

COMPANY EXPENSES ALLOCATION TO PRODUCT CATEGORY WITH ENTERPRISE RESOURCE PLANNING (ERP) CATEGORY ALGORITHMS

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Abstract

Background – Accurate allocation of indirect expenses remains a critical managerial challenge in fast-moving consumer goods (FMCG) companies, particularly in the toiletries sector, which operates across numerous product categories and market areas. Conventional manual allocation practices are often time-consuming, rely heavily on subjective judgment, and may slow down the decision-making process. Recent developments in enterprise resource planning (ERP) systems offer opportunities to integrate algorithm-based allocation approaches, enabling more accurate and timely profitability analysis.

Aim – This study aims to develop and evaluate an ERP-embedded Category Allocation Algorithm to improve the accuracy, efficiency, and managerial usefulness of indirect cost allocation within a large Indonesian toiletries manufacturing company.

Design / methodology / approach – Using a design science research approach combined with a single-case study, this research utilizes actual ERP transaction data from May 2023. The dataset covers IDR 188.2 billion in sales (67% domestic and 33% export) and IDR 36.0 billion in indirect expenses distributed across 397 general ledger sub-accounts. The allocation algorithm was constructed based on predefined product-category patterns and market-area rules and implemented through ERP Business Objects reporting. Evaluation was conducted based on allocation accuracy, processing efficiency, and the usefulness of managerial insights generated.

Findings – The results demonstrate that indirect expenses were automatically and transparently allocated across more than 25 product categories, generating detailed category-level Profit and Loss reports. Compared to manual methods, the ERP-based approach improved allocation accuracy, reduced processing time from several days to minutes, and enabled near-real-time profitability reporting.

Conclusion – This study shows that integrating a Category Allocation Algorithm into an ERP system can improve the accuracy, efficiency, and transparency of indirect cost allocation in the FMCG toiletries industry. The embedded ERP approach reduces time spent on manual processing and enables automated profitability reporting at the category level, supporting more data-driven managerial decision-making.

Research implication – This study contributes to the literature on management accounting and information systems by demonstrating how algorithmic cost allocation can be systematically embedded within ERP environments. The findings offer a scalable solution for FMCG companies seeking greater cost transparency, shorter reporting cycles, and data-driven strategic decision-making.

Limitations – The study is limited to one company and a one-month observation period. Future research can extend the model to multiple firms, longer time horizons, or different sub-sectors of FMCG, to increase generalisability.

Keyword : Cost Allocation; Profitability Analysis; Enterprise Resource Planning (ERP); FMCG Industry; Management Accounting

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Abstrak

Latar Belakang - Alokasi biaya tidak langsung yang akurat masih menjadi tantangan manajerial bagi perusahaan *Fast-Moving Consumer Goods* (FMCG), khususnya di sektor *toiletries* yang mencakup berbagai kategori produk dan wilayah pasar. Praktik alokasi manual konvensional cenderung memakan waktu, sangat bergantung pada penilaian subjektif, dan dapat memperlambat proses pengambilan keputusan. Perkembangan terbaru dalam *system enterprise resource planning* (ERP) membuka peluang untuk mengintegrasikan pendekatan alokasi berbasis algoritma, sehingga memungkinkan analisis profitabilitas yang lebih akurat dan tepat waktu.

Tujuan - Penelitian ini bertujuan untuk mengembangkan dan mengevaluasi *Category Allocation Algorithm* yang terintegrasi dalam sistem ERP guna meningkatkan akurasi, efisiensi, serta memberikan kemudahan manajerial dari proses alokasi biaya tidak langsung pada sebagian besar perusahaan manufaktur *toiletries* di Indonesia.

Desain / metodologi / pendekatan - Penelitian ini menggunakan pendekatan perancangan ilmu penelitian yang dikombinasikan dengan studi kasus tunggal. Data yang digunakan berasal dari transaksi ERP aktual pada Mei 2023, mencakup penjualan sebesar IDR 188,2 miliar (67% domestik dan 33% ekspor) serta biaya tidak langsung sebesar IDR 36,0 miliar yang tersebar pada 397 sub-akun buku besar. Algoritma alokasi dikembangkan berdasarkan pola kategori produk dan aturan wilayah pasar yang telah ditentukan, serta diimplementasikan melalui pelaporan ERP Business Objects. Evaluasi dilakukan berdasarkan akurasi alokasi, efisiensi proses, dan manfaat wawasan manajerial yang dihasilkan.

Temuan - Hasil penelitian menunjukkan bahwa biaya tidak langsung dapat dialokasikan secara otomatis dan transparan ke lebih dari 25 kategori produk, sehingga menghasilkan laporan laba rugi pada tingkat kategori yang lebih rinci. Dibandingkan dengan metode manual, pendekatan berbasis ERP meningkatkan akurasi alokasi, mempercepat waktu pemrosesan dari beberapa hari menjadi hanya beberapa menit, serta memungkinkan pelaporan profitabilitas yang mendekati *real-time*.

Kesimpulan - Penelitian ini menunjukkan bahwa penerapan *Category Allocation Algorithm* dalam sistem ERP dapat meningkatkan akurasi, efisiensi, dan transparansi alokasi biaya tidak langsung pada sektor FMCG *toiletries*. Pendekatan yang terintegrasi dalam ERP ini juga mengurangi waktu pemrosesan manual serta memungkinkan penyusunan laporan profitabilitas per kategori secara otomatis, sehingga mendukung pengambilan keputusan manajerial yang lebih berbasis data.

Implikasi penelitian - Penelitian ini memberikan kontribusi pada literatur akuntansi manajemen dan sistem informasi dengan menunjukkan bagaimana alokasi biaya berbasis algoritma dapat diintegrasikan secara sistematis dalam lingkungan ERP. Secara praktis, temuan ini menawarkan solusi yang dapat dikembangkan (*scalable*) bagi perusahaan FMCG untuk meningkatkan transparansi biaya, mempercepat siklus pelaporan, serta mendukung pengambilan keputusan strategis berbasis data.

Batasan penelitian - Penelitian ini terbatas pada satu perusahaan dan periode observasi selama satu bulan. Penelitian selanjutnya dapat memperluas model ini pada beberapa perusahaan, periode waktu yang lebih panjang, atau subsektor FMCG yang berbeda untuk meningkatkan generalisasi hasil penelitian.

Kata kunci: Alokasi Biaya; Analisis Profitabilitas; *Enterprise Resource Planning* (ERP); Industri FMCG; Akuntansi Manajemen

INTRODUCTION

Accurate expense allocation plays an important role in supporting profitability management in fast-moving consumer goods (FMCG) companies. In highly competitive markets with relatively thin margins, small allocation errors can distort profitability analysis and lead to

less effective management decisions. Proper allocation means each product category reflecting its true economic contribution. This can help you make better decisions about pricing, promotion and investment. But still many FMCG companies are using spreadsheet for manual allocation of indirect cost. This



often causes delays, inconsistencies and limited transparency, especially when working with a large number of product variations.

A good example of this is the toiletries sector where consumer trends change quickly and category strategies vary enormously. The allocation of indirect expenses such as promotion, advertising and overseas costs is particularly complex. Misallocation may understate high-performing categories or overburden emerging ones, thereby influencing strategic resource distribution. The structured allocation approach has been examined in previous literature on regulated industries. (Sheng et al., 2021) utilised entropy-based models to enhance fairness in allocation, whereas (Gupta et al., 2018) employed matrix methodologies in transmission networks. These studies support the relevance of systematic allocation mechanisms, but the industrial context is different from the dynamic and marketing-intensive FMCG environment.

More generally, prior studies on digital transformation indicate that the use of new technology can enhance organisational performance and facilitate better decision-making (Ramadani et al., 2025), indicates that financial technology integration enhances business sustainability, while (Bawono et al., 2022) indicates that technology adoption has a positive effect on organisational performance in the TOE framework. The findings show that

structured digital mechanisms for enterprise systems can be useful for effectiveness in management. Drawing on these insights, this paper investigates how the cost allocation logic can be embedded directly in an ERP system to improve transparency, efficiency and category-level profitability analysis in an FMCG toiletries company.

These studies show that mathematical and optimization-based models can greatly improve efficiency and fairness in allocation. Utilities, on the other hand, operate in a highly regulated, capital-intensive environment, and their allocation problems are thus structurally different from those in the FMCG toiletries sector. The studies confirm the technical importance of allocation, but are industry-specific and not directly transferable to FMCG. This indicates an important gap in research. Similarly, FMCG companies have complex allocation problems, but the specific context has not yet been fully addressed in existing studies. (Ezinne C & Ogunsola, 2021) have highlighted the criticality of allocation from a management accounting perspective in facilitating equitable decision-making in organisations. (Batalla Martinez et al., 2021) further emphasized that accurate allocation enhances financial reporting and profitability analysis. Taken together, these studies suggest that allocation should not be seen merely as a technical procedure, but as an important element of governance and accountability. When allocation is handled

improperly, it can affect the reliability of performance measurement, influence managerial incentives in unintended ways, and, over time, weaken strategic planning decisions. These contributions establish the significance of allocation for decision-making but are not yet integrated with ERP systems at the category level. ERP systems have become the backbone of modern financial reporting, but many organisations still perform category-level allocations outside the system using manual tools, creating inefficiencies and breaking the audit trail.

Recently, ERP has been viewed as a platform enabling better cost visibility and planning. (Ezinne C & Ogunsola, 2021) showed the ability of SAP Controlling module in improving cost allocation and transparency within energy companies. (Batalla Martinez et al., 2021) Analysed the OPEX planning processes and suggested a model to optimise the application of ERP and Data Warehouse systems. (Xie et al., 2022) Used constrained nonlinear programming to optimise ERP implementation in SMEs, showing the impact of resource allocation on project success. Finally, the research notes that ERP systems provide a unified platform for embedding allocation rules alongside organisational data, thereby enabling more accurate, transparent, and consistently applied allocation processes. Based on these findings, this study proposes an ERP-based allocation framework for FMCG products, segmented by product category (male,

female, general) and market destination (domestic, overseas). The framework embeds the allocation logic in the ERP, removes off-system manipulation, ensures consistency and provides real-time profitability reports at category level. The results contribute to managerial practice and add to the literature by extending ERP research to the FMCG setting, which remains relatively underexplored.

The paper is organized as follows. The background, aims and significance of the study are introduced. The second section presents the theoretical framework and the main concepts related to ERP systems, cost allocation and profitability analysis. The ERP adoption and allocation approaches literature review is a review of previously published studies. Methodology section describes the research design, data, and algorithm development procedure. The findings are then presented in the results and discussion section along with the managerial implications. The paper concludes with a conclusion highlighting the main contributions and suggestions for future research. The structure is meant to cover theoretical and practical issues. The study is relevant to academics, practitioners and policy makers interested in the improvement of



cost transparency and decision making in the FMCG sector.

LITERATURE REVIEW

Methodological, organisational, and technological considerations are needed for the implementation of ERP-integrated allocation frameworks. This review classifies the literature into three main dimensions to understand the impact of these elements on expense allocation and profitability analysis: Cost Allocation Methods, ERP Adoption, and Customisation.

These dimensions show that while research from different sectors such as energy, telecom, utilities, and services provides insights into allocation practices, it leaves an important gap in the FMCG domain. The cost allocation has been studied from the technical and financial point of view. In utility settings, entropy-based models improve the fairness of allocations (Sheng et al., 2021). Research on transmission networks highlights the application of a based approach to cost sharing (Gupta et al., 2018). Also, the studies in cost classification have demonstrated that an appropriate structure of cost elements is needed to improve transparency and support managerial decision-making (Kuritsyna et al., 2021). More sophisticated techniques, such as multi-period allocation models (Wang, 2021), demonstrate the benefits of mathematical

methods for efficiency improvements in long-range planning. These contributions provide important methodological foundations but are not connected to ERP embedded FMCG applications.

The ERP research helps to demonstrate how integrated systems enhance financial reporting and allocation. SAP customisation study provides a design of profitability analysis report using the ABAP List Viewer for telecommunication companies (Damayanti et al., 2022). OPEX planning research highlights the challenge controllers have in choosing which tasks should reside in ERP and which in Data Warehouse systems (Batalla Martinez et al., 2021). Other studies demonstrate the application of ERP for cost allocation monitoring to enhance managerial insight and mitigate the delays in reporting (Ezinne C & Ogunsola, 2021). However, these studies are limited to energy and telecom sectors, and do not cover FMCG, where the product categories are diverse and allocation becomes even more complicated. The digitalisation of management accounting provides an additional dimension. Research has revealed the growing significance of artificial intelligence for augmenting ERP efficiency and managerial control control (Korobeynikova et al., 2021). Managerial accounting perspectives in emerging economies such as Sri Lanka and Indonesia emphasize pragmatic ERP adaptations in resource-constrained contexts (Barna et al.,

2021). The works together suggest digital, algorithmic ways of allocation, but none of the studies directly address automated allocation at the FMCG product category level.

Presented in table 1, a descriptive classification of literature with an initial focus on Cost Classification & Accounting Practices. The studies provide a basis for allocation by grouping costs into useful classes. (Kuritsyna et al., 2021) improve the classifications of personnel cost. (Husada Tarigan et al., 2019) Demonstrate how the hierarchy of GL based on ERP can support the allocation of costs in FMCG. (Timoshenko et al., 2021) Demonstrate how cost classification is taught and applied in accounting education. This body of work emphasises the importance of organisations establishing well-defined cost taxonomies and standardised formats within their ERP systems before implementing sophisticated allocation models. In the absence of a clear classification structure, the assignment of indirect costs may be arbitrary and hard to justify. Moreover, the emphasis on cost classification points out that knowledge of these principles is not only a technical requirement but also an important skill for accountants and managers. The second stream, Applied Managerial Accounting & Performance, deals with the impact of allocation on managerial insights and organizational outcomes. For example, Panfilova et al. (2020) show that allocation is important in supply chain decision-making. These studies suggest that allocation should not be seen simply as a back-office accounting

activity, but as a process that directly impacts managerial behaviour and strategic decisions. Connecting allocation decisions to performance metrics enables organizations to identify inefficiencies, evaluate the profitability of various categories, and modify their marketing or production strategies accordingly. This stream also illustrates how allocation methodologies embedded in ERP systems can produce timely, actionable information that helps tie accounting data to business strategy. On a more conceptual plane, allocation practices relate to fairness in decision-making (Pakšiová, 2017). The final stream on Allocation Models & Methodological Advances reflects the growing attention to the importance of quantitative methods to improve fairness and accuracy of cost allocation. The research shows how mathematical and optimization-based methods can be used to improve allocation processes. A number of these models originated in the energy and utilities sector, but the principles can be applied to the FMCG case. These approaches are incorporated into ERP systems to enhance the technical accuracy and management usability of profitability reporting, resulting in more consistent and reliable reporting across product categories.

These bodies of literature provide a conceptual basis for the Category Allocation Algorithm proposed in this study. The cost classification provides a clear structure for defining allocation objects. Research in managerial accounting has shown the importance of linking allocation outcomes with

decision-making results. At the same time, methodological advances indicate the need for systematic and rule-based allocation mechanisms. From these results, this study integrates classification structure, managerial relevance, and rule-based allocation into a single algorithm within an ERP environment, thereby translating theoretical principles into an operational solution for FMCG cost allocation.

Research on ERP adoption and customisation in Table 2 is classified. Enterprise systems play an important role in improving cost allocation, reporting accuracy, and managerial insight. Research shows that ERP contributes to increased financial transparency by integrating economic and operational data (Barna et al., 2021) and by developing customized profitability reports using customization tools such as SAP ABAP (Damayanti et al., 2022). The results of these studies suggest that ERP systems should be considered not only as tools for recording transactions but also as platforms that convert raw financial data into structured information for managerial decision making.

Reporting modules, when adapted to meet the organisation's needs, can provide a continuous audit trail and greater accountability than manual reporting practices. This argument is also supported by recent studies in the FMCG industry. For example, (Nasiri et al., 2022) applied SAP-ERP framework in an FMCG company and

reported better coordination, such as 39% reduction in inventory levels and 71% increase in turnover. Similarly, Ratnatunga et al. (2012) compared activity-based costing (ABC) with time-driven ABC (TDABC) within ERP systems. They found that integrating costing models improves the accuracy and usefulness of information for decision-making. Such findings indicate an increasing use of ERP systems as real-time analytical tools for cost and performance management, especially in fast-moving product environments such as toiletries.

Moreover, ERP allocation tasks, particularly under the SAP Controlling (CO) module, facilitate a more formalised distribution of indirect costs across business units and product groups. For instance, Ezinne C. and Ogunsola (demonstrate that the allocation frameworks based on ERP can enhance transparency in energy companies. (Batalla Martinez et al., 2021) demonstrate that OPEX planning can be more efficient by deciding which activities should be managed in ERP and which should be managed in data warehouse systems. The findings indicate that ERP systems can handle complex allocation logic, enabling companies to determine the optimal location for computational processes. The CO module, in particular, contains predefined structures for linking costs to cost centres and categories, helping reduce ambiguity and maintain consistency across reporting periods.

At the same time, some studies point out difficulties in ERP implementation and the need for appropriate strategies to address them. For example, (Xie et al., 2022) propose optimization-based methods to assist resource allocation in ERP implementation in SMEs, which result in enhanced project outcomes. These problems are often the result of the high cost of implementation, the need for extensive training, and the lack of alignment between the ERP system and the existing business processes. Optimisation approaches address these challenges by helping managers prioritise scarce resources on key elements like leadership commitment, user capability, and process integration, minimising risks of delays, cost overruns or poor adoption.

The role of ERP is twofold. On the operational level, ERP supports automated expense allocation. On the managerial level, it supports profitability analysis and strategic decision-making. However, most studies have been done in areas such as energy and telecommunications, and there is a gap in FMCG contexts. Further research is needed to adapt the ERP-based allocation methods to more complex and dynamic environments in industries such as toiletries where indirect costs such as advertising, promotion and distribution are significant.

The literature on ERP adoption and customisation generally provides a good backdrop to position the Category Allocation Algorithm in an enterprise system

environment. Previous studies have found that properly configured ERP systems can lead to better cost allocation, increased accuracy in reporting and improved managerial decision-making. However, many existing approaches are still either generic or limited to specific industries. Building on these insights, this work further develops this by providing a structured allocation logic on the product category level in ERP, thus enabling a more detailed profitability analysis suitable for FMCG environments. In doing so, it extends existing ERP research from system capabilities to practical implementation in complex product portfolios.

However, standard ERP modules as SAP CO are, in general, designed to be applied broadly in different sectors. Although predefined allocation structures are provided and systematic distribution of indirect costs is enabled, the allocation logic may be fairly generic and less attuned to the specific characteristics of product categories in FMCG settings. On the other hand, more targeted allocation methods, based on product categories and market segmentation, can provide a more granular and context-specific cost distribution. This perspective underscores the importance of adjusting the ERP allocation logic to better reflect the operational complexity and management needs of multi-product contexts, including the toiletries industry.

Research Framework

The research framework is shown in Figure 1. The framework is rooted in the problem of expense allocation accuracy and acknowledges the inefficiencies and subjectivities inherent in manual indirect cost allocation. This study, using a design science research approach, proposes an allocation artefact in two major steps: first, it defines the master data (product categories, general ledger accounts, and cost centres), and second, it builds the allocation rules

based on category patterns and market-area logic. The algorithm is then incorporated into the ERP system to support allocation within it. In the testing phase, the artefact is evaluated through ERP simulation and general ledger reconciliation to ensure accuracy and consistency. The end result is the generation of automated category-level profit and loss reports, improving allocation accuracy, reducing processing time, and providing clearer insights for managerial decision-making.

Table 1
 Literature Classification on Allocation, Cost, and Accounting

Classification	Scope	Key References
Cost Classification & Accounting Practices	Developing refined cost taxonomies, ERP GL hierarchies, and accounting education.	Kuritsyna et al. (2021); Husada Tarigan et al. (2019); Timoshenko et al. (2021)
Applied Managerial Accounting & Performance	Using allocation in ERP and managerial contexts to support decision-making and profitability analysis	Panfilova et al. (2020)
Allocation Models & Methodological Advances	Quantitative models for fair and optimal allocation.	Sheng et al. (2021); Gupta (2018); Pakšiová (2017)

Table 2
 ERP Adoption and Customization for Allocation

Classification	Key References
ERP for Transparency & Reporting	Barna et al. (2021); Damayanti et al. (2022)
ERP Allocation Practices & Modules	Ezinne C & Ogunsola (2021); Batalla Martinez et al. (2021).
ERP Adoption Challenges & Strategies	Xie et al. (2022) ; Nasiri et al. (2022) ; Ratnatunga et al. (2012)



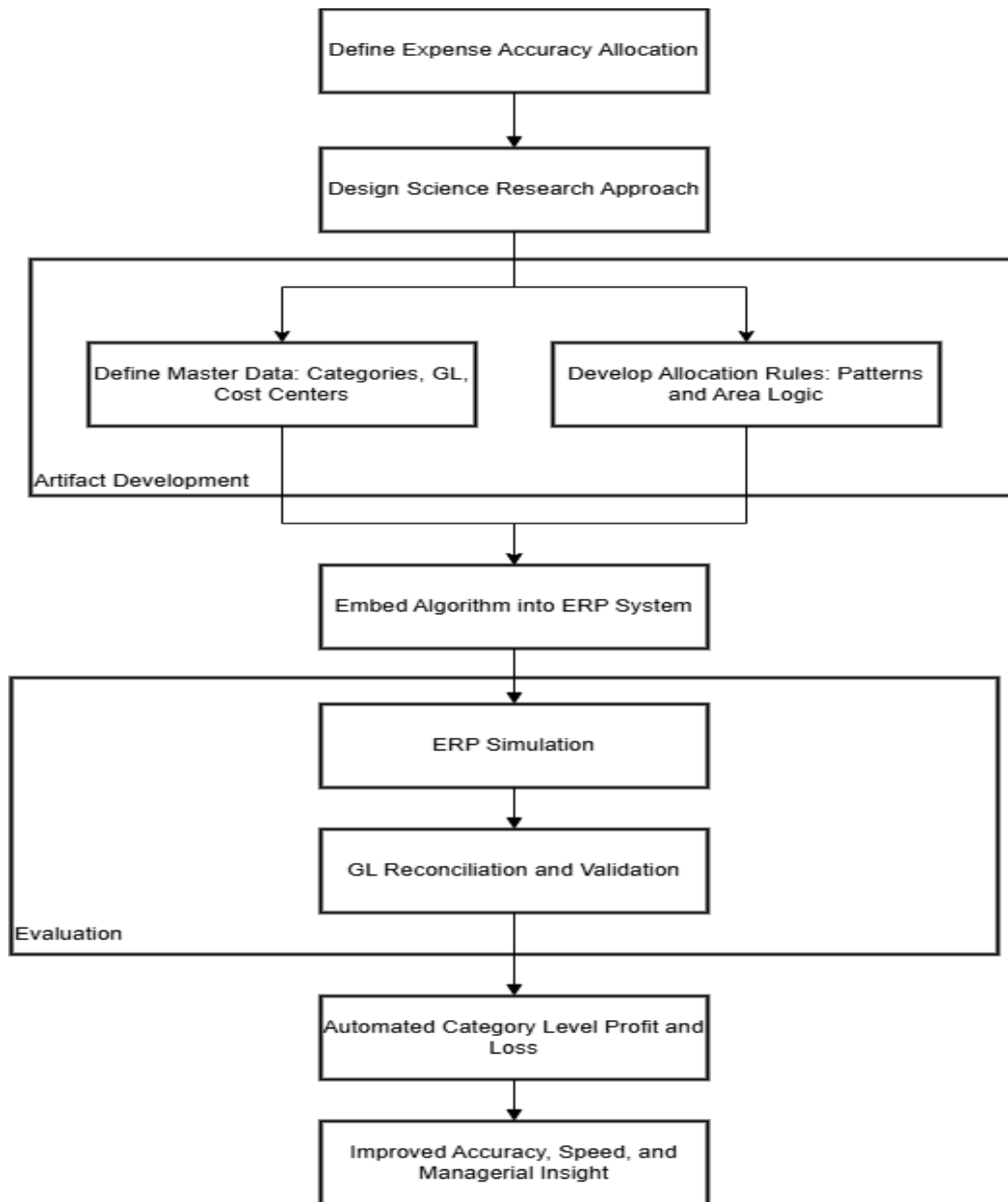


Figure 1. Research Framework

RESEARCH METHODOLOGY

The rationale for combining a case study with design science is to provide contextual relevance and practical contribution. The case study approach enables a detailed investigation of challenges in an ERP-based allocation in an FMCG company. Design

science provides a systematic process for the development and evaluation of an artefact, in this case, the allocation algorithm. Although based on a single case, such an approach is justified because the selected firm is a large, mature FMCG toiletries firm with comprehensive ERP integration. As suggested by (Yin, 2018) we find that a

single-case design is appropriate, given the case's revelatory insights into under-explored phenomena, here, ERP-embedded expense allocation. This depth-oriented design allows close observation of system logic and managerial interpretation that would be difficult to obtain from a multi-company survey. In line with calls for exploratory research in management accounting and information systems, the analysis focuses on contextual richness and analytical transparency rather than statistical generalization.

Research Design

The study adopts a case study and design science approach. This case study is based on a company in the toiletries sector, an FMCG company in Indonesia with more than 1,900 product items and an existing ERP implementation. Case studies are well known as a good way to gain deep understanding and rich insight into organizational practices (Yin, 2018). They offer the possibility to directly observe allocation processes in a real ERP environment. They are also often used in management and accounting research to connect practice with theory. This is complemented by the design science approach in which an embedded allocation algorithm for an ERP system is designed and evaluated to solve an allocation inefficiency in the real world.

Data Source

Using real ERP transaction data (May 2023) with domestic sales of IDR 126 billion and export of IDR 62 billion. Selling & General Expenses (Expenses) IDR 36 billion Data were extracted from general ledger accounts, cost centres and sub accounts, a total of 397 sub accounts. Using real transactional data from the ERP system improves the internal validity of the study, meaning the algorithm is tested on real financial transactions. The framework captures the complexity of FMCG operations through its various accounts and cost centres.

Algorithm Development

The allocation algorithm was developed in four main stages. First, master data were defined like product categories (male and female), general ledger accounts and cost centres. Secondly, the allocation patterns were configured as follows: Pattern A for all products, Pattern B for male categories, and Pattern C for female categories. Thirdly, the allocation was organized by area, such as Area A for domestic, Area B for overseas, and Area C for general expenses. Finally, variant sequences were defined to connect general ledger accounts, allocation areas and patterns into a consistent set of allocation rules.

This incremental development follows design science principles, where theoretical allocation concepts are gradually transformed into a functional ERP-based

solution. The structured approach also enables the model to be replicated and adapted to different organisational contexts. This study does not statistically validate the ERP system, but the actual data of general ledger were simulated and reconciled with the ERP system to evaluate the accuracy of the algorithm. The evaluation procedure consisted in comparing obtained results with ones from the previously used manual approach to verify consistency. This work can be extended in future research by applying quantitative performance measures such as analysis of variance or predictive accuracy across multiple periods or organizations to enhance the empirical validation.

To better align with design science principles, the development was conducted as an iterative build-evaluate process. The algorithm was first implemented and then tested by ERP simulation and reconciliation with general ledger data. At this stage feedback was received on differences in allocation distribution and inconsistencies across product categories to improve allocation rules, category patterns and area definitions. This iterative refinement enhanced the algorithm's accuracy, consistency and conformity with real-world data.

Implementation in ERP

The algorithm was realized in the ERP Business Objects reporting environment.

Direct expenses were automatically allocated in the appropriate categories and indirect costs were allocated based on sales contribution and area patterns. Embedding the allocation algorithm within the ERP Business Objects ensures that the output is directly relevant to the organisation and can be integrated with existing reporting tools without requiring external systems or manual adjustments.

RESULTS AND DISCUSSION

We tested the ERP-embedded category allocation algorithm using transaction data from May 2023 in the toiletries sector. The data set had total sales of IDR 188.2 billion and indirect expenses of IDR 36.0 billion. The distribution of sales by market destination is presented in Table 3. Domestic sales amounted to IDR 126.2 billion (67%) while export sales amounted to IDR 62.0 billion (33%). This indicates that the company relies more heavily on the domestic market.

The distribution of indirect costs by general ledger accounts is shown in Table 4. Selling expenses reached Rp20.6 billion, the largest portion of which was for sales promotion (Rp11.8 billion), followed by sales incentives (Rp3.3 billion) and advertising (Rp1.7 billion). General expenses amounted to IDR 15.4 billion, led by personnel costs (IDR 9.6 billion) and general administrative expenses (IDR 5.8 billion). After processing

through the Category Allocation Algorithm, indirect expenses were systematically distributed across more than 25 product categories using predefined category patterns and market-area rules.

Table 5. Product Category Profit & Loss illustrates the outcome of using the ERP-embedded Category Allocation Algorithm on selected product categories. The figure provides a structured financial overview on category level. The financial overview consists of net sales, cost of goods sold, gross profit, allocated selling expenses, general expenses and operating income. This shows how the allocation logic is embedded and automatically performed in the ERP reporting system. Based on Figure 2, the Hair Colour (Male) category generated IDR 48.8 billion in domestic sales. From this amount, direct costs totaled IDR 24.8 billion, resulting in a gross profit of IDR 23.9 billion. Through the allocation process, selling and general expenses of IDR 12.2 billion were assigned to this category based on predefined product-category patterns and market-area rules. After allocation, the category recorded an operating income of IDR 11.8 billion.

All calculations were done automatically in the ERP system, so that the indirect costs (promotion, incentives, advertising, personnel and administrative expenses) were proportionally distributed to the categories generating the respective revenue. Instead of being aggregated at the corporate level, these

costs were systematically allocated to product categories following the defined rules.

While the results demonstrate the ERP-embedded allocation algorithm's capability to generate structured, real-time category-level profitability, this study does not include a direct quantitative comparison between pre- and post-implementation conditions. The evaluation is based on system-level validation, including ERP simulation and reconciliation with general ledger results, rather than on longitudinal performance comparisons. Thus the findings are mainly suggestive of gains in process efficiency, consistency and reporting structure. Future work can build on this analysis by looking at multi-period data or controlled comparisons to quantitatively assess the algorithm's impact on financial performance and decision outcomes.

The results show that the implementation of a category allocation algorithm in the ERP environment improves the accuracy, transparency and efficiency of the allocation, compared to the manual method used before. This is accomplished by directly connecting allocation rules to general ledger accounts, cost centres and product categories. This finding is consistent with the studies of Pakšiová, 2017 and Gatti, 2018 that emphasise the importance of allocation fairness for reliable profitability assessment. The efficiency gain from several days to minutes confirms previous evidence of ERP-

enabled allocation improvements reported by Damayanti et al., 2022. In addition, the ability to deliver real-time category level profitability extends allocation research from the utilities and energy sectors (Sheng et al., 2021) to the FMCG toiletries context.

In practice the manual spreadsheet-based allocation is full of risks especially in companies with a large product portfolio. The sheer volume of items and diversity of cost elements result in greater risks of calculation errors, inconsistent allocation logic and version control issues across many files. In addition, manual processes limit traceability and make it difficult to maintain consistent allocation rules across categories and reporting periods. These issues can distort category-level profitability results and reduce the reliability of managerial decision-making.

In addition to these technical improvements, the findings also indicate that organizational conditions play an important role in supporting the effectiveness of the ERP-embedded allocation algorithm. A well-structured master data setup, standardised cost centres and consistent financial processes allow the algorithm to run reliably in the ERP system. These conditions indicate that besides system capability, organisational readiness is a factor for successful implementation of automated allocation and improved quality of managerial insights obtained.

In large-scale FMCG operations with more than 1,900 product items, reliance on Unlike traditional ERP reporting that aggregates Indirect costs, this study demonstrates the practical value of embedding allocation logic directly into ERP systems. The findings extend ERP allocation frameworks previously examined in manufacturing and energy (Ezinne C & Oguniola, 2021). The other hand provides operational confirmation of the algorithm based allocation approaches discussed by (Xie et al., 2022). Overall, the study shows that embedding allocation within ERP systems helps bridge the gap between management accounting theory and practical financial reporting.

The selection of product categories shown in Table 5 is based on their representativeness over the entire product portfolio. Hair Colour, Deodorant, and Body & Etiquette were chosen because they are different in terms of sales levels, cost structures, and strategic roles in the toiletries segment. Hair Colour is a high-volume category with a significant revenue contribution, while Deodorant and Body & Etiquette are medium- and lower-scale categories with varied cost structures. This variation allows the analysis to demonstrate how the allocation algorithm performs in categories with different financial characteristics, giving a more complete view of its usefulness in the FMCG context.

Table 3
 Sales Result (May 2023, million IDR)

Destination	Actual Amount
Domestic Sales	126,232.5
Export Sales	61,976.9
Total	188,209.4

Table 4
 Actual Expenses by General Ledger (million IDR)

Account Hierarchy	General Ledger Account	Actual Expenses
Selling Expenses	Sales promotion	11,791
	Sales incentives	3,268
	Advertising	1,752
Selling Expenses	R&D	861
	Other selling expenses	73
	Overseas expenses	1,438
	Overseas promotion	1,426
Subtotal		20,610
General Expenses	Personnel	9,613
	General administration	5,779
Subtotal		15,392
Total		36,002

Table 5
 Product Category Profit and Losses

Account Hierarchy	General Ledger Account	Hair Color-M	Deodorant-M	Body & Etiquette-M
Net Sales		48.820	2.627	2.193
	Net Domestic Sales	48.820	2.627	2.193
	Net Export Sales	0	0	0
Cost of Goods Sold		24.849	2.760	1.986
	Cost of Goods	22.408	2.629	1.864
	Royalty Domestic	2.441	132	122
	Royalty Export	0	0	0
Gross Profit		23.971	133	207
Selling and General Expenses		12.165	1.021	569
Selling Expenses		5.824	578	241
	Sales promotion	2.695	162	96
	Sales incentives	905	57	42
	Advertising	54	15	6
	Research & Development	285	222	9
	Other selling expenses	1.884	122	88
	Overseas expenses	0	0	0
	Overseas promo	0	0	0

Account Hierarchy	General Ledger Account	Hair Color-M	Deodorant-M	Body & Etiquette-M
General Expenses		6.341	443	328
	Personnel expenses	4.388	310	231
	General Administration expenses	1.953	133	97
Operating Income		11.806	1.154	362

CONCLUSION

This study answers the research question by demonstrating that the integration of a Category Allocation Algorithm into an Enterprise Resource Planning (ERP) system can improve the accuracy, efficiency, and transparency of indirect expense allocation in an FMCG toiletries company. By embedding predefined product-category patterns and market-area rules into the ERP Business Objects environment, indirect expenses can be allocated automatically across more than 25 product categories. The resulting category-level Profit and Loss reports provide a more detailed representation of the financial contribution of each product category and support more timely, data-driven managerial decision-making.

The findings show that the ERP-embedded approach reduces the limitations associated with spreadsheet-based manual allocation, including subjective judgment, inconsistent allocation logic, limited traceability, and lengthy processing time. The automated process shortens reporting time from several days to minutes while maintaining consistency through ERP

simulation and general ledger reconciliation. The algorithm also enhances managerial usefulness by enabling managers to evaluate category-level profitability, monitor promotional and administrative expenses, identify underperforming categories, and formulate more appropriate pricing, marketing, and resource-allocation strategies.

The study further indicates that the effectiveness of the algorithm depends not only on system configuration but also on organisational readiness, particularly the availability of structured master data, standardised general ledger accounts, consistent cost-centre definitions, and reliable financial processes. Therefore, the implementation of an ERP-embedded allocation model should be accompanied by appropriate data governance and periodic review of allocation rules.

Although the study provides practical evidence from an actual ERP environment, its findings are limited to a single toiletries company and a one-month observation period. Future studies should test the algorithm across multiple periods, companies, and FMCG subsectors and apply

quantitative pre- and post-implementation comparisons to assess its broader generalisability and long-term contribution to managerial performance.

RESEARCH IMPLICATIONS

This study suggests that the inclusion of structured cost allocation mechanisms in ERP systems can lead to greater financial transparency, enhanced managerial reporting efficiency and more effective decision processes in complex organisational settings. The findings also imply that the digitalization of the allocation processes reduces subjectivity and reinforces the connection between accounting principles and operational reporting. The implications are especially significant for organizations that have multiple product lines, and in particular for FMCG firms with high indirect costs, as well as for researchers interested in the evolution of accounting practices in digital systems. The study contributes to the larger trend in financial management toward data-driven and integrated management by demonstrating how allocation embedded in ERP can be used in practice.

The results offer managerial practical support to make more informed and data-

driven decisions in FMCG contexts. With real-time reporting on profitability at the category level, managers can observe the effectiveness of their promotional activities, identify product categories that are not performing well, and make the necessary adjustments to their pricing or marketing strategies. Moreover, tracking indirect costs to specific categories allows for more accurate budgeting and resource allocation, particularly when handling the substantial marketing costs typical of toiletries. The improved visibility facilitates more agile and strategic decision making, helping organizations better align the financial performance with business objectives.

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