



Costs Associated With The Standardization Of The Footwear Production System

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Abstract

Footwear production in San José de Cúcuta and its Metropolitan Area is an important activity for the local economy, with considerable effects on economic and social variables such as economic growth and the quality of life of many people in the region. However, the economic performance seen in the region has not been the best. This is reflected in the behavior of various economic indicators. For example, the crisis attributed to the devaluation of the bolivar, the breakdown of trade relations, the Venezuelan economic policy and, in addition to this, the situation faced by the country with the entry of smuggled Chinese products. All these nuances that have taken the production of footwear, have caused the increase in costs and production expenses, therefore, the standardization of processes has remained under a dynamic variant as the different economic events previously mentioned are presented.

Keywords: activity, standard, method, process, process, variable.

1. Introduction

Cost and finance engineering has been responsible for increasing the productivity of large companies in the world, because it is important to understand the systematic study of operations, procedures, tools and methods used in production processes. At present, footwear is an important sector of the world economy, providing development, employment, growth and welfare to the population. Shoe production

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accounts for 2.1 percent of the country's Gross Domestic Product, although industry, business and government agree that there is untapped potential to achieve ever-increasing productivity and thus cope with inflation and competition. The main key to achieving higher productivity is the continuous application of principles, methods, standards and work design. Only in this way can higher productivity be obtained from personnel and machines.

Although the increase in trade may be an opportunity for the sector, it also represents a challenge for it, as it will now have to compete more directly with companies from developed countries, which have better infrastructure and technology. Added to this, the search to generate an added value and differentiating their products, This has strongly hit the economy of most economic sectors, including the footwear sector, present in the city of Cúcuta and its Metropolitan Area DANE. (2015). Departmental Accounts- GDP YEAR 2015 (Preliminary Figures). Bogotá: Press Bulletin.

The purpose of the cost research for the standardization of the production process of the ballet flats line reference f06, f48 and f318, footwear sector, is to have a clearer vision of the improvement tools, mainly those based on financial studies, which allow minimizing the time in each of the processes and improving the methods used by the workers; For this, it was necessary to make visits to different companies in the footwear sector, in the first instance, to identify the entire production process, components, operations, processes and inventories, which involves the production of ballets for women reference f06, f48 and f318, Taking into account the current situation of the company through an initial diagnosis, it is proposed to conduct a study of methods and times.

With this research it is expected to obtain the standardization of the production process, with which it will be possible to satisfy the needs of the system to respond adequately to a given demand, decrease of reprocessing, identification of bottlenecks through the development of macro tools, it will be known in a detailed way the whole process, improvements in working conditions, The technical data sheets of machinery and equipment that will be used in the process will be obtained in order to propose maintenance initiatives, new proposals for improvements that will help the development of new working methods that will increase productivity and efficiency in the manufacturing processes of ballets reference f06, f48 and f318 in the footwear sector will be able to be proposed.

For this research, the procedure established by Niebel and Freivalds, in their book, *Industrial Engineering: Methods, Standards and Work Design*, which provides all the information required for the standardization of the footwear production process, was used as a basis.

2. Article structure

2.1 Business Context

Currently, countries such as China, India, Taiwan, South Korea, Indonesia, Vietnam and Thailand, are present in the global competition with much success, mainly due to their availability of labor and the use of modern technology, currently there are approximately 20,000 Chinese companies working with leather and 1.6 million employees in the footwear industry. According to a report by the economic and commercial office of the Spanish embassy in Shanghai, 85% of the local production has a quality ranging from low to medium, while those of medium-high range are imported and the materials most used in the manufacture of footwear are leather, fabric, rubber and plastic.

Shoe manufacturers in Cúcuta have not been able to balance production with marketing, one of the factors that causes the crisis that has been occurring due to the problems with the neighboring Venezuelan country that decreased in a notorious way the production of footwear in the city, The production process used by the city's manufacturers is empirical, although 1 out of 10 footwear factories uses more technified machines. The main material used in the manufacture of footwear is synthetic due to its low cost.

The companies dedicated to the production, marketing and distribution of ballet flats for girls and women, have among their objectives, to satisfy the demand and meet the primary needs in everything that refers to the welfare of its customers by providing comfort, to offer a quality product and comfort, taking as the main object of study, the manufacture of the line of ballet flats for women, references f06, f48 and f318, it should be noted that the vast majority of companies in the footwear sector, have approximately 30 references.

During the production process of the line of ladies' ballet flats, references f06, f48 and f318, currently manufactured in the company. There is a lack of organization and inadequate distribution in the work areas, this causes employees to have to make long trips, which are often unnecessary, causing losses and delays in the delivery of orders, likewise, it is evident that the company does not have a defined order in the planning of the operations that are performed during the production process, thus limiting the normal course of operations, and causing the occurrence of long idle times.


The above considerations show the need for the company to consolidate a defined internal structure by determining standard production times and, in the same way, to establish control over each of the operations. If alternatives that contribute to improve the current situation are not implemented, there could be an increase in unproductive times, a decrease in productivity, an increase in the time required for the execution of operations, an increase in invested resources and production costs, reprocessing, and noncompliance with customer orders.

The accounting epistemology is oriented to create a thought projected to the reflection and analysis of the accounting events or facts, on a par with their historical contexts and in a critical tone with the current reality, for such a case it is necessary to understand the accounting work not only from its internal structure but also from a holistic conception, It can also be said that this branch of accounting seeks to adequately understand the problematic development of accounting knowledge, to satisfy the concerns or demands inherent to public accounting both in Colombia and worldwide.

The research focused on carrying out a cost standardization study in the line of ballets for women, references f06, f48 and f318 in the footwear sector, for the standardization of the production process to improve the control of production and simultaneously control the required times, The processes will be analyzed with the different diagrams, then the standard time will be obtained in each of the operations involved in the manufacture of the product and the reduction of production times, to finally make proposals for improvements in the process through the formulation of micro tools and development of technical data sheets of the equipment.


Although it is important to clarify that the manufacturing process of all ladies' ballets is the same, the real difference is the ornament that goes on the top of the ballet, the material with which it is manufactured, or the added value of each one of them, because some include processes with laser machines that are performed outside the company causing delays in orders.

Table 1. Manufacturing process of F48 reference ballets for ladies.

 Process	Description
Minor parts enlistment	In the minor parts preparation area, activities related to the preparation of soles and insoles, counters and shoe platforms are carried out.
Cut	In the cutting station, the activities related to the cutting of the material are carried out to obtain the pieces that will make up the model of the f318 reference pallet. It begins when the operator takes the mold, places it on the material, and then with a blade and manually, performs the cutting of the material to obtain pieces, which are then sent to the sewing station.
Garnish	This area consists of assembling the cut, as it were, the shirt of the vane, and then gluing and sewing all the pieces of the mold.
Tiler	<p>In this process, the tiler is in charge of the two processes, assembling and screeding. Assembled, consists of assembling the shoe with the mold; once all the pieces of the shoe are joined together, the assembly process continues in a mold to give shape and style to the shoe, when it is already glued and sewn.</p> <p>After 24 hours, the same assembler starts sunning the pallet.</p> <p>Sole soling. Its main function is to glue the soles together; this is done by means of current stoves, so that the sole sticks better to the insole.</p>
Finished cleaned, packed 1	This area is in charge of removing the resulting residues, gluing the customized template in some cases, polishing the respective ornaments and adding the missing ornaments.
Final packaging	When everything is in order, the product is packed in boxes, ready to be delivered to the customer.

Source. Own elaboration


Table 2. Manufacturing process of F06 reference ballets for women.

 Process	Description
Minor parts enlistment	In the minor parts preparation area, activities related to the preparation of soles and insoles, counters and shoe platforms are carried out.
Cut	In the cutting station, the activities related to the cutting of the material are carried out to obtain the pieces that make up the model of the f06 reference pallet. It begins when the operator takes the mold, places it on the material, and then with a blade and manually, performs the cutting of the material to obtain pieces, which are then sent to the laser cutting station.
Laser cutting	In this process, through a laser machine, the material is given another shape and style, to create a variety of die-cuts in the pieces that are cut, giving it an added value. The cuts are then sent to the sewing station.
Garnish	This area consists of assembling the cut, as it were, the shirt of the vane, and then gluing and sewing all the pieces of the mold.

Tiler	<p>In this process, the tiler is in charge of the two processes, assembling and screeding.</p> <p>Assembled, consists of assembling the shoe with the mold; once all the pieces of the shoe are joined together, the assembly process continues in a mold to give shape and style to the shoe, when it is already glued and sewn.</p> <p>After 24 hours, the same assembler starts sunning the pallet.</p> <p>Sole soling. Its main function is to glue the soles together; this is done by means of current stoves, so that the sole sticks better to the insole.</p>
Finished cleaned, packed 1	This area is in charge of removing the resulting residues, gluing the customized template in some cases, polishing the respective ornaments and adding the missing ornaments.
Final packaging	When everything is in order, the product is packed in boxes, ready to be delivered to the customer.

Source. Own elaboration

Table 3. Manufacturing process of F318 for ladies' ballets.

 Process	Description
Minor parts enlistment	In the minor parts preparation area, activities related to the preparation of soles and insoles, counters and shoe platforms are carried out.
Cut	In the cutting station, the activities related to the cutting of the material are carried out to obtain the pieces that make up the model of the f318 reference pallet. It begins when the operator takes the mold, places it on the material, and then with a blade and manually, performs the cutting of the material to obtain pieces, which are then sent to the laser cutting station.
Garnish	This area consists of assembling the cut, as it were the shirt, of the baleta and later, gluing and sewing all the pieces of the mold.
Tiler	<p>In this process, the tiler is in charge of the two processes, assembling and screeding.</p> <p>Assembled, consists of assembling the shoe with the mold; once all the pieces of the baleta are joined together, the assembling process continues in a mold to give shape and style to the baleta, when it is already glued and sewn.</p> <p>After 24 hours, the same assembler starts sunning the pallet.</p> <p>Sole soling. Its main function is to glue the soles together; this is done by means of current stoves, so that the sole sticks better to the insole.</p>
Finished cleaned, packed 1	This area is in charge of removing the resulting residues, then the customized template is glued in some cases, the respective ornaments are polished and the missing ornaments are added.
Final packaging	When everything is in order, the product is packed in boxes, ready to be delivered to the customer.

Source. Own elaboration

2.2 Analysis tools and registry.

2.2.1 Operations Diagram. Niebel, and Freivalds (2009), state that the operations process chart shown in Figure 6, shows the chronological sequence of all operations, inspections, allowable times and materials used in a manufacturing or business process, from the arrival of the raw material to the packaging of the finished product. The chart shows the input of all components and subassemblies into the main assembly. Just as a schematic shows design details, such as parts, tolerances and specifications, the operating process chart provides manufacturing and business details, just by looking. Two symbols are used to construct the operating process chart: a small circle represents an operation, and a small square represents an inspection. An operation is performed when a part under study is intentionally transformed, or when it is studied or planned before any productive work is performed on that part.

Before beginning the actual construction of the operational process chart, analysts identify the chart by the title, Operational Process Chart, and additional information, such as part number, drawing number, process description, current or proposed method, date, and name of the person who produced the chart. Additional information may include data such as chart number, plant, building and department.

The vertical lines indicate the overall process flow as the work is performed, while the horizontal lines, which feed into the vertical flow lines, indicate materials either purchased or made during the process. Parts are shown as entering a vertical line for assembly or leaving a vertical line for disassembly. Materials that are disassembled or removed are represented by horizontal material lines and drawn to the right of the vertical flow line, while assembly materials are shown by horizontal lines drawn to the left of the vertical flow line. The finished operational process diagram helps analysts to visualize the method in progress, with all its details, so that new and improved procedures can be identified.

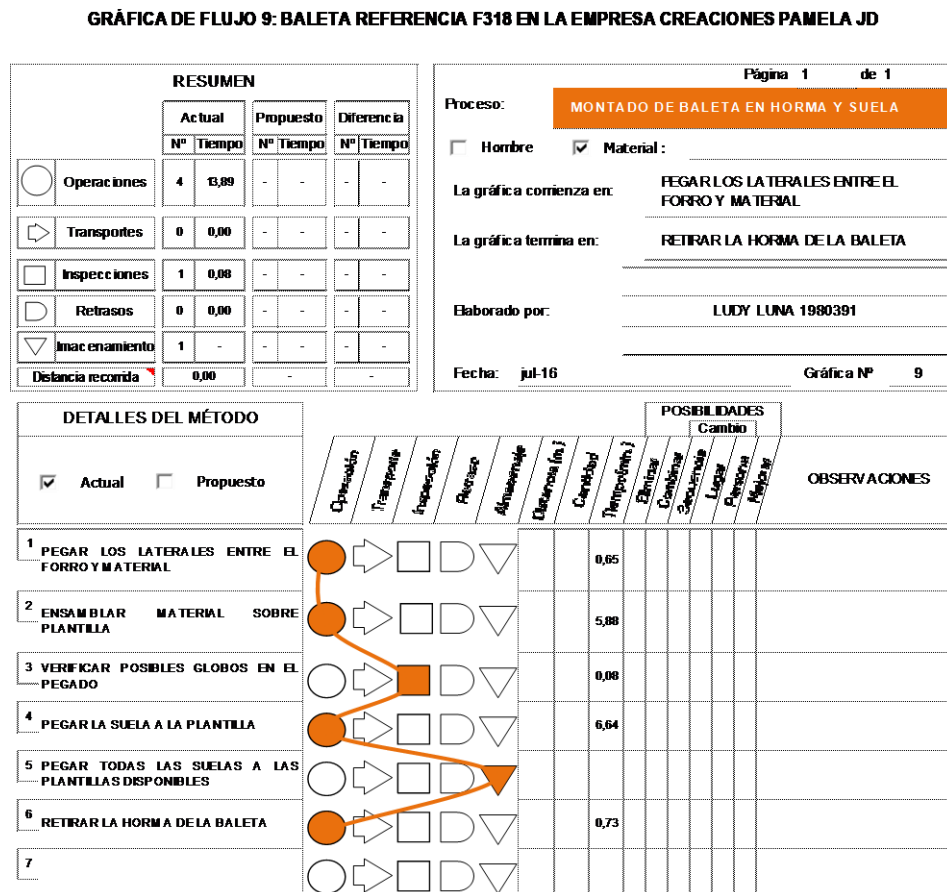
The American Society of Mechanical Engineers (ASME), established a standard set of improved elements and symbols. The operation process diagram graphically represents a general picture of how processes or stages are carried out, considering only the main operations and inspections. With this, it is understood that only and exclusively the operation and inspection symbols were used. The Operation and Inspection symbols are presented below. . In general, the process flow diagram is much more detailed than the operating process diagram. As a result, it is generally not applied to all assemblies, but rather to each component of an assembly. The process flow diagram is particularly useful for recording non-productive hidden costs such as distances traveled, delays and temporary storage. Once these non-productive periods are identified, analysts can take steps to minimize them and thereby reduce their costs.

ASME, (1974), points out that, in addition to recording operations and inspections, process flow diagrams show all the movement and storage delays to which an item is exposed as it moves through the plant. Process flow diagrams, therefore, need several symbols in addition to the operation and inspection symbols used in operational process diagrams. A small arrow signifies transport, which can be defined as moving an object from one place to another, except when the movement is carried out during the normal course of an operation or inspection. A capital letter D represents a delay, which occurs when a part cannot be processed immediately at the next workstation. An equilateral triangle standing at its apex signifies storage, which occurs when a part is stored and protected in a certain location, so that no one can remove it without authorization. These five symbols (see Figure 4) constitute the standard set of symbols used in process flow diagrams.

The product diagram provides the details of the events involving a product or material, while the operational flow diagram shows in detail how a person carries out a sequence of operations.

In the same way as the operating process diagram, the process flow diagram is identified by a title, Process Flow Diagram, and additional accompanying information, which generally includes the part number, diagram number, process description, current or proposed method, date and the name of the person who prepared the diagram.

Figure 1. Ballet Manufacturing Processes



Source. Own elaboration

3. Method

According to Frank Morales (1989), descriptive research, also called diagnostic research, basically consists of characterizing a phenomenon or concrete situation by indicating its most peculiar or differentiating features.

Based on the above definition, this project is identified with this type of research, because through the initial diagnosis will know the customs and prevailing attitudes that are occurring within the company Creaciones Pamela JD, so as to know the current situation, then an accurate description of the activities, processes and objects that are in the environment to investigate without interfering in the development of the process, then through the development of a time study may establish proposals for improving the production process and formulation of micro tools, in order to standardize the process.

Population. The total population of the present project is the 8000 pairs of ballet flats produced in one month, which correspond to the 7 references of ladies' ballet flats that presented the highest demand in the last 6 months of the companies.

Sample. Considering that the company Creaciones Pamela JD, needs to standardize the manufacturing processes of the ballets, the line of ballets for women references f06, f48 and f318 will be taken as a sample for the development of the project, which corresponds to 4800 pairs of ballets produced in one month.

Primary sources. The collection of information, for the purposes of manufacturing the line of ballets for women references f06, f48 and f318 through visits to the company Creaciones Pamela JD through direct observation of the execution of operations, an interview with the manager of the company, a checklist will be made in order to know the current conditions of the work environment.

Secondary sources. They are made up of the bibliography consulted, related to the object of the research, such as texts, internet, professionals specialized in the topics, degree projects and other documents.

Number of articles by country of publication.

Country	Percentage
USA	50%
Canada	20%
Europa	5%
Latin America	5%
Colombia	10%

Source: Own elaboration

4. Results

In the company, this is evidence that no records of operation time are kept. CREACIONES PAMELA JD has not developed any type of method and time studies. It was observed that the company does not have an occupational health and safety program because there is no signage at the workstations; this increases the risk of injuries and accidents, as the worker is deprived of the most elementary information about the risk and how to avoid them. There is also a lack of storage space for leftover material and finished product, due to the company's facilities. The company's structure has deteriorated in terms of walls, floors and ceilings, which makes safety conditions in the workplace inadequate. There are also insufficient toilets and they are not in good condition for the number of employees, which means that the hygienic and sanitary conditions are not adequate for good employee performance. There is no adequate management and storage of waste and flammable substances used in the production process, which shows a lack of organization, order and cleanliness to provide a safe and pleasant environment for the company's workers.

In order to determine the current conditions in a qualitative manner, a checklist was used, obtaining current information on the situations presented there, through the collection of information .

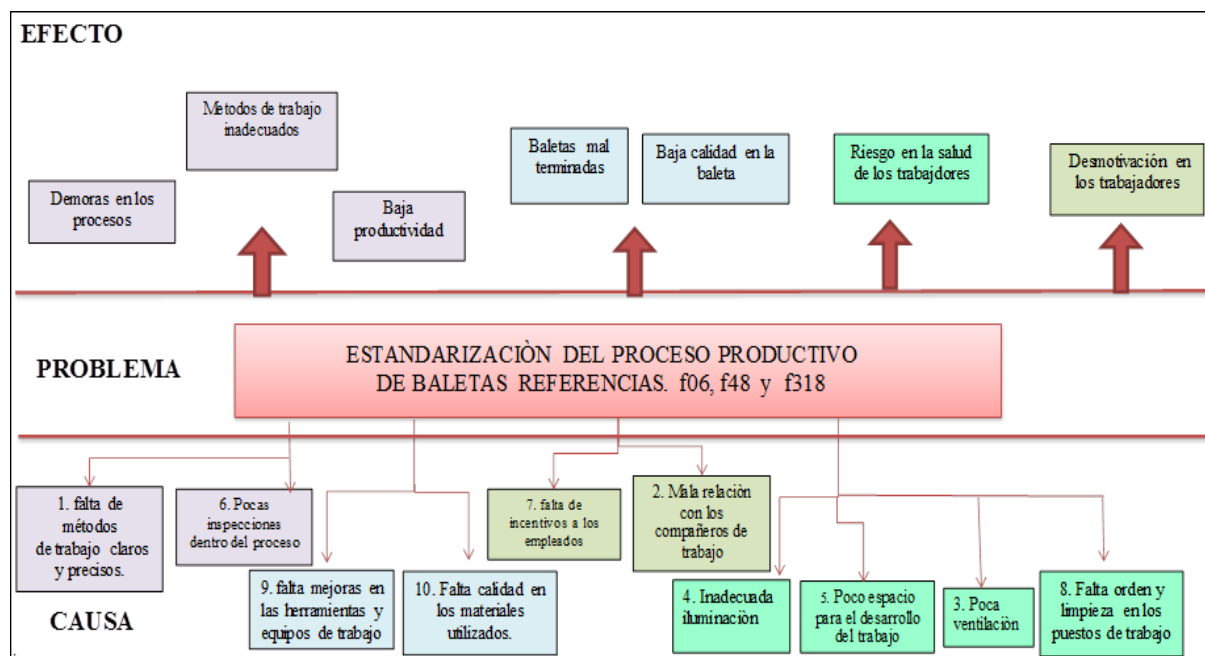
Table 5. Qualitative Analysis

Criteria	Criteria description	Quantity	Percentage
A	Acceptable		28,3%
Na	Not acceptable		30,4%
Nc	Does not comply		41,3%
Total			100%

Source: Own elaboration

The 10 causes that were established as the main elements of the problem were located in the Ishikawa diagram under the 6M methodology, as follows: 20% of the work method, 40% of the environment, 10% of the machinery and/or equipment, 20% of the administration and 10% of the raw material.

Figure 2. Quantitative analysis



Source: Own elaboration

5. Conclusions

Although the increase in trade may be an opportunity for the sector, it also represents a challenge for it, as it will now have to compete more directly with companies from developed countries, which have better infrastructure and technology. In addition to this, the search to generate an added value and differentiate their products has strongly affected the economy of most economic sectors, including the footwear sector, present in the city of Cúcuta and its Metropolitan Area. The footwear manufacturers in Cúcuta have not been able to balance production with commercialization, one of the factors that originates the crisis that has been occurring due to the problems with the neighboring Venezuelan country that decreased in a notorious way the production of footwear in the city, Under this crisis, the city's footwear manufacturers have gone out to look for new national and international markets. The production process used by the city's manufacturers is empirical, although 1 out of every 10 footwear factories uses more technified machines; the main material used in the manufacture of footwear is synthetic due to its low cost.

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