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Research Article

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Construction Design Thinking in Cost Analysis: The Application of Activity-Based Costing (ABC) for the Efficiency of Costing of Production

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Abstract: *Inaccurate costing of goods of production (COGS) can cause distortion of product margins and selling price decisions, especially in manufacturing businesses with a diversity of activities and overhead costs. This article examines how design thinking can be constructed as an approach to designing an Activity-Based Costing (ABC) system that is centered on the needs of cost information users. The locus of the study is the practice of determining HPP in manufacturing companies and micro, small, and medium enterprises (MSMEs), especially in the context of Indonesian studies. The study used a structured narrative literature review and conceptual synthesis of 13 scientific sources as well as one source of design process guidance that was chosen for its relevance to the ABCs, design thinking, and cost system implementation. The results of the synthesis resulted in a five-stage framework: empathize to map information needs, define to identify cost distortions, ideate to select activity groups and cost triggers, prototype to build HPP calculators, and test to compare output and usability of information. This framework distinguishes the accuracy of cost allocation from actual cost savings: changes in HPP numbers do not automatically mean a decrease in production expenses. Implicitly, the integration of design thinking and ABC has the potential to strengthen user acceptance, transparency of overhead allocation, and the quality of pricing decisions, with effectiveness still requiring empirical testing.*

Keywords: *Design Thinking; Activity-Based Costing; Cost of Production; Cost Driver, Cost Accuracy.*

Introduction

Manufacturing companies face the need to carefully set cost of production (COGS) when raw materials, labor, and overhead are not consumed uniformly by all products. Incorrect cost of goods affects margin calculations and order feasibility assessments, even if the company's total expenses have been correctly recorded. In this context, cost accounting not only generates financial reports, but provides a map of resource usage for operational decisions. The review of Sánchez-Rebull et al. (2023) illustrates the breadth of ABC research developments, while Putra et al. (2025) underscore implementation issues and the need to link cost information to decision-making.

Traditional cost systems often use a single overhead charging base, such as labor hours or production volumes. This method is simple, but it can cover the consumption of different activities between routine products and specialized products. Distortion does not mean that all companies should immediately adopt a more complex system; the additional benefits of information must outweigh the cost of measurement. The case study of Dipya and Martadinata (2024) found a lack of charging in the context of the burnt hazelnut oil business, while Yulianti et al. (2024) showed that ABCs can produce lower HPP than the comparative approach on certain types of tofu. Both results confirm that method improvement is not synonymous with increasing or decreasing HPP universally.

ABC structures the relationship between costs through activities and cost drivers (cost drivers), so that overhead burdens are traced according to activity consumption patterns. This application is relevant to processes with variations in machine setup, inspection, material transfer, scheduling, and order handling. Pranoto and Amiluddin (2024) show the application of ABC to the beverage product business, while

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Handayani et al. (2023) discuss the distortion of overhead burdening in the context of services. Although the objects are not identical, these studies support the need to review the unit of activity as an intermediary between resource consumption and cost objects.

The implementation of ABC also demands the ability of organizations to identify activities, collect driver data, and maintain the quality of records. The system can be rejected when production staff have to fill out complex forms or when managers do not understand how calculations are obtained. Paramita and Violita (2025) identify the limitations of human resources, resistance to change, and the need for training in the implementation of ABC in family businesses. Haricahyo and Rachman (2026) also explain that the complexity of activities and data needs are important challenges for the development of cost information systems.

These implementation problems open up space for the use of design thinking as a design approach that prioritizes user experience, problem understanding, experimentation, and iterative learning. Design thinking is not a substitute for the logic of cost measurement; its role is to help organizations design procedures for recording and displaying information that can actually be used. Mayer and Schwemmle (2025) identify the mechanisms of integration, problem reframing, empowerment, and collaborative involvement in the influence of design thinking. Schlott (2024) also points out the importance of team dynamics and organizational conditions to generate the benefits of the design process.

The five frequently used stages, empathize, define, ideate, prototype, and test, provide a practical language for organizing problem solving. These stages can be applied repeatedly when the prototype results do not match the needs of accounting or production activities. The Stanford Guidelines (no years) explain that the process is centered on user needs and learning through testing. In cost analysis, users include cost accountants, production heads, business owners, and pricing decision-makers who require different levels of information detail.

The synthesis of the two fields leads to more specific research problems than simply comparing traditional cost methods with ABCs. The key question is how organizations can design ABCs that are accurate enough, simple enough to work with, and reliable enough to use in pricing decisions. The systematic review of Sánchez-Rebull et al. (2023) and the research of Paramita and Violita (2025) demonstrate the need to balance technical design and implementation readiness. Meanwhile, Mayer and Schwemmle (2025) provide the basis for a cross-functional collaborative approach when developing managerial solutions.

Based on this description, this article proposes a conceptual framework for integrating design thinking and ABC to improve the HPP determination process, especially in the context of manufacturing companies and MSMEs with limited cost information. The contribution is not a claim that a company has obtained certain savings, but rather a mapping of mechanisms, implementation stages, evaluation indicators, and empirical testing prerequisites. A distinction between cost accuracy, recording process efficiency, and actual cost savings is necessary so that the implementation evaluation does not result in excessive conclusions.

Literature Review

Concept of Cost of Production and Cost Distortion

HPP in manufacturing accumulates direct raw material costs, direct labor, and factory overhead relevant to the product. The main problem often arises in shared overhead that is not easily traced directly to the output unit. A single base can lead to undercosting on products that require a lot of setup or inspection

and overcosting on simple products. The studies of Dipya and Martadinata (2024) and Guritno and Zai (2024) illustrate the importance of comparing cost methods according to the production structure being studied. Because the findings are contextual, the difference in HPP should be read as an indication of cost redistribution, not an automatic of expense efficiency.

Activity-Based Costing and Cost Driver Rationality

ABC views activities as a link between resources and products. Overhead costs are grouped into relatively homogeneous activities, then charged using drivers that reflect activity consumption such as number of setups, engine hours, or frequency of inspections. Activity rates are obtained from activity group costs divided by the total relevant driver units, while the load to the product is the result of the rate and driver units consumed by the product. Sánchez-Rebull et al. (2023) review the evolution of the concept and application of ABC; Bodendorf and Franke (2024) show the development of activity-based cost analysis with more advanced analytics in the automotive industry. Advanced systems are not always necessary for MSMEs if a small number of drivers are already able to explain important variations.

Design Thinking as a Human-Centered Approach

Design thinking emphasizes the iterative exploration of user needs and testing of solutions, rather than just following a rigid sequence of procedures. The integration and reframing mechanisms discussed by Mayer and Schwemmle (2025) are relevant for changing the question from "how to calculate as much cost as possible?" to "what minimum cost information helps decisions the most?". Schlott (2024) shows that team collaboration is an important part of implementing design thinking. In ABC projects, this approach requires the participation of cost owners, production operators, purchasing departments, and sales decision-makers.

Synthesis of Previous Research and Research Gap

The ABC literature evaluates a lot of differences in HPP numbers between methods as well as technical barriers to implementation. The research of Pranoto and Amiluddin (2024), Dipya and Martadinata (2024), and Paramita and Violita (2025) provides contextual evidence on the benefits of information and barriers to use. The study of Putra et al. (2025) reinforces that implementation issues cannot be solved by simply changing the allocation formula. On the other hand, the design thinking literature discusses the acceptance, collaboration, and testing of prototypes, but not specifically ABC design (Mayer & Schwemmle, 2025; Schlott, 2024). The gap identified by this article is the lack of an integrated framework that links the logic of cost-encumbrances, user information needs, and iterative evaluation to HPP decisions. This gap is a proposition derived from a limited corpus of studies, not a claim that the entire global literature has never addressed such integration.

Table 1. Previous Research

Source	Reported focus/evidence	Implications for synthesis
Sánchez-Rebull et al. (2023)	A systematic review of ABC cross-research	ABCs are evolving; implementation design needs to consider context
Dipya & Martadinata (2024)	Case of calculation of HPP of burnt hazelnut oil	Potential undercosting when costs are not covered

Source	Reported focus/evidence	Implications for synthesis
Yulianti et al. (2024)	Comparison of ABC and full costing in tofu business	ABC does not have to result in higher HPP
Paramita & Violita (2025)	Barriers to implementing ABC in family businesses	Staff readiness and resistance to change are important
Mayer & Schwemmle (2025)	Overview of the mechanism of influence of design thinking	Reframing, integration and collaborative engagement
Schlott (2024)	A systematic review of design thinking and teams	Cross-functional collaboration supports adoption

Source: *Proceed Data, 2026*

Table source: author synthesis based on articles listed in the Bibliography. This table compares study focuses, rather than presenting meta-analyses or combined statistical effects.

Method

This study is a conceptual study using a structured narrative literature review of scientific publications relevant to Activity-Based Costing, HPP determination methods, cost system implementation challenges, and design thinking. The context of the discussion includes manufacturing companies and MSMEs, with attention to Indonesian case evidence and international conceptual studies. Sources were selected purposively based on direct relevance to one of the three study questions, traceability of the identity of the publication, and the adequacy of information in the abstract or source text; The corpus used consists of 13 scientific publications and one source of design thinking guidance. This study did not involve respondents, field interviews, or audits of specific companies' cost reports. Because the search process was not conducted as a thorough systematic search and did not have a PRISMA diagram, the findings were not claimed to be systematic literature reviews or statistical generalizations.

The study data was collected through documentation of bibliographic information, study objectives, object context, findings or arguments, and implementation obstacles written in the source publication. The analysis instrument was in the form of a conceptual extraction matrix with the categories of cost allocation accuracy, cost driver selection, data quality, user participation, process readiness, and price decision evaluation. The synthesis was carried out by comparing the findings of the case study and the review literature, then mapping the ABC problem to five design thinking activities: empathize, define, ideate, prototype, and test. The validity of the argument was maintained by separating the information reported by the source from the author's proposed model, while the relevance of the framework was evaluated logically through the completeness of the procedure, transparency of the calculation assumptions, and the availability of indicators that can be tested in the next empirical study.

Results and Discussion

Literature Evidence on ABC Accuracy and Inhibition

The literature reviewed shows two main patterns. First, the allocation of costs by activity can reveal differences in product costs that are not visible when all overhead is charged on a single common basis. Dipya and Martadinata (2024) reported the problem of undercosting in the object of the case, while Yulianti et al. (2024) reported lower ABC unit costs than full costing in the case of certain types of products. Second, more detailed technical results are not automatically easy to implement. Paramita and Violita (2025) found

competency barriers and resistance to change, while Putra et al. (2025) summarized the challenges of implementing ABC from the broader literature. The findings of this study are therefore qualitative and do not produce savings figures, differences in average HPP, or causal impact on a particular company.

Table 2. Construction of the Five Stages of Design Thinking ABC

Stages	ABC design activities	Checkable outputs
Empathize	Interview information needs between accounting, production, marketing; Map out workflows	User maps and decision needs
Define	Determine products that have the potential to experience distortion and poor data quality	Cost and baseline issue statement
Ideate	Design alternative activity pools, drivers, and logging frequencies	Driver list, operational definition, design alternatives
Prototype	Build ABC sheets for selected products; cost tracing test	HPP prototype and cost audit trail
Test	Compare calculations, input loads, usability of information, and pricing decisions	Test notes, driver improvements, pilot decisions

Source: *Proceed Data, 2026*

Operational Model of Calculation and Evaluation

Operationally, the total overhead for each activity pool is determined first; then the activity rate is calculated by dividing the pool cost by the number of driver units. Product overhead is the sum of the consumption of product drivers multiplied by the related activity rate. Product HPP is calculated by adding direct raw materials, direct labor, and allocated overhead. For the purpose of price decisions, managers need to distinguish the HPP per unit from marketing, administration, and target margin costs so as not to equate production costs with selling prices. All steps require reconciliation of total costs to the ledger to avoid lost or double-calculated costs.

Evaluation dimensions	Proposed operational indicators	Test data sources
Allocation accuracy	Driver compatibility with activity consumption; 100% overhead reconciliation	Activity cards, expense journals
Operating costs	Recording hours, software and training fees	Work logs, implementation budgets
Usefulness of information	Ease of understanding and tracking HPP	User tests, structured interviews
Quality of decisions	Information-based pricing/order decision changes	Before–after decision documents
Actual operational efficiency	Measurable reduction in waste after intervention	Operations and real cost data

Source: *Proceed Data, 2026*

Source: author's proposed indicator; has not been tested for validity, reliability, or sensitivity. System administration efficiency and production cost savings are measured separately.

Why ABCs Need Consumer-Centered Planning

The strength of ABC lies in activity mapping, but the completeness of the calculation alone does not guarantee the use of information. Highly detailed measurements have the potential to increase staff hours, increase system requirements, and generate rejection if the benefits of the decision are not apparent. The Paramita and Violita (2025) study describes the barriers to change in the corporate environment, while Mayer and Schwemmle (2025) identify engagement and reframing as important design thinking mechanisms. The integration of the two approaches allows the organization to start from the most important decisions, then choose the number of drivers proportional to the value of the information. In this way, technical rigor and ease of use are two design criteria that both need to be met.

HPP Comparison Is Not Proof of Cost Savings

Changes in the HPP figures after the implementation of ABC are often treated as evidence of efficiency, even though some of the changes can come from the redistribution of overhead that was previously charged inappropriately. If the total overhead does not change, the ABC calculation mainly shifts the portion of costs between sources, not reduces the total cost. Comparisons in the cases of Dipya and Martadinata (2024) and Yulianti et al. (2024) show the importance of reading the direction and magnitude of differences based on the characteristics of their respective cost objects. Actual savings can only be stated if interventions based on ABC information reduce resource consumption, non-value-added activities, capacity costs, or expenses that can be completely avoided. Therefore, integrative design testing must have two different groups of outcomes, namely the accuracy of the HPP information and the real efficiency after managerial decisions are implemented.

Prototype and Test Stage as a Learning Resource

The prototyping stage provides an opportunity for the team to test a small number of products with different overheads before the entire system is changed. For example, management can compare a setup rate based on the number of production changes with a rate based on setup duration if data on both are available. The test results do not have to lead to the addition of drivers; drivers can instead be reduced if the measurement costs are large while the contribution of information is small. This principle is relevant to the criticism of the complex ABC implementation as discussed by Kaplan and Anderson (2004) and the development of cost analytics as shown by Bodendorf and Franke (2024). With a phased approach, system changes into operational hypotheses that can be refuted, corrected, or expanded based on evidence of use.

Theoretical and Practical Implications

At a theoretical level, this article proposes a relationship between the design of cost accounting systems and the ability of organizations to conduct cross-functional learning. ABC answers how costs are charged, while design thinking helps answer how cost solutions are designed and accepted by their users. At a practical level, companies are advised to start from product segments with high or heterogeneous overhead, then test the traceability of drivers and their impact on pricing decisions and order selection. This framework is also relevant for MSMEs because it can be implemented through spreadsheet prototypes without having to assume the needs of an enterprise system. However, companies should take into account the cost of data collection, possible measurement bias, and accounting reconciliation needs before adopting the system.

Limitations and Empirical Test Agenda

This study is conceptual and combines research evidence from various sectors, so it does not provide an estimate of the average effect of the integration of design thinking and ABC. The corpus was selected based on relevance, not a census of the literature, so conclusions about the research gap should be read in a limited way. Further research can use multiple case study designs or quasi-experiments in production units, with pre- and post-intervention measurements for allocation accuracy, recording duration, pricing decisions, and actual operational costs. It is also important to compare the implementation of regular ABC with the implementation of ABC designed through design thinking to isolate the added value of the design approach, while controlling for product complexity and the level of digitalization.

Conclusion

A synthesis of the literature suggests that ABC can improve the accuracy of overhead tracing by taking into account the activities that the product consumes, but the direction of change in HPP is contextual and does not necessarily indicate production cost savings. The construction of design thinking provides an approach to tailoring the ABC system to the needs of the user through problem mapping, cost driver selection, prototyping, and repeated testing. The contribution of this article is a five-stage framework as well as a set of indicators to differentiate the accuracy of cost information, system administration costs, information usability, and actual efficiency. The effectiveness of the framework is still a conceptual proposition, not a causal finding that has been tested in the company.

Suggestions

Companies that will adopt ABC are advised to pilot products that have a diversity of activities, involve cross-functional decision-makers, and keep records of cost reconciliation and user feedback. Follow-up research needs to test these designs through actual cost data and compare results before–after implementation and between implementation groups, so that the benefits of design thinking on ABC quality can be distinguished from the benefits of the cost-charging method itself. In addition to the accuracy of the HPP, the evaluation needs to measure the timing of the recording and the outcome of the price decision to assess the balance of benefits with implementation costs.

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