



Formulation of Strategies for the Implementation of Integral Management System Based on ISO 9001:2015 and 14001:2015 in the Company Surtiapiques (Bogotá-Colombia)

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Surtiapiques is a Company of the metalworking sector, in this contribution the design of an Integral Management System (IMS) is proposed, employing the Quality Management ISO 9001:2015, emphasizing in tracing and measurement of process, and customer satisfaction; the needed improvements were determined to increase environmental performance, applying Cleaner Production tools (CP) and the standard ISO 14001:2015. This will allow the growth of the company in the industrial sector, contributing to sustainable development. Designed solutions were based on the analysis and operational development, using qualitative, quantitative, and statistical methods, which were inputs for the documental design of the Management System, which pretends standardize processes and increases the effectiveness of business management. In the operational development phase, of quality management, the technical specifications of the products, process sheets and the control charts were built; in so far as an environmental performance, the main aspects and impacts of the company were analyzed, as well as the analysis of occupational risk and strategies for the sustainable management of natural resources, using matrices to assess environmental aspects and Eco-balances and life cycle analysis.

1. Introduction

Small companies in the metal-mechanic sector are numerous in the Colombian productive sector, which is why they deserve to be strengthened, applying strategic management, in order to extend its production, making efficient use of its resources and at the same time fulfilling the expectations of the stakeholders. One of the business tools that allow these results is the implementation of Quality Management System, Environmental Safety, and Occupational Health, because of its process approach, it allows to organize strategic objectives that improve the efficiency and effectiveness of the companies (Carmona., et al, 2016).

The Management standards ISO 9001:2015 and ISO 14001:2015 are voluntary application, however, companies that want to standardize their process, improve and demonstrate the quality of their products or services. To apply good manufacturing practices, retain important customers, comply with the legal requirements, should apply eco-efficient production methods, through a preventive approach (Van Hoof., et al, 2008), which brings tangible and environmental economics benefits, producing more quantities with fewer resources, are some reasons why companies are motivated to implement IMS.

Regarding Colombian companies, according to ISO Org. data (2015), the country is the second in Latin America with organizations certified in Management Systems ISO 9001 and 14001, meanwhile, on a global basis, it maintains the position 12 and 18 respectively. According to Fresner & Engelhardt (2004), an Integrated Quality Systems (IQS) is a key element for the success of innovative companies, since they are the basis of the Sustainable Development strategies, of them.

The purpose of the investigation was to develop an Integrate, Environmental Quality Management System, for the Surtiapiques Company, for which it was necessary to diagnose the production process and define the basic environmental function of the company, in order to formulate cleaner production strategies; furthermore, the management strategies of occupational health and safety were determined (Motawa., et.al. 2007).

All the above were made with the purpose of achieving a change of business culture in Surtiapiques. According with (Deming, 1989), processes must be aligned with the strategic platform of the organizations and improve the quality of the company, with commitment and management leadership, for the accomplishment of the business objectives as purposed by Juran (Gutiérrez, 2005).

Surtiapiques Company, in recent years, has been losing market share, important customers and therefore it has economic losses, in part, for not having an articulated management of the company's strategy, not following its processes and not formulating improvement actions.

Hence, given the needs of customers and the internal and external stakeholders, strategic objectives have been formulated for each process, allowing the measurement and monitoring of them, (Ríos, 2014). In addition, awareness off the staff is an important aspect for the management system implementation proposed (Fernández, 2006). Integral solutions were designed, applying the continuous improvement cycle, and applied to the modules of the IMS for the Surtiapiques Company (Pardo, 2012).

2. Materials and methods

The investigation was accomplished in several stages. The diagnosis of the Company was initially made focused in the establishment of the quality, environmental, and health and safety at work variables in the business, as well as compliance of the legal requirements. For which, checklists, matrices, surveys applied to staff were used, as well as recognition of the works areas in the routes inside the company, allowed to detail the product quality, the care for the environmental and Health and Safety of the employees.

Based on the diagnostic tools developments, the stage of operational development began, in which the technical specifications of the products, process sheets and quality control charts were designed. As to environmental component, the aspects and impacts were evaluated; following Batlle Collumbs methodologies and strategies were generated for the sustainable use of natural resources, applying PML tools, Ecomaps, Eco-balance, MED matrix, inefficiency costs, and life cycles analysis, among others. Subsequently, an analysis of occupational hazards was achieved, using the GTC 45 methodology. Later, the mechanisms for controlling the risk evaluated for the management of Health and Safety at work management were establish.

In the final stage the documented information of the Integrated Management System for the company Surtiapiques, as well as formulation of the management, indicators necessary for the follow up and measure with the purpose of formulating the necessary corrective actions in the organization, were established

3. Results and Analysis

Basic quality control tools were applied, Ishikawa and Pareto diagrams, (Fernandez, 2006), which allowed to determine that the Surtiapiques company had a basic level regarding their business management. It was noticed that two of the most important root causes of not complying comprise the 76.91 % of the total causes. According to the Pareto principle, it is established, that if the lack of knowledge of the standard and the absence of strategic planning in the company is improved, it would allow to correct the integral management of the Surtiapiques Company.

In the Figure 1 is represented the proposed process map for the company, implemented following the "three types model". (Rios, 2014)

With the application of technical and process sheets, a study of methods and times of the productive process of the company was conducted. The results are observed in the Table 1. Based on these results, it is analyzed the opportunity of improvement to reduce time and increase the production capacity, whereby the "Reduction of production times" program is generated.

Table 1: Production times.

Product	Units	Quantity	Time	Units average
Bars	Unit	1	9:34 min	290 units/week
Pinions	Unit	1	1:02 min	2790 units/week

Given that one of the aspects articulated in the quality and environmental management, is the Occupational Health and Safety (OH&S), some aspects were analyzed. The company did not have with an OH&S management system, because of this the "Vigía SST" program is proposed, identifying the occupational hazards to which workers are exposed, applying the hazard assessment matrix: GTC 45 (Figure 2).

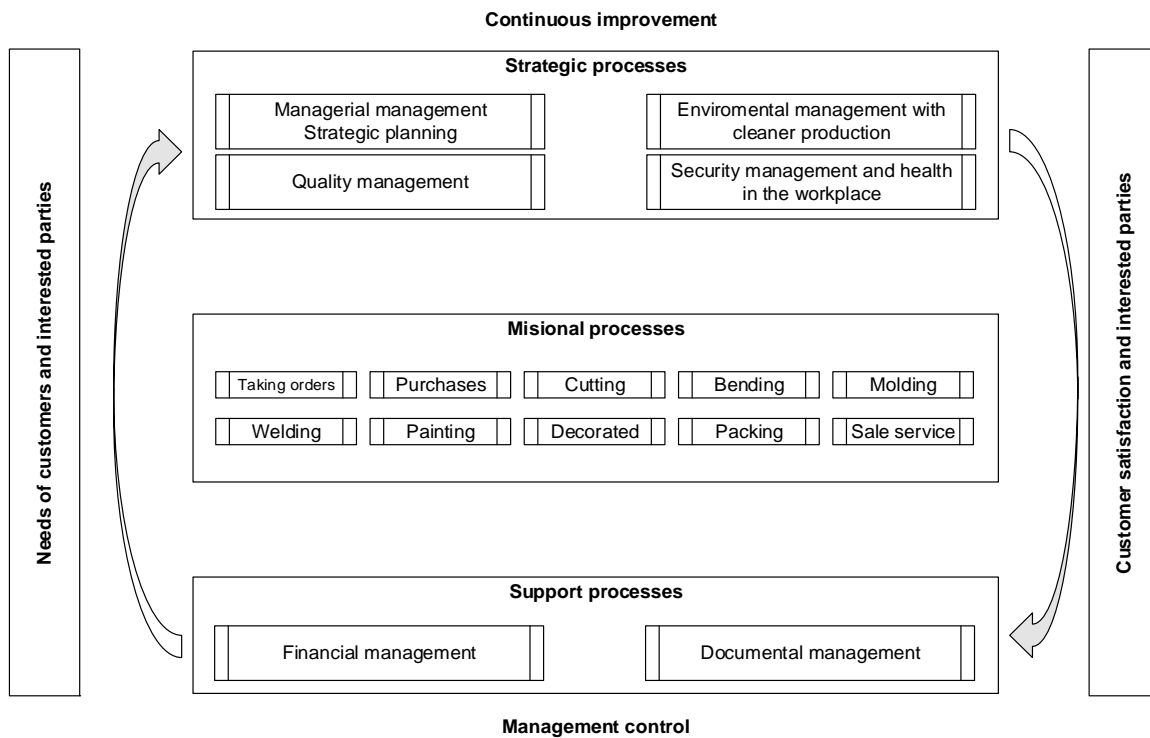


Figure 1: Surtipliques process map.

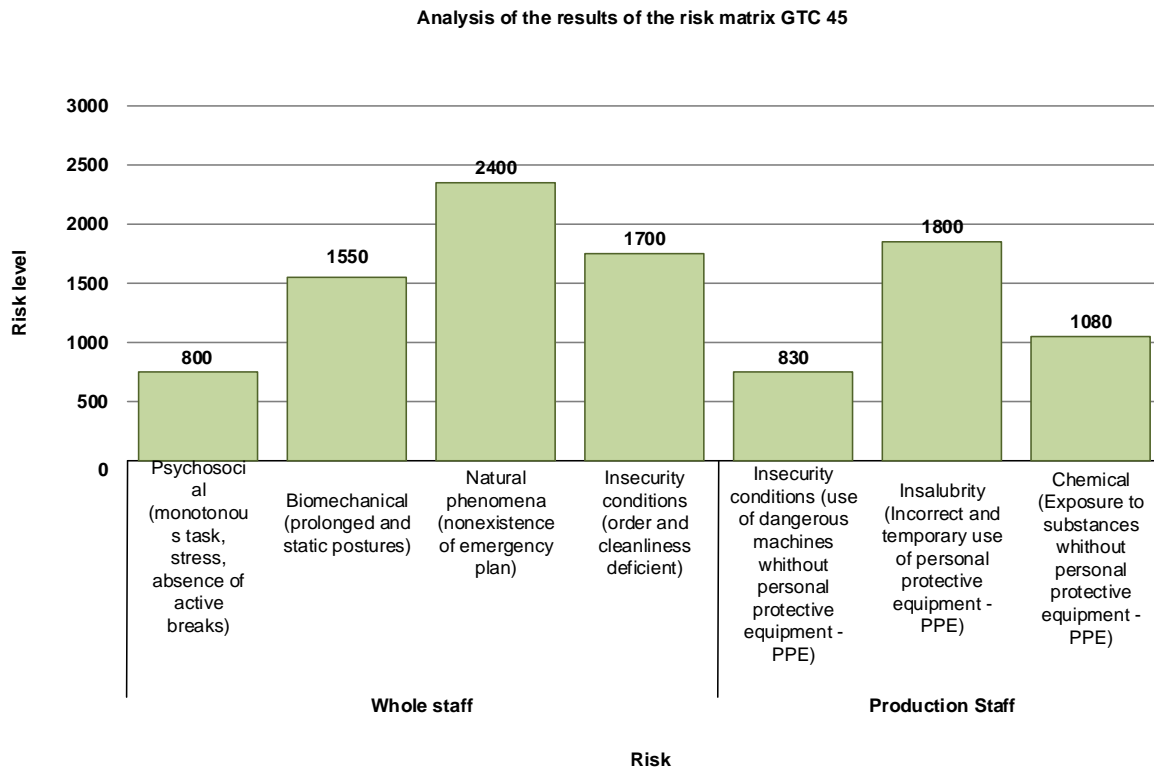


Figure 2: Analysis of the GTC 45 matrix result.

From these assessments, it was determined that in the acceptable risks, it is found: physical risk generated by the machinery and equipment, due to proper hearing protection equipment, the exposure of gases and chemical vapors, which is mitigated by a gas extraction system, and the handling of heavy loads, which are minimized by practicing ergonomics posture.

In the unacceptable hazards, manifested in the production process, a factor which increments the hazard evidenced in the incorrect use or non-existence of individual protective elements, necessary to handle dangerous machinery and chemical substances. To correct these non-conformances, an "EPP" program was created, with reference to the psychosocial and biomechanical hazards. It is undoubtable that monotonous tasks, accompanied by extended workdays, likewise the prolonged and static postures, need to be controlled, thus a postural hygiene program is promoted. For the insecure conditions caused by deficient order and cleanliness, an integral solution of HSEQ, consistent with the procedure for the handling of solid residues and a new design for the production plant, lastly, it is identified the nonexistence of the emergency plan, so one is proposed.

A diagnosis of the environmental performance in Surtiapiques was realized (Figure 3), applying the identification and titration matrix of environmental aspects and impacts, and of Batelle-Columbus, these results evidence that the priority environmental aspect is the generation of usable and hazardous solid residues, likewise the energy consumption. Both aspects produce a high impact in the natural resources and are mainly generated in the soldering and painting sub processes.

Cleaner Production tools were implemented, for example: eco-balance, MED matrix, inventory analysis, product life cycle and inefficiency costs. With the application of these tools, it was diagnosed that of the aforementioned aspects, it is important, to improve the environmental management of the company, to control the inadequate handling of the raw materials and the atmospheric emissions.

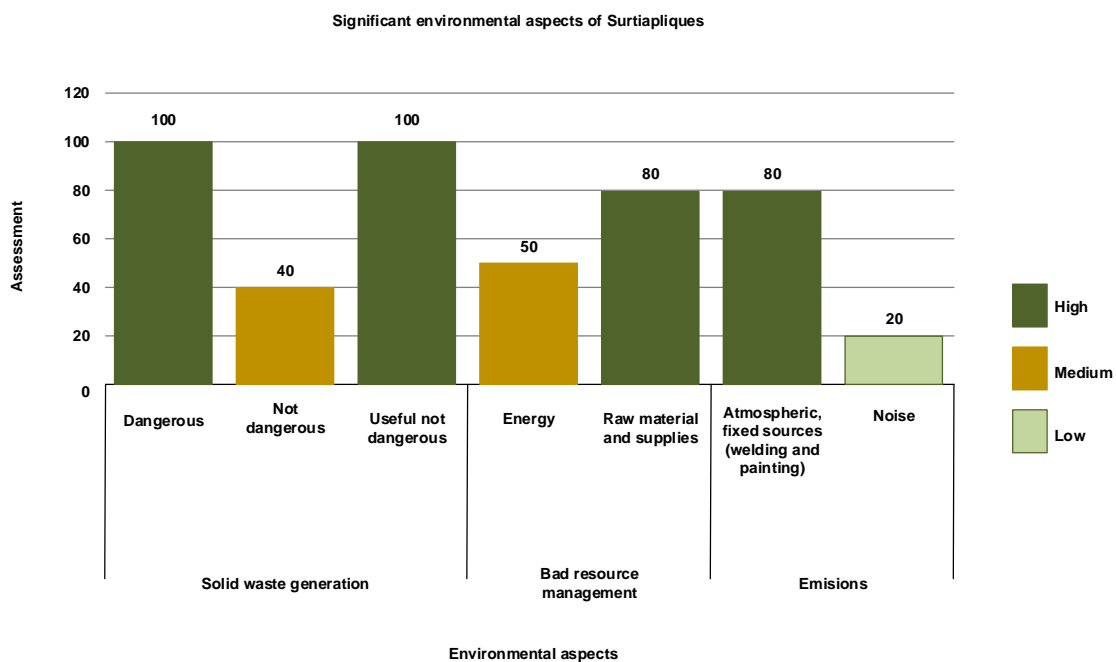


Figure 3: Significant environmental aspects of Surtiapiques.

All the documentation required by the standard was generated, and an integrated management manual, as master document to support the management system, in search of obtaining a system that will allow Surtiapiques to achieve a high-quality product, an excellent environmental performance and a safe working environment for the productive development. All of this with the purpose that the company satisfies its customers necessities, positioning and growing itself in the market. To facilitate the document management, and fulfillment of internal and external auditing, all the documented information, is annexed to the master list, locating 232 documents: 69 IMS, 41 QMS, 51 EMS, and 71 as OH&S support. The documentary base for Surtiapiques, was developed considering the "GTC ISO/TR 10013: 2002, in which it is established the hierarchy of the QMS documentation, starting with the manual (policy and objectives), then the procedures

and instructions, and lastly, the documentation generated for the IMS. In this phase, it was developed the Balance Score Cards and the key performance indicators summaries, to guarantee its monitoring and measuring in a permanent and pertinent manner.

4. Conclusions

Surtiapiques has a great opportunity for improvement, as with the system implementation and its programs, it will achieve the legal requirements, and will have a decrease in the production times that will allow it to be more competitive and capture more and better customers. (Shi, et al., 2008). It will become a cleaner industry, by reducing the impact of solid waste generation and the mismanagement of the resources. Moreover, it will reduce the level of risk to which staff is exposed.

This research had an impact in the business sector, since a typical company of Bogotá was taken as an object of study. A solution was proposed to strengthen its strategic management. The use of Cleaner Production is highlighted to improve business environmental performance, applying eco-efficiency and sustainable in conjunction with the management strategies of the other elements, to promote the Corporate social responsibility and contribute to the evolution of Management System Integration (Nunhes, et al., 2016).

The design of the Integrated Management System for the company can be taken as a reference for MSMEs in the country. Taking into account that, according with "Confederación Colombiana de Cámaras de Comercio", the 94.7 % of the companies registered in Colombia are microenterprises and 4.9 % are small and medium enterprises (Revista Dinero, 2015). These organizations, according to the National Department of Statistics-DANE, generate 67 % of employment in the country, which is why having Integrated System Management, would favor the Colombian productive sector (Valencia et al., 2017).

Proper implementation of the Cleaner production, contributes to the achievement of the objectives of sustainable development of the company, and becomes a reference to other entrepreneurs and the community of how it can contribute to environmental decontamination with the application of effective and efficient strategies.

Surtiapiques, in this process raised the level of awareness about the actions to satisfy the needs of customer, preserve the environment and promote the Health at work, as an essential part in the implementation of Integrated Management System, which was achieved through the promotion and technical training within the company.

Acknowledgments

Surtiapiques Company.

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