

ORIGINAL ARTICLE

Activity-based costing method (ABC costing) and profitability at a Peruvian mining company

ABSTRACT

This research seeks to determine how the activity-based costing system (ABC costing) influences the profitability of a small polymetallic mining company, using a hypothetical deductive methodology, with an applied quantitative approach, non-experimental design, and causal correlational level. The population consists of 84 monthly cost reports and financial statements from 2015 to 2021 and the census-type sample consists of 83 reports, except for the month of April 2020 as a result of the stoppage due to COVID-19 restrictions. The result of a general hypothesis test using regression statistics calculated with the SPSS software, determined a Chi-Square value of 9.149 with $p = 0.010 < \alpha = 0.05$. Therefore, the null hypothesis was rejected, and the alternative hypothesis was accepted. This means that ABC costing has an influence on the studied company's profitability.

Keywords: costing; activity-based costing method (ABC costing); traditional costing method; companies.

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Submitted: 07/03/2023 - Aceptado: 12/04/2023 - Publicado: 06/xx/2023

INTRODUCTION

The general objective of this research is to determine how ABC costing affects the profitability of the products of a small polymetallic mining company, as well as its specific raw materials, labor, and manufacturing overhead costs.

According to Andrade (2022):

Traditional costing systems use few factors, or cost drivers, which are generally based on production quantities. Also, these systems typically account for costs from the perspective that products generate more costs than activities. (para. 27)

The procedures performed are detailed below:

- Selling and administrative expenses become manufacturing costs that are added to the products.
- For the distribution of fixed costs, the criteria used are man-hours, machine-hours worked, or volumes produced.
- Production processes are primarily valued and aimed at the organization's structure.

On the other hand, ABC costing determines and identifies those resources that the organization uses in the fulfillment of its mission and the activities performed by its organizational units. It also identifies the actions that are performed in the fulfillment of objectives, eliminating those that do not add value; afterwards, costs are assigned to the previously identified activities. This costing method establishes the way in which activities consume resources in the company; in other words, the measures of competence that are used as a causal link between activities and resources. The "activity measures" that best explain the origin and variation of indirect manufacturing costs must be found. To this end, it is necessary to calculate the unit cost of providing each activity within the production process; in this sense, an activity's total indirect cost is divided by the number of "activity units" consumed from the "activity measure" or "identified cost driver."

Furthermore, according to Heredia (2008):

It determines how products or services consume resources or activity costs, i.e., it is necessary to identify the number of "activity units" consumed by each product in its manufacture. Establish the costs of activity resources to the products or services that go through those activities. (p. 90)

Hornngren *et al.* (2012) point out that ABC costing allows identifying those activities that are part of a value chain, measures the costs of each activity, and allocates costs to products and services (called cost objects).

In the United States, Kaplan and Cooper (1998) argue that ABC costing allows indirect costs to be directed initially to activities and their processes, then to goods, services, and customers. ABC costing is structured to be efficient in the development of its different activities, which can be adapted to companies, resulting in good economic performance.

In Peru, companies that are independent in their production and products are diverse, making it difficult to properly allocate a cost, specifically indirect manufacturing expenses such as personnel wages and salaries, materials, among others. In the case of mining companies, it is important to know how to differentiate the costs of their main business, which is the sale of minerals, from other activities such as subcontracting of services, supply sales, equipment rental, etc.

The company under study is engaged in the extraction and marketing of polymetallic concentrates, mainly zinc, copper and lead. In addition, it sells supplies to its contractors on a regular basis, while sales of fixed assets to third parties and mineral processing services are carried out only occasionally.

The traditional costing system alters the real cost by arbitrarily assigning costs to all activities instead of considering the cost of each action required to bring the product to the market. In this costing system, the allocation of costs is carried out arbitrarily and/or using the unit prices of these products in the market; as they are applied with the costs, they generate

incorrect profit margins because they do not consider the indirect fixed costs and expenses separately and related to their activity. Therefore, if the company does not include an ABC product analysis, it will not be able to know if the products it sells are profitable.

Sinchihuano (2019) mentions in his research that costing was initially made empirically, which prevents a proper determination of the selling price and gross profit. These costs do not have a technical basis to include the costs produced and recorded empirically, determining wrong selling prices and profit margins. According to ABC costing, the services provided by the hospital have been unprofitable; therefore, a reasonable profit was considered in relation to the equitable calculation of indirect costs that were distributed in their entirety to the activities inherent to the process and more detailed information on costs was obtained, allowing management to make both efficient and effective decisions based on the results on profitability and prices.

Mendoza (2021) conducted an applied research study with cross-sectional descriptive level and non-experimental design. The population consisted of textile products, and it was determined that the sample should be non-probabilistic because the most sold products would be analyzed. The techniques and instrumentation used were Spring and Stock systems, result analyses, and process diagrams. The objective was to implement ABC costing to contribute to the understanding of cost behavior and to improve the profitability of best-selling products. It was concluded that profitability increased from 3.34% to 6.49%, equivalent to PEN 912,704 of savings per year as a result of the distribution of indirect costs through the activities. Moreover, operating costs decreased by PEN 8.98 and sales discounts dropped by 3.24%.

Research by Gómez and Nieto (2020) aimed to determine the gross profit or loss of a product while establishing the correct market price. It was concluded that the company had undervalued the selling price of roasted coffee due to the very high costs involved, resulting in very low profitability margins that caused a loss of 72% per product sold.

METHODS

The research approach is quantitative while the research type is applied. The research design is non-experimental and cross-sectional. For its development, 84 monthly financial statements and cost reports ranging from 2015 to 2021 from a polymetallic mining company were taken as population. The sample was based on a census and did not consider the information for the month of April 2020 because the company did not carry out operations due to a plant shutdown. A database was used, which contained the variations between traditional costing and ABC costing according to the following indicators: profitability, gross profit, operating profit and materials profit, production costs, direct labor, raw materials, and indirect manufacturing costs.

The techniques used were the observation of the material consumption accounts, direct labor and indirect manufacturing costs from the production cost reports. Subsequently, the margins obtained from the income and operating costs of each line were calculated and the variation of costs and profitability between ABC costing and traditional costing was analyzed. The company is located in the district of Morococha, province of Yauli, department of Junín, Peru.

RESULTS

To substantiate the hypotheses proposed, it was necessary to demonstrate the consistency of the information of the cost variables and their profitability in ABC costing, as well as the following dimensions: labor, raw materials, indirect manufacturing costs, gross profit, operating profit, and product profit. Since the research is causal, the hypothesis test was carried out using regression statistics through SPSS (see Table 1).

To evaluate the general hypothesis, Table 1 is reviewed, which shows the value of significance is $0.010 < 0.05$, so the null hypothesis is rejected, and the alternative hypothesis is accepted. Thus, the ABC costing system influences the profitability of products of a small polymetallic mining company in the period 2015-2021. Also, Nagelkerke's R² provided evidence indicating that the ABC costing variable

Table 1
Hypothesis test

	Chi-square	df	Sig.	Nagelkerke's R ²	Ho
General hypothesis result					
ABC costing system influences profitability of products of a small polymetallic mining company in 2015-2021.	9.149	2	0.010	.348	It is rejected.
Specific hypothesis result					
E01: ABC costing labor cost allocation influences product profitability of a small polymetallic mining company in 2015-2021.	0.302	9	.860	.016	It is accepted.
E02: ABC costing system influences identification of indirect manufacturing costs in profitability of products of small polymetallic mining company in 2015- 2021.	7.675	9	.022	.294	It is rejected.
E03: ABC costing system influences raw material cost allocation in profitability of products of small polymetallic mining company in 2015-2021.	0.149	9	.699	.006	It is accepted.

Note. Prepared by the authors, 2023.

has an influence of 34.8% on the profitability of products of a small polymetallic mining company in the period 2015-2021.

From specific hypothesis 1 on the influence of the allocation of labor cost in ABC costing on the profitability of products of a small polymetallic mining company in the period 2015-2021, a significance value of $0.86 > 0.05$ (see Table 1) was obtained. In other words, the null hypothesis was accepted, and the alternative hypothesis was rejected, meaning that labor allocation did not affect the product profitability of a small polymetallic mining company in the period 2015-2021. Furthermore, Nagelkerke's R² indicates that labor allocation in ABC costing does not play a role as it accounted for a tiny percentage of 1.2% in the profitability of products of a small polymetallic mining company in the period 2015-2021.

Regarding specific hypothesis 2 on the influence of the identification of indirect manufacturing costs in the ABC costing system on the profitability of products of a small polymetallic mining company in the period 2015-2021, a significance value of $0.022 < 0.05$ was obtained (see Table 1), which means that the null hypothesis was rejected, and the alternative hypothesis was accepted. In other words, the identification of indirect manufacturing costs in the ABC costing system did influence the profitability of products of a small polymetallic mining company in the period 2015-2021. Moreover, Nagelkerke's R² indicates that the identification of indirect manufacturing costs in the

ABC costing system influences the profitability of products of a small polymetallic mining company in the period 2015-2021 by 29.40%.

From specific hypothesis 3 on the influence of the allocation of raw material cost in the ABC costing system on the profitability of products of a small polymetallic mining company in the period 2015-2021, a significance value of $0.699 > 0.05$ (see Table 1) is obtained, thus allowing the null hypothesis to be accepted and the alternative hypothesis to be rejected. This means that the allocation of raw material cost in the ABC costing system does not influence the profitability of products of a small polymetallic mining company in the period 2015-2021. Finally, Nagelkerke's R² indicates that the allocation of raw material costs in ABC costing does not have any influence as it accounted for a tiny percentage of 0.6% on the profitability of products of a small polymetallic mining company in the period 2015-2021.

DISCUSSION

From the general hypothesis, it was determined that there is an influence of the ABC costing system on profitability. The results were verified by Sinchihuano (2019) when determining that in the ABC costing system the services offered by the Emergency Area did not generate profit, which they could not have learned by using the traditional costing system. It also agrees with Horngren's theory (2012), who indicates that ABC costing assigns costs to objects according to the company's activities. The company under study has mainly two sources of income whose

activities are distributed between the sale of concentrates and the sale of materials; with ABC costing it was possible to assign production costs based on cost centers for each activity in geology, mine, extraction, beneficiation plant, maintenance, and mine administration.

From the first specific hypothesis, it was determined that there is an influence of the allocation of labor in ABC costing on gross profit of products of a small polymetallic mining company. These results do not agree with what was found by Sinchihuano (2019), whose research concludes that ABC costing allows determining the labor for objects related to emergency medical services, surgery, and hospitalization, allowing them to set selling prices. According to Toro (2010), "direct labor is the value of work performed by employees who contribute to productive development and which can be easily identified" (p. 99). In the company, there was no influence because most employees are working as operators and supervisors, and this direct labor is allocated to production costs, while administrative and sales employees are allocated to operating expenses, so that their distribution is in accordance with the activities they perform.

The second specific hypothesis showed the influence of indirect manufacturing costs of the ABC costing system on the company's profitability. These results were confirmed by Mendoza (2021), whose research determined that the ABC costing system improved the production costs of best-selling goods, reducing their costs from PEN 0.25 to PEN 0.09. According to Kaplan and Cooper (1988), "in ABC costing, indirect manufacturing costs are assigned to resource-consuming activities, and subsequently assigned to products, proportionally to their consumption in the activities" (p. 6).

From the result of the third specific hypothesis, it was analyzed that in the ABC costing system the raw materials did not influence the profitability of products of a small polymetallic mining company in the period 2015-2021. This result differs from work by Gómez and Nieto (2020), who concluded that ABC costing helped detect that the selling price of the product "roasted gourmet coffee" had been undervalued because of a failure to identify the related

production costs, resulting in losses of 72% per unit sold. According to Toro (2010), for raw material costs it is necessary for the consumption of the input to be proportionally related to the quantities produced, and that it be easily identifiable in a product. At present, the company has a warehouse at the mining unit, which includes supplies for consumption and for sale to contractors, which are indeed differentiated into different areas. However, materials such as inputs and PPE are used in the same activities, with these costs being allocated to production. These costs are minor, but if the company decides to increase its sales of materials, they could have a material impact on its profitability.

CONCLUSIONS

ABC costing allowed a positive breakdown of profit margins into copper, zinc and lead ores from production materials and supplies, unlike traditional costing. It is recommended to continue using the cost allocation methodology with the accounting area and to train in the application and operational control in order to develop effective procedures.

It was found that there is no influence of labor because most of the personnel such as workers, supervisors and heads of operational maintenance are related to the treatment and extraction of ore. However, in the case of new personnel, it is recommended that they be assigned as cost center preparers and that they be aligned with the company's activities. In case somebody does not know the company's costing policy, it is recommended to request an induction process for this person.

It was shown that ABC costing influenced the distribution of indirect costs related to mining royalties, food, camp expenses, and contractor personnel premises, so it is necessary to raise awareness and assign a person responsible for the valuation of activities that are not generating value in order to allow the company to reduce the excessive consumption of indirect resources.

Based on the analysis, it was concluded that an insignificant amount of material costs such as laboratory reagents and PPE was allocated to the production cost and its difference with respect to traditional costing was irrelevant. However,

it is advisable to improve the procedures for storing materials with respect to their location, separating those that are intended for production from those intended for sale to contractors, since higher volumes in the future could have an impact on profit margins.

REFERENCES

- Andrade, J. (2022). *Limitaciones de los Sistemas de Costos Tradicionales* [Publicar]. LinkedIn <https://es.linkedin.com/pulse/limitaciones-de-los-sistemas-costos-tradicionales-jes%C3%BAAs-rodolfo?trk=pulse-article>
- Gómez, A. and Nieto, J. (2020). *Diseño de un método de costos basado en actividades: estudio de caso empresa Café con FE S.A.S. en el proceso del café gourmet tostado en la ciudad de Cali* [Tesis de título profesional, Universidad del Valle]. Repositorio de la Universidad del Valle. <http://hdl.handle.net/10893/18059>
- Heredia, D. (2008). Metodología de Costeo Basado en las Actividades para Confecciones. *Económicas CUC*, 29(1), 79–104. <https://revistascientificas.cuc.edu.co/economicascuc/article/view/1229>
- Horngren, C., Datar, S. and Rajan, M. (2012). *Contabilidad de costos. Un enfoque gerencial* (14^a ed.). Pearson Educación de México S.A.
- Kaplan, R. and Cooper, R. (1988) *Como usar el costeo ABC, AMB y el ABB para mejorar la gestión del proceso y la rentabilidad*. Harvard Business School Press Boston. <https://books.google.com.pe/books?id=03fEVdIU4QQC&printsec=frontcover#v=onepage&q&f=false>
- Mendoza, M. (2021). *Propuesta de implementación de un sistema de Costos ABC para mejorar la rentabilidad de los productos de más comercializados en una empresa de confecciones* [Tesis de título profesional, Universidad Nacional Mayor de San Marcos]. <https://cybertesis.unmsm.edu.pe/handle/20.500.12672/16491?show=full>
- Sinchiuano, M. (2019). *Diseño de un sistema de costos ABC para los servicios de hospitalización del hospital general Riohospital, Cantón Riobamba, provincia Chimborazo* [Tesis de título profesional, Escuela Superior Politécnica de Chimborazo]. <http://dspace.esPOCH.edu.ec/handle/123456789/11686>
- Toro, F. (2010). *Costos ABC y Presupuestos*. Ecoe Ediciones. <https://s81d6ec85d18a02ec.jimcontent.com>

Competing interests

The author declares that there is no conflict of interest.

Authors' Contribution

Ruth Milagros Vicente Bejarano (lead author): Conceptualization, data curation, formal analysis, research, methodology, project administration, validation, visualization, writing (original, revision and edition).