspects of FMEA that characterize that failure was created:

1. Critical Process.
2. The role of product assets, in collecting and identifying the production function and their related/expected faults.
3. Causes of the failure mode, which identifies the cause of the active fault, with a corresponding mitigation or preventive action.
4. Consequence and effect of the failure, that is, how the flaw affects people, the environment and production.
5. Prioritization of risk, which has to do with how often they occur and finally.
6. Alternative technological solutions were applied, in the style of a "thesaurus solutions".

Table (1) Analysis Methodology Failure Modes and Effects

*	Critical Process (CP)	Function	Failure Mode	Consequence	Hierarchy of the risk	Alternative technological solutions
			Causes	Effects		
	CP 1					
	CP “n”					

Source: Compiled from original Aguilar Otero (2010:18)

To fulfill the third objective of this research, Kaplan and Norton’s recommendations were followed (2004: 267-294) for the creation of strategic jobs families, which were related to the prevalence of the manager or executive as the person with the greater authority who decides on which families should occupy the key positions.

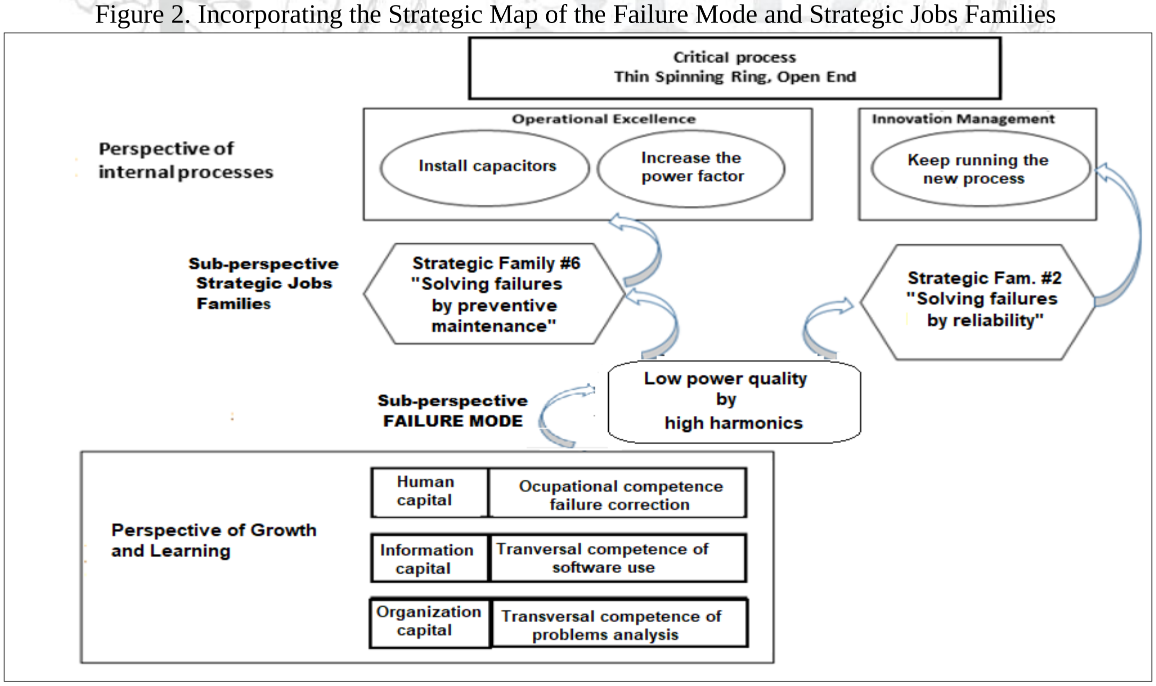
For the purpose of this study, one of the authors who is also the Chief Engineer in one of the Industries used in the study, developed a process of interaction and exchange of information with a group of experts from the textile industry and other experienced workers during the first half of 2013, where he held multiple job interviews with the goal of selecting the Strategic Job Families, mainly based on fault history.

It should be noted that the above-mentioned procedure is an original element of this investigation, never before mentioned in the literature, that provides managers a basis of making important decisions, which in this case indicates what they are (Strategic jobs) and how to integrate the strategic jobs families that will work to prevent, mitigate or eliminate failures that occur in the critical processes Industry.

Therefore, the work of identifying the families of jobs is not completed from "desk" or in one working session with experts. The reason why it was termed "families" is due to a related to the improvement of organizational performance through the introduction of new, more efficient and modern strategy in the production process technology, which required the acquisition of new skills and identification of more complex jobs that solved almost 80% of the technical problems that occurred and that were linked directly with the financial perspective of the plant. Thus, six families were identified for Strategic Posts: FPE 1. Failure Solutions by Maintenance Control; FPE 2. Failure Solutions by Electric Reliability; FPE 3. Failure Solutions through preventive maintenance; FPE 4. Failure Solutions through Reliability Electronics; FPE 5. Failure Solutions through Reliability Instrumentation; and FPE 6. Failure Solutions through Predictive Maintenance.

Figure 2 shows a sector of the Strategic Map, which integrated two sub-perspectives within the Perspective of Internal Processes: Sub-Perspective Failure Mode and Sub-Perspective Family of Strategic Posts (FPES), considering the impact of the same results perspective as such. This incorporation is crucial to outline the course of action to mitigate the failure and the cause-effect relationship between the two sub-perspectives and internal processes perspective, from a failure in the critical process identified as Ring Spinning Process, Open End.

Figure 2. Incorporating the Strategic Map of the Failure Mode and Strategic Jobs Families



Source: Prepared by researcher

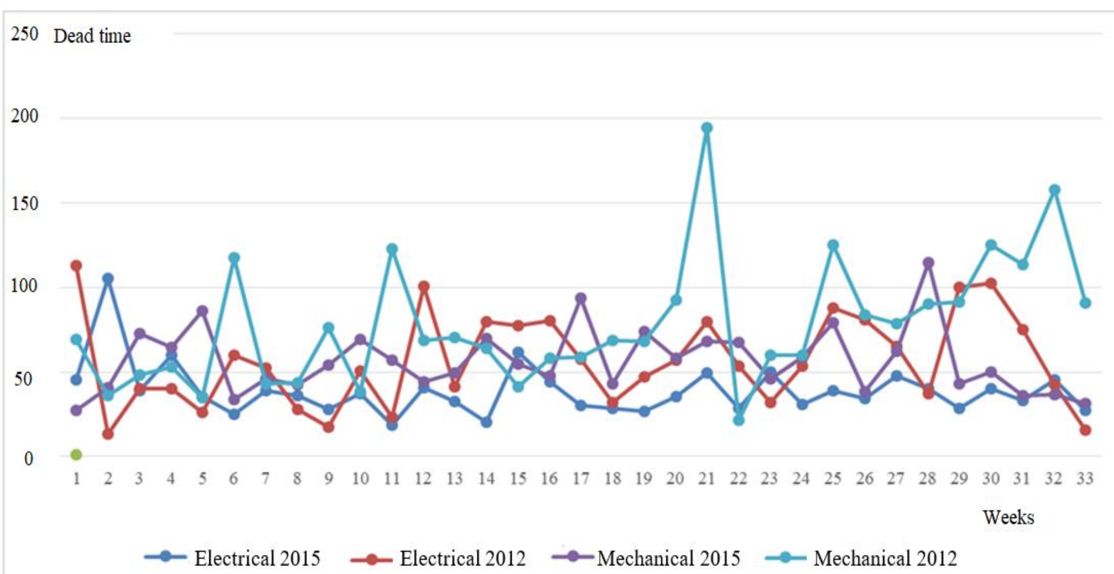
Thus, the inclusion of the two sub-perspectives above aligns the perspective of Growth and Learning of internal processes under the strategic map of the organization through the use of the variables: 'Failure Mode' and 'FPES', in order to maintain the running critical process identified as Ring Spinning. In this case, it is a failure detected in the framework of the Electric Reliability for Preventive Maintenance. That is why it is eliminated by the FPES act #2: Solving failure by reliability and #6 Solving Failure by Preventive Maintenance.

As a result of the inclusion of these two sub-perspectives on the strategic map of the company, the performance of the members of the FPES managed to increase the power factor to 99% and continued running this process in accordance with the provisions of the Perspective of Internal Process. All this was possible because these technicians were previously trained in internal labor competition in this industry, identified as fault correction and transversal skills, which is associated with the use of Software and Problem Analysis, as presented in the perspective of growth and learning (Figure 2). For the identification and validation of skills, they must master, technicians, ensure that the inclusion of sub-perspectives mentioned in the strategic map of the organization is beyond the scope of this work and are part of the heritage of tacit and explicit knowledge of this industry in particular.

Discussion

For the verification of the hypothesis data, the hours of dead time recorded during 33 weeks of the year 2012 and the same 33 weeks of 2015 were used. Figure 3, shows the hours of dead time (the ordinate-axis) against 33 weeks of the study (the abscissa axis). However, only the critical process data of Ring Spinning Process, Open End are displayed, both under electrical and mechanical maintenance.

Figure 3. Comparative dead time 2015 VS 2012. Mechanical and Electrical



Source: MINITAB Graphics employing Textile taken as a basis for this work

Table 3 shows that both the averages and standard deviations of dead time of 2015 are much lower when compared to 2012 values, which is a sign of better performance after implementing the alignment of processes - failures – FPES

Table (3) Averages and standard deviations 2015 VS 2012 Statistical Group

Comparatives		N	Average	Standard Deviation	Standard error of the average
Electrical	Year 2015	33	38,97	15,543	2,706
	Year 2012	33	56,50	27,315	4,755
Mechanical	Year 2015	33	56,43	19,33	3,36
	Year 2012	33	77,81	37,72	6,57

Source: Prepared by researcher.

However, the best results are shown in table 3, derived from the H_{01} Hypothesis and the H_{02}. The results of the application of statistical data showed significant differences as shown in Tables 4 and 5.

Table (4) Statistical verification of the significant differences between dead time by Electrical Factors in 2015 and 2012

Independent Samples Test										
		Equal Variances		T test for the average equality						
		F	Sig.	t	gl	Sig.	Difference between average	Typical error of the difference	95% confidence interval: Lower	95% confidence interval: Superior
Electric. 2015 VS 2012	Have been assumed equal variances	14,18	,000	-3,204	64	,002	-17,530	5,471	-28,459	-6,601
	Have not been assumed equal variances			-3,204	50,75	,002	-17,530	5,471	-28,515	-6,546

Source: Prepared by researcher.

The table shows the two possible conditions in relation to equality of variance, and the equality of averages. On the part of the variance, Levene statistic assumes the value of F = 14.182 and p (statistical significance) value 0.00. This means not assuming equal variances of the two samples (Electrical Factors Dead time by 2015 versus 2012), since the 0.00 significance value <0.01.

Regarding equality of means, the value of "t" is -3.204 and significance value is 0,002. So the not equal means, 0.002 <0.01 is also checked. It also shows the confidence interval that allows us to accept this contrast, since the mean difference -17.530 is within the confidence interval (-6.601 -28.459 and). From both results, not equal variances as non-equal means, it is concluded that there is sufficient evidence to reject H_{01} demonstrating significant differences between dead times in 2015 and 2012 in the maintenance related to electrical failures in the ring spinning process.

Table (5) Statistical verification of the significant differences between dead time by Mechanical Factors in 2015 and 2012

Independent Samples Test										
		Equal Variances		T test for the average equality						
		F	Sig.	t	gl	Sig.	Difference between average	Typical error of the difference	95% confidence interval	
									Lower	Superior
Mechanical 2015 VS 2012	Have been assumed equal variances	8,385	,005	-2,898	64	,005	-21,377	7,378	-36,11	-6,638
	Have not been assumed equal variances			-2,898	47,7	,006	-21,377	7,378	-36,21	-6,541

Source: Prepared by researcher.

At the time an interpretation is executed in a similar way to the dead times by electrical factors interpretation, it was concluded that, equally, there is sufficient evidence to reject the H_{02}, since both are of equal variances with the Levene test as well as equality of averages-tested "t", where the p value is less than 0.01. Likewise, confidence intervals are within accepted values. We concluded, then, that there is sufficient evidence to reject H_{02}, showing significant differences between dead time in 2015 and 2012 in the maintenance related to mechanical failures in the ring spinning process.

Conclusions

In this work, we started from the principle that all organizations' positions are important, and impact to a greater or lesser extent, the performance of the organization. However, there are specific jobs that have a major impact on the strategy of maintaining the critical internal processes, which in the case of this study is targeted exclusively at the production area, considering the sector under study without incidents. These strategic positions are grouped in what is known as Strategic Jobs Families (SJF), generally grouped never more than 15% of the positions in the organization. In the case of this study, these families grouped 14% of the technicians dedicated to the industrial maintenance.

The design process of the SJF was accompanied by a link to improve organizational performance through the introduction of a new, more efficient and modern strategy in the production process technology, which required the acquisition of new skills and the necessary identification of positions, they solve more complex and almost 80% of the technical problems that occur and were linked directly with the Financial Perspective Balanced Scorecard. This is why this study is framed within the field of technology management.

In practice, the viability of integrating, original and effectively Methodology Analysis Failure Modes and Effects with the concept of job families have demonstrated strategic positions. The results achieved in the investigation showed that applying the integration of sub-perspectives: Failure Mode and Strategic Jobs Families on the strategic map of the company, the resultant hours of dead time in 2015 were 40% lower than in 2012. In this industry has not only managed to prevent, predict and mitigate the flaw, but also have enough evidence on equipment, parts and components that are coming to a lifecycle end and to have a planning process for the replacement or modernization, joined with the re-training and updating skills of their operators in order to maintain minimum levels of failures in all processes.

This research encourages the necessary standardization of a process that starts with the query of failure history then the analysis of its causes and consequences, hierarchy of risk and technological solutions that achieve the mitigating, elimination and prevention of failure. As in any industrial process, well-structured phenomena are generated cyclically and these cycles can be studied and structured.

The process of consulting experts directly related to production is another originality of the research, it can be used as a reference to similar situations in which it is necessary to identify the key issues affecting production and counteract their harmful consequences.

Managers of companies must develop the organizational capital, understood as the ability of the organization to mobilize and support change processes required to support the strategy. The authors of this paper believe that the organization of capital provides integration capabilities for intangible assets of human capital and information, as well as the tangible physical and financial assets which are not only aligned with the strategy but also integrated and working together, in order to achieve the strategic objectives of the organization. Such alignment and its impact on organizational performance results have been found in this research.

From both the results of non-equal variances and non-equal means, it is concluded that there is sufficient evidence to prove the existence of significant differences between timeouts of 2015 and 2012 related to the maintenance of electrical and mechanical failures. It also identified in the critical process of ring spinning, demonstrating the influence of assigning strategic jobs families in the analysis of failure modes and effects. Finally, it showed differences in other critical processes outputs from the scope of this article, although it was shown that in all processes, there was a significant decrease in dead time influenced by the results of this research.

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