Analysis of Production Costs: An Approach to Decision-Making

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Abstract: Due to competitive growth, companies need to have a cost system that allows them to identify allthe costs incurred in the production process. Furthermore, it is necessary to know the company's needs and production characteristics for its implementation. That is why the present investigation analyzes the production costs in an Ecuadorian textile SME dedicated to manufacturing and commercializing lingerie for the home. This study aims to identify a cost model that adapts to the characteristics and needs of the organization, both economical and productive. The methodology is based on a) organizational knowledge and information gathering, b) analyzing the production costs, and c) establishing the optimal cost model proposal. The findings indicate that the textile SME does not have a production cost system that allows timely decision-making. Thus, the study proposes implementing a cost system for operations since it best adapts to the characteristics and needs of the case study. Furthermore, this system aims to optimize the entity's internal processes, allowing timely decision-making, both strategic and productive.

1 INTRODUCTION

Cost accounting is a technique or method that establishes the price of a project, process, goods, and/or service (Kesimli, 2022). Its main objective is to provide "internally oriented" information, which allows the valuation of the costs involved in the production process (Rogosic, 2021). Production costs include raw materials, labor, and manufacturing overhead (MOH) (Istan et al., 2021). Thus, the direct raw material is easily identifiable in a specific good or service (Mekonnen et al., 2019). Labor represents the payments made to the workers to transform the raw material (Putri, 2017). Finally, MOH is monetary disbursements that constitute the indirect part of the transformation process of a product (Dey et al., 2020).

Adequate management of production costs and a cost system allows an organization to establish the correct monetary value of the resources used in product production without affecting it (Cirilo & Cunha, 2018). Moreover, having a cost system is essential to generate helpful information that solves the inefficiencies linked to the transformation and marketing of a given product (Hoozée & Ngo, 2018). Thus, the selection of the cost system depends on the information needs required by each company. The most common cost accumulation systems in organizations that produce goods are by production orders, processes, and Activity-Based Costing (ABC) (Cárdenas et al., 2020). The production order system is used for limited manufacturing and corresponds to a specific work order (Handayani et al., 2020). The processing system is used for large-scale, continuous production. Combining the system with production orders and processes gives rise to the system by operations. This system considers that the processing operations are similar, while the direct materials used in production are different (Chacón, 2016; Flores, 2016). Finally, the ABC system is based on the

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activities of an organization and focuses on the expenses involved in the production process (Areena, 2019). From the ABC system comes the Time-Driven Activity-Based Costing (TDABC) model. This system provides the cost based on the time consumed by each activity (Kaplan & Anderson, 2004).

This research analyzes the production costs corresponding to 2020 to determine the optimal costing system for a textile SME, contributing to timely decision-making. For confidentiality reasons, the entity in which this research is carried out is known as the "case study." This article comprises four sections: 1) Theoretical background; 2) Study methodology; 3) The results expressed in phases; and finally, 4) Conclusions and recommendations.

2 MATERIALS AND METHODS

The case study selection was based on convenience due to the availability of two parameters: 1) the confidential and limited access data on production costs and 2) the availability of the collaborators involved in the investigation. On the other hand, the present study is based on the procedure for the cost construction that facilitates decision-making proposed by Mejía (2015) and the diagnostic process for determining the cost system developed by Ríos (2014). In this sense, for the research development, a combination of the exposed methodologies was carried out, resulting in three main phases a) Knowledge of the entity and review of information, b) Analysis of production costs, and c) Determination and proposal of a cost system. Therefore, it is essential to document each step in-depth in the general phases.

The first phase focused on the collection and review of information in order to determine whether the organization has control of production costs. This was done through visits to the facilities and interviews with the collaborators of the case study entity. The production costs were analyzed in the second phase to know how they are treated. For this purpose, the sample was selected based on purposive sampling. Finally, the third phase focused on proposing a costing system for the company to assist in timely decision-making. For decision-making, a literature review matrix of the costing systems applicable to the case study was prepared. From this, a first selection was made, using a decision matrix, to choose the cost systems that can be used as favorable alternatives in the characteristics of the entity. Then, with the results obtained in the previous process, the final selection was made using the weighted factors technique, which takes as parameters: the requirements and needs of the organization)}.

2.1 Knowledge of the Entity and Review of Information

The initial phase of the investigation was based on preliminary knowledge of the company, which starts from two approaches. The first refers to the understanding of the entity's internal production. Then, by applying an interview addressed to the commercial department and later with an analysis carried out with the annual production reports, information was obtained regarding the products with the highest demand and rotation in the period studied. Thus, the products with the most significant representation in 2020 were quilts, cushions, and sheets.

Figure 1 represents the monthly production level for the year 2020. In this sense, it is evident that there was a drastic drop in the production of its main textile articles between March and June. This atypical productive behavior refers to the health emergency from COVID-19 that went through the town from March onwards. For this reason, the Management and the departments related to manufacturing considered implementing new textile articles such as biosafety suits and masks:

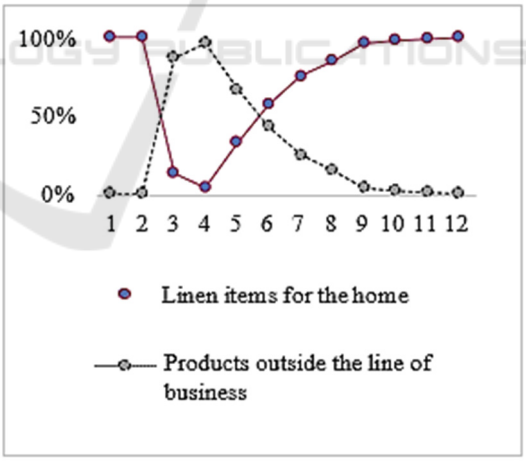

Figure 1: Production level. Household linen products vs. products outside the business line.

The second approach concerns the organization's treatment of internal production costs. According to the Manager, the Production Leader, and several collaborators framed within the operational process,

a) the sale price of the items is established according to the supply chains and the model customization, and

b) deficiencies in the payment of concepts, such as labor, transportation, maintenance, and fuel, are detected. Reviewing the documentation provided, such as Kardex, balance sheets, financial statements, digital databases, and physical reports, verified this.

2.2 Production Costs Analysis

In this second phase, the study's universe was initially established to determine the research's scope. Therefore, this process consisted of organizing all the products produced in 2020 by category. Table 1 illustrates the sales level of textile products for the year under study. The results obtained were: 147,292 articles produced, grouped into 49 categories, of which almost 56% of sales come from three main types: quilt, cushion, and sheet. Similarly, at the management's request, the item "table runner" was considered for analysis in the investigation due to a significant increase in customer orders in recent months.

Once the sampling was established, elaborating on the products was recognized as a second step. Physical monitoring of all the activities and methods was carried out in the elaboration of the different articles. Subsequently, it was determined that exclusivity is the main differentiating characteristic of the manufacture of the pieces. Thus, the manufacturing process per category is similar, with differences only in the strokes, cut, type of raw material, and design.

Table 1: Representation of sales level of textileproducts in the year analyzed.

N°	Product category	Representation
1	Quilt	25.27%
2	Cushion	16.89%
3	Bedsheet	13.65%
4	Table runner	0.01%
5	Other	44.20%
	Total	100%
	Sales concentration	55.81%

3 FIELDWORK

This section details the main results of developing the methodology presented in this research. The following results were obtained for raw material, labor, and MOH within the company's behavior and treatment of its production costs.

Raw Material. The raw material consumption is generally known before the budget analysis to reveal the quantity required of this input per period. That is why its behavior in 2020 showed an unusual trend in certain months, with a decrease in the production of textile articles. This is evidenced in Fig. 2. It shows that, between March and April, there was a reduction in the participation of this cost element due to the lack of supply chains, the paralysis of the services of certain suppliers, and the difficulty in raw material import. However, a remarkable recovery can be seen since September, somewhat managing to redeem the low production of previous months.

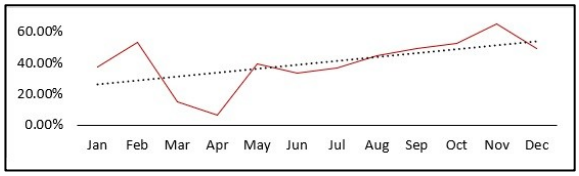

Figure 2: Monthly general behavior of the raw material of the articles studied.

Table 2: Percentage of the cost of materials used in the manufactured products.

Comforter	Sheets	Cushion	Table runner
Poster 0.7%	Adhesive 2.0%	Banner 0.7%	Label 0.4%
Label 0.2%	Poster 0.8%	Label 0.7%	Thread 1.5%
Cover 13%	Elastic 4.2%	Canvas 46.5%	Back 6.9%
Thread 1.2%	Label 0.4%	Brocade 17.2%	Main 25.5%
Micro-thread 27.5%	Packaging 3.8%	Marker 33.8%	Cardboard 1.2%
Polyester 27.9%	Thread 1.3%	Card 1.1%	Sublimated 48.6%
Down 29.5%	Base 36.2%		Card 2.3%
	Envelope 38%		Packaging 13.5%
	Sleeve 13.2%		
Total 100%	100%	100%	100%

For calculating the general participation of the raw material in the textile articles determined in the sample, the material consumption reports corresponding to 2020 were taken as a reference. In this manner, the raw material represents an average of

40.20% of the total production costs. Therefore, it proves that this cost element is the primary basis of the manufacturing process. In addition, the company's treatment of the raw material begins with registering inventories through internal software managed by the warehouse owner. In this sense, Table 2 contemplates a summary of the raw materialcontrol of the entity. This control is based on a percentage determination and is managed by software. Based on this, an estimate of the price of household linen is established.

The raw material is the cost element with the most excellent control in the case study. Hence, efficient management in consuming material resources and supplies is promoted. That is why it is evident that the internal organizational priority, both for control and the departments related to production, is to focus its objectives on optimizing all raw material costs, reducing waste, and keeping records of material consumption. However, despite rigorous internal control of this input, a specific treatment of a currently existing cost model has not been evidenced.

Labor. Labor participation in production is crucial for the textile SME's performance. Based on the analysis of the annual behavior of this cost element, it was determined that the direct participation of labor had shown a dangerous tendency from March to June. Figure 3 shows a high percentage of growth, and it is powerfully demonstrated that there is a significant increase in labor cost in the first quarter compared to the others.

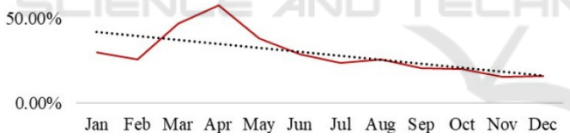

Figure 3: Monthly general behavior of the workforce in the products.

This unique behavior refers to two main factors. First, a strict mobility restriction derived from COVID-19 was established in the town; however, the case study company continued to work usually with all its collaborators. Second, the home linen product line had to be restructured and executed on minor scales, prioritizing the manufacture of items outside its line of business. In this sense, labor represented an average of 29.13% of the total production costs of textile articles.

Based on the above, the textile SME, a manufacturing company, establishes that direct labor costs (DLC) represent 64.81% of the company's total employees. Within DLC, they cover work areas such as cutting, sewing, finishing, and machine operators. On the contrary, Indirect Labor Costs (ILC) represent a total of 35.19% and are mainly made up of strategic (18.52%) and support (16.67%) personnel. This indirect labor participation includes work areas such as production assistants, designers, and production and sales leaders.

Manufacturing overhead. Regarding the behavior analysis of this last cost element, Fig. 4 illustrates the MOH behavior throughout the period studied. Therefore, compared to the cost elements analyzed above, their behavior is relatively standard, with different cost variations with insignificant increases and decreases. This is due precisely to the level of direct participation of external entities that provide finishing and manufacturing services for certain textile products because, at certain times, it is at its maximum production capacity. Consequently, the company must resort to these expenses to fulfill its customers' orders on time. That is why the share of indirect manufacturing costs is represented by 30.68%.

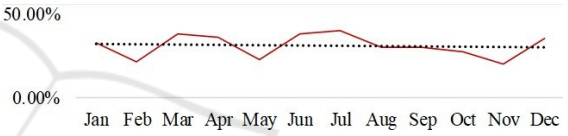

Figure 4: Monthly general MOH behavior in the products studied.

Figure 5 presents the main items that make up the MOH. The indirect cost with the highest monetary value incurred by the organization was the item of garments to outsourcers (maquilas), representing 50.3% of the total MOH, followed by indirect manufacturing supplies (16.6%) and leases to establishments (11.4%).

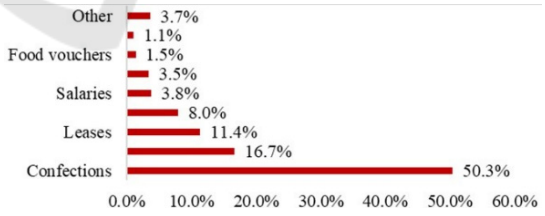

Figure 5: Percentage of MOH representation in textile production.

Thus, external companies' participation in different production services represents the highest indirect cost within the production costs, alluding to a stable behavior in the period studied. However, the company's treatment of this cost element is null since it only keeps accounting records and documentation supported by files in correspondence with all the expenses incurred in the company in general.

3.1 Knowledge of the Entity and Review of Information

The last phase began with elaborating a literature review matrix illustrated in Annex 1. It revealed what type of production is directed, cost allocation, companies to be applied, and purpose. This is to know which systems are coupled to the company's characteristics. Moreover, identifying the company's features (Annex 2) was considered the first procedure for the correct cost system selection. This report was approved and validated by the General Management. Table 3 presents the selection process, taking the matrix that Joya (2016) and Guevara (2021) elaborated on. "X" means the section is met, and "O" does not apply to the evaluation section.

In this sense, the cost models representing the highest rating in a final sum were three systems: Purchase Orders, Processes, and Operations. The ABC and TDABC cost systems were not considered because the company does not have well-defined productive activities. In addition, its adaptation requires a lot of time and high costs. Therefore, a second selection was made, considering the results of the previous table. In this manner, a series of requirements adapted to the entity's needs were established to implement a cost model that allows adequate control and an equitable allocation of costs.

Table 3: Selection of the cost system based on the company's characteristics.

Selection cost systems based on the characteristics of the case study	**By Orders**	**By Processes**	**By Operations**	**ABC**	**TDABC**
Type of company	X	X	X	X	X
Type of production	X	O	X	O	O
Operational structure	O	X	X	O	O
Similar production processes	O	X	X	X	X
Exclusive designs	X	O	X	O	O
Planned production	O	X	X	X	X
Cyclic production	O	X	X	X	X
The specific direct raw material is required to produce each category	X	O	X	O	O
The raw material enters through various processes in several departments	O	X	X	X	X
Reception of production.	X	O	X	O	O
Control of cost elements	X	X	X	X	X
Product Costing	X	O	X	O	O

To this end, the technique of weighted factors expressed in (1) was used. For Solano (2020), this technique considers a "quantitative analysis that compares alternatives to achieve an optimal decision, in which the options are affected by factors that contain a relative weight." In this sense, a series of steps are established for decision-making. The procedures include a) defining the critical success factors or decision criteria, b) assigning a weight to each criterion, c) defining a scale of values for the decision criteria, d) multiplying the weight score of each factor and calculating the total score and, e) explaining the quantitative results (Heizer & Render, 2011).

$$S_j = \sum W_i F_{ij} \quad (1)$$

Where:

S*j*: Overall score of each alternative.
W*i*: Weighted weight.
F*ij*: Score of the *j* alternatives for each factor *i*.

Annex 3 illustrates the decision criteria based on the company's needs for correctly implementing a cost system. In addition, each requirement was assigned a weight based on the importance of each criterion. Finally, the conditions and the established percentage were validated with interviews with the General Directorate, dialogues with the entity's collaborators, results of the previous phases, and direct observation.

Next, a weighting matrix was created based on the decision criteria. First, the cost system with the highest qualification was chosen, as shown in Table 4. Thus, a score of 0 to 3 was established for each system, where: zero - does not apply, one - barely meets the decision factor, two - partially complies with the deciding factor, and three - fully complies with the deciding factor. Subsequently, a weighting was made between the weight and the individual rating of each decision criterion for each system. As a result of the total weighting, the highest rating was the cost per operations system, with a score of 2.95, which best adapts to the company's production process.

Table 4: Weighting matrix for the cost system selection.

Decision Criteria	Weight	Cost Systems		
		Production Order	By Processes	By Operations
Production				
Production process.	20%	1	1	3
Control of cost elements				
Raw material control.	15%	3	3	3
Labor control.	15%	3	3	3
Indirect manufacturing cost control.	15%	3	3	3
Determination of costs				
Unit production costs.	15%	3	3	3
Information systems and decision making				
Information systems	10%	3	3	3
Decision making	10%	3	3	3
Summary	100%	19	19	21
Total		**2.6**	**2.6**	**3**

4 CONCLUSIONS

In correlation with the analysis of production costs carried out in the case study company, it was determined that: a) the only existing treatment during the manufacturing process of textile articles is the raw material input. This element is based on physical and digital documentary evidence, which contains the homogeneous distribution of material costs, mathematical calculations, and statistical representations that allow a partial approximation of the sale price of textile garments. b) On the other hand, inputs such as labor and indirect manufacturing costs do not show a specific procedure by the production departments. In this sense, it is concluded that these inputs represent together more than 50% of the total production costs, evading the proportional cost allocation in the textile products determined in the sample. That is why they are not considered within establishing the actual cost of textile products. c) From the previous sections, it is also inferred that the textile SME understudy does not have a cost system, much less follow a specific cost model as a reference.

In correspondence with what was described above on determining the case study's particularities and internal productive needs, it was concluded that the cost system for operations is considered an ideal proposal for the textile company. This was confirmed through the different qualifications assigned in the selection processes to the possible cost systems to be applied in the establishment. On the other hand, the processing system could be successfully implemented because it has a batch production volume and the various departmental processes to which the raw material is subjected to reach the final product. However, it was not selected due to the company's production type. The nature of its products is made according to the modifications and designs requested by customers.

The operations system combines the process cost model to establish conversion costs and the job order system to allocate direct material costs. Thus, this cost model would grant the following benefits to the case study. First, it records and controls raw materials, labor, and manufacturing overhead. Second, it adapts to the nature of the entity and its producing manner, whether it is a batch or an order of orders. Third, it conforms to the information systems provided by the company. Fourth, it gives more accurate information that improves the delivery of results for timely decision-making. Finally, it facilitates the planning and control of production processes.

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APPENDIX

Appendix A – Cost systems literary review matrix available at:

https://imagineresearch.org/csa_appendix/