

ADVANCING MANAGEMENT ACCOUNTING THROUGH INTEGRATED BUDGETING: AN EDUCATIONAL MODEL FOR EXPERIENTIAL PRODUCTION TRAINING

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Abstract. Accelerated industrial transformations and the advancing digitalization of production systems call for a renewed approach to teaching management accounting in higher education. In this context, budgeting is not merely a financial planning tool but a central mechanism that links operational coordination, resource allocation, and performance evaluation, particularly within manufacturing enterprises. Despite these developments, university curricula continue to focus predominantly on theoretical explanations, offering limited exposure to real production flows or decision-oriented variance analysis. Addressing this gap, the present study develops an integrated educational model that connects budgeting, production costs, and performance indicators into a coherent experiential learning framework. Through the use of scenario-based budgeting, production-flow simulations, and structured managerial analysis, the model enables students to understand the planning–execution–control cycle in an environment that mirrors industrial practice. The study contributes to the modernization of management accounting education by providing an application-oriented framework that enhances professional judgment and equips future accountants with the competencies required to support performance optimization in manufacturing firms.

Keywords: budgeting; management accounting; operational performance; production costs; responsibility centers; practical training; accounting education

JEL Classification: M41; M49, I23

Introduction. The profound transformations that the industrial environment is undergoing, driven by digitization and the expansion of concepts associated with Industry 4.0, directly influence the skills required of future accountants and management specialists. In manufacturing companies, budgeting has become an essential tool for coordinating operations, ensuring the efficient use of resources, and informing managerial decisions [3]. However, in higher education, the teaching of management accounting remains, as a rule, anchored in predominantly theoretical approaches, often disconnected from real production processes and the dynamics of responsibility centers.

This gap between the requirements of the industrial environment and the content of university programs is intensely discussed in the literature. On the one hand, research conducted in manufacturing companies highlights the effectiveness of modern practices such as activity-based budgeting, target costing, or kaizen costing, demonstrating their contribution to reducing waste and improving operational performance [4]. On the other hand, studies on management support information systems confirm that the flexibility and quality of IT tools are critical determinants of the quality of information generated in budgeting processes [2]. At the same time, the literature in the field of accounting education emphasizes the need to integrate critical thinking, sustainability elements, and methods based on practical experience in order to strengthen students' professional skills [1].

Based on these directions, this study aims to develop an integrated educational model capable of bringing the training process closer to the realities of manufacturing companies. The research is guided by two fundamental questions:

- ✓ How can budgeting be effectively integrated into management accounting teaching to reflect the complexity of production processes?
- ✓ What educational mechanisms can facilitate the development of professional reasoning and understanding of the planning-execution-control cycle in industrial contexts?

Therefore, the study proposes an applied framework based on budget scenarios, production flow simulations, and analytical reflection, with the aim of improving students' ability to substantiate relevant managerial decisions and contribute to optimizing performance in manufacturing companies.

Content. In the current industrial context, characterized by operational variability and the accelerated pace of technological change, budgeting can no longer be understood as an exclusively annual exercise. It is transforming into a continuous, iterative process, aligned with the logic of real-time data and the need to rapidly adapt production capacities to fluctuations in the external environment. In this context, manufacturing companies are increasingly using rolling budgets, activity-based budgeting systems, and predictive analytics tools integrated into ERP platforms. Their role goes beyond the financial sphere, becoming essential mechanisms for the cross-functional coordination of production, procurement, quality control, and resource management processes.

However, in most higher education institutions, these transformations are not sufficiently reflected in management accounting curricula. A significant portion of programs continue to adopt traditional teaching methods, focusing on standardized problems from textbooks, isolated examples, or algorithmic exercises that do not capture the complexity of industrial processes [5]. This approach has several structural limitations.

Firstly, relevance to the manufacturing environment is reduced because students are not exposed to real-life scenarios involving volume variations, resource constraints, dependencies between responsibility centers, or deviations caused by unforeseen operational conditions. Second, the lack of contact with real deviations—caused by technological shutdowns, supply delays, or losses generated in the production process—limits understanding of how accounting information supports managerial decisions. Thirdly, teaching budgeting, costs, and performance indicators separately reduces understanding of their interdependent nature, which is fundamental to applied management accounting. Finally, insufficient digital skills are becoming increasingly problematic, given the widespread use of ERP systems in industry and the need to familiarize students with digital simulations.

To address these challenges, the study proposes an integrated educational model built on three complementary pillars: functional integration, practical simulation, and analytical reflection.

Functional integration is the foundation of the model. It connects, in a unified logic, budgeting (production planning, resource consumption, and allocation of indirect expenses), production costs (direct materials, direct wages, machine hours, and cost factors), and performance indicators (cost variances, efficiency rates, and contribution margin). The interdependence between these components becomes the operational framework of the model: budget assumptions determine production configuration, production flows generate costs that must be monitored, and deviation analysis provides the information needed to adjust budgets. This continuous cycle reproduces the real logic of managerial processes in companies.

Practical simulation is the second pillar of the model and aims to familiarize students with situations that accurately reflect operational dynamics. Through interactive scenarios, they analyze, for

example, the effects of demand fluctuations on production batches, the impact of raw material price volatility on budgets, the consequences of technological shutdowns on direct and indirect costs, or the changes generated by losses and rejects on deviations from standards. In these contexts, students are invited to develop rolling budgets, identify the causes of deviations, recommend adjustments, and justify the proposed decisions. This develops their ability to correlate accounting data with managerial decision-making logic.

Finally, *analytical reflection* ensures the consolidation of the learning process through critical evaluation of scenarios. Students analyze how initial assumptions influence production costs, identify patterns of deviations and their causes, evaluate the implications of decisions on performance indicators, and examine the results of responsibility centers. This stage supports the development of analytical and integrative thinking, which is necessary for understanding the complexity of managerial decisions.

Applying the model offers multiple benefits to both academic institutions and industry. For universities, the model helps align study programs with international standards in accounting education, stimulate interdisciplinary learning, and increase student engagement through interactive and contextualized methods. For industry, the approach ensures the training of graduates who are able to understand and manage complex processes, actively participate in optimizing operational performance, and reduce further training costs.

Therefore, the proposed model has the potential to significantly reduce the gap between traditional university education and the demands of the contemporary business environment, facilitating the development of the skills needed by specialists in the manufacturing sector.

Conclusions. The study argues for the need to reconfigure management accounting teaching in the context of industrial transformation and digitization. Traditional pedagogical approaches, centered on standardized examples and theoretical exercises, no longer reflect the complexity of production, in which budgeting functions as an integrated mechanism for coordination, control, and performance evaluation.

The proposed model, based on functional integration, practical simulation, and analytical reflection, provides an applicable framework for training the skills required by industry. Combining budget scenarios with simulations of flows and contextualized deviation analyses strengthens professional reasoning and the ability to interpret managerial information, bringing the curriculum closer to current practices.

However, implementation poses challenges: adequate digital infrastructure, continuous adaptation to the specifics of programs and sectors. Therefore, empirical validation in diverse university contexts and exploration of the integration of emerging technologies (including AI solutions) into curriculum design are necessary. In essence, the model contributes to the modernization of accounting education, facilitating the transition of graduates to roles focused on optimizing organizational performance.

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