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OPTIMIZING RESOURCE UTILIZATION: A COMPREHENSIVE APPROACH TO ACCOUNTING IN COMPONENT MANUFACTURING ENTERPRISES

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Abstract:

Cost management is a essential aspect of enterprise management, influencing the accuracy of cost data calculations, streamlining internal data transfers, and delineating economic responsibilities within cost centers. The choice of cost management methods significantly impacts various facets of a company's operations, both externally and internally. This research paper examines the implementation of resource consumption accounting within component manufacturing enterprises, illustrating its application system through practical examples supported by theoretical research. The study emphasizes the identification and definition of resource accumulation points, operations, cost allocation to auxiliary production departments, and product cost computations. Throughout the system application process, we also scrutinize the disparities between theory and practice, offering insights into addressing practical nuances.

Keywords: *Resource consumption accounting (RCA); Cost management; Applied research.*

1. INTRODUCTION

In the dynamic landscape of modern business, effective resource management stands as a cornerstone for the sustained success of component manufacturing enterprises [1]. By delving into the background, reviewing pertinent literature, articulating the rationale behind this study, and outlining the paper's structure, it paves the way for a nuanced understanding of the pivotal role played by resource consumption accounting in optimizing operations [2]. Component manufacturing enterprises operate within intricate webs of supply chains, production processes, and financial structures. To thrive in an increasingly competitive market, they must continuously seek innovative ways to enhance resource utilization while maintaining cost efficiency. Accounting methods are pivotal in achieving this delicate equilibrium, as they directly influence cost data accuracy, internal data transfer efficacy, and the allocation of economic responsibilities among internal cost centers [3]. Consequently, the choice of cost management methodologies carries far-reaching implications, both within the organization and in its external interactions.

Extensive literature exists on cost management and accounting methods in various industries [4-6]. Numerous studies have examined traditional accounting practices, such as absorption costing and activity-based costing, along with their strengths and limitations. However, a growing body of research highlights the efficacy of resource consumption accounting in addressing the unique challenges faced by component manufacturing enterprises [7]. This accounting approach emphasizes the tracking of resource consumption at the operational level, allowing for a more granular and precise understanding of costs [8]. Despite this growing interest, there remains a gap in research that comprehensively explores the application and implications of resource consumption accounting within this specific sector.

This paper aims to bridge the existing gap in the literature by focusing specifically on resource consumption accounting in component manufacturing enterprises. We recognize that the adoption of this accounting methodology presents a promising avenue for these enterprises to enhance their competitiveness, streamline operations, and improve decision-making processes. By conducting a systematic examination of the application system of resource consumption accounting, we seek to provide practitioners and scholars with valuable insights into key aspects, including the identification and definition of resource gathering points, operations, cost allocation to auxiliary production departments, and product cost calculations.

The subsequent sections of this paper will delve into the practical application of resource consumption accounting, drawing upon theoretical research and real-world examples to illustrate its effectiveness. We will also scrutinize the challenges and nuances encountered when transitioning theory into practice, offering practical guidance for implementation. Through this comprehensive exploration, we endeavor to contribute to

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the body of knowledge in cost management and accounting practices within component manufacturing enterprises, ultimately supporting their quest for optimized resource utilization and sustainable growth.

2. RELATED WORK

2.1 Resources and Resource Gathering Points

Resources constitute the spectrum of costs and expenses that enterprises incur in the production of goods or the provision of labor services [9-10]. These encompass the financial outlays associated with various operational aspects such as labor, raw materials, machinery, buildings, and more. The concept of a "resource gathering point" denotes the focal point within a cost center where resources are consolidated. In the context of Resource Consumption Accounting (RCA), the approach takes inspiration from German Cost Accounting (GPK) for cost center division, and subsequently, it subdivides these cost centers based on resource categories, aligning with the granular cost item details found in financial accounting. Essentially, within a cost center, a resource gathering point serves as the identifiable locus for a particular category of resources [11-13].

Resource gathering points can be broadly categorized into several types, including but not limited to:

(i) Human Resource Gathering Points: These represent the aggregation of costs related to labor, encompassing salaries, wages, benefits, and other human resource expenses.
(ii) Equipment Resource Gathering Points: This category pertains to the consolidation of costs associated with machinery, tools, and equipment required for production or operational processes.
(iii) Office Facility Resource Gathering Points: These encompass the costs linked to office infrastructure, including rent, utilities, maintenance, and office supplies.
(iv) Material Resource Gathering Points: Material resource gathering points centralize the costs related to raw materials, components, or supplies used in the production or service delivery processes.

When viewed hierarchically, resource gathering points can be categorized into two primary levels:

(i) Primary Cost Gathering Points: These represent the initial aggregation of resources, measured according to the unit of measurement in their raw or initial state [14].
(ii) Secondary Cost Gathering Points: At this level, resources are further processed or transformed after their initial aggregation, resulting in secondary resources with different characteristics or measurements [15].

This nuanced approach to resource gathering points within the RCA framework allows enterprises to dissect and manage their costs more comprehensively, ensuring a finer-grained understanding of resource utilization and allocation across different categories and processing stages[16].

2.2 Production Process and Resource Consumption of Component Enterprises.

A component manufacturing company specializes in the production of pipe piles, which serve as its primary product. These pipe piles are essentially hollow cylindrical concrete prefabricated components crafted through a high-speed centrifugal molding process. Subsequently, they are cured under high-pressure, high-temperature steam conditions. These pipe piles find their primary applications in various underground foundation projects, including those for docks, houses, and other building structures.

The distinguishing factors among different types of pipe piles primarily revolve around variances in steel cage diameters and the quantity of concrete utilized. The manufacturing process of pipe piles is organized into standardized batches, conforming to the specifications outlined in customer orders. The heart of the production operation lies within the dedicated pipe pile workshop, where these products are systematically manufactured along the production line. This production line encompasses a series of distinct processes, each catering to specific aspects of pipe pile production. Some of these processes are tailored for individual product production, while others are geared towards batch production. For a comprehensive overview of the main processes and their associated resource consumption details, please refer to Table 1 below.

Table 1: Main process description and resource consumption table

Process	Action description	Resource consumption (excluding direct materials
Cutting	Cut the PC steel rod to the required size	Labor, cutting machine, electricity

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Stir	Inject sand, gravel and water into the mixer to mix into concrete	Labor, mixing equipment, electricity
Workshop management	Responsible for the overall organization, coordination and management of pipe pile production	Labor and office facilities

2.3 Cost center division

Cost centers play a pivotal role in the realm of enterprise cost accounting and cost management, forming the bedrock upon which effective responsibility management is constructed. The linchpin to achieving this lies in the establishment of a precise causal relationship between cost objects and their corresponding cost drivers. Resource Consumption Accounting (RCA), drawing inspiration from the experience of German Cost Accounting (GPK), significantly informs the delineation of cost centers within organizations [13]. It is imperative to recognize that each cost center is associated with a singular "cost driver" and corresponds to a specific type of output.

In the context of component manufacturing enterprises, the division and analysis of cost centers are guided by the existing organizational structure and production processes. This involves an examination of the production process to identify sub-processes with similar outputs, which are then designated as subordinate cost centers. This approach streamlines the division of cost centers in accordance with the enterprise's management hierarchy, rendering it convenient for the allocation of responsibilities and identification of responsible individuals. Typically, the cost management hierarchy in manufacturing enterprises consists of four levels: management and support level, process level (organized by workshops), resource aggregation points, and operations. Figure 1 provides a visual representation of this division.

In the specific context of component manufacturing enterprises, the division of cost centers unfolds across three distinct levels of responsible cost centers. These levels are delineated as follows:

Department Level (First Level): At this level, the analysis of the organizational structure and the specifics of pipe pile production inform the division. Here, departments align precisely with the company's functional management departments and workshops. Each department stands as a first-level cost center, reflecting the organization's structure and responsibilities.

Production Area or Process Level (Second Level): This level represents the foundational tier of management and pertains to the direct management of specific production processes. The secondary cost centers at this level correspond to the subdivisions of the primary production workshop, based on the process flow. For instance, these subdivisions may include operations such as mold loading, mixing, blanking, and mold closing, among others.

Resource Gathering Points (Third Level): At the third level, resource gathering points are instrumental in analyzing the inputs, outputs, and nature of resources consumed by the upper-level cost centers. These resource gathering points group resources into distinct categories based on quantifiable and homogeneous output criteria. Examples of such resource gathering points encompass human resources gathering points, equipment resource gathering points, facility resource gathering points, and other similar resource gathering points, as outlined in Table 2.

This structured approach to cost center division and analysis provides component manufacturing enterprises with a robust framework for cost management, enabling them to align their operations with their organizational structure, streamline responsibilities, and enhance resource allocation efficiency.

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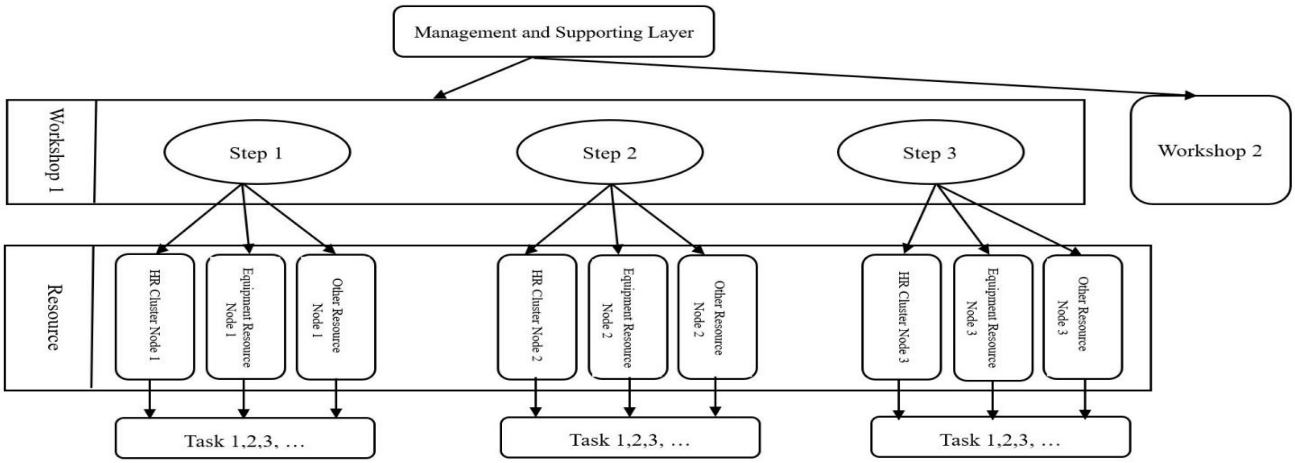

Figure 1: Cost Management Hierarchy Diagram

Table 2: Detailed list of responsibility cost center division

First level cost center	Team	Secondary cost center: process	Third-level cost center: resource gathering point	
Pipe pile making workshop	Steel bar processing	Cutting process	Human resources assembly point	Equipment resource gathering point
	Mixing team	Mixing process	Human resources assembly point	Equipment resource gathering point
Repair shop	----	Maintenance process	Human resources assembly point	Facility resource gathering point

3. Proposed Method

Resource Consumption Accounting (RCA) introduces significant changes to the measurement structure compared to Activity-Based Costing (ABC). RCA's approach to resource consumption and output involves a sequential process: first, it quantifies resource output within operations, and then it attributes operation costs to products. This stands in stark contrast to ABC's methodology of "jobs consuming resources and products consuming jobs." The key distinction lies in how RCA calculates resource outputs, doing so individually rather than aggregating all resource costs together. (i)

In both ABC and RCA, job management plays a pivotal role. Job identification and definition serve as the foundation of ABC accounting, and this aspect remains integral to RCA, which absorbs elements from ABC. However, RCA's focus shifts to operations and operation drivers, with jobs becoming the lowest-level cost management entities within RCA. (ii)

Identifying operations and their corresponding operation drivers is accomplished through a series of steps, including process analysis and operation analysis. In practice, processes often involve multiple operational steps. While theoretically defining each step as a job is precise, it can lead to increased management complexity due to the sheer number of jobs. Hence, to streamline operations and reduce management overhead, processes can be defined according to practical needs, typically involving preparation and execution tasks.

The accounting process within RCA unfolds as follows:

Resource Cost Allocation: Initially, resource costs incurred at each resource gathering point are allocated to each operation based on the resource consumption driver.

Operation-to-Product Cost Allocation: Subsequently, the costs allocated to each operation are further allocated to the products based on the operation driver pertinent to that operation.

This process ensures that resource costs are accurately attributed to both operations and products, facilitating a

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Vol. 34, May, 2024
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granular understanding of resource consumption and its impact on product costs. Figure 2 illustrates the specific accounting process, encompassing steps such as resource cost collection, calculation of remaining or idle production capacity based on planned and actual resource output, and determination of the unit cost of operations based on their output levels.

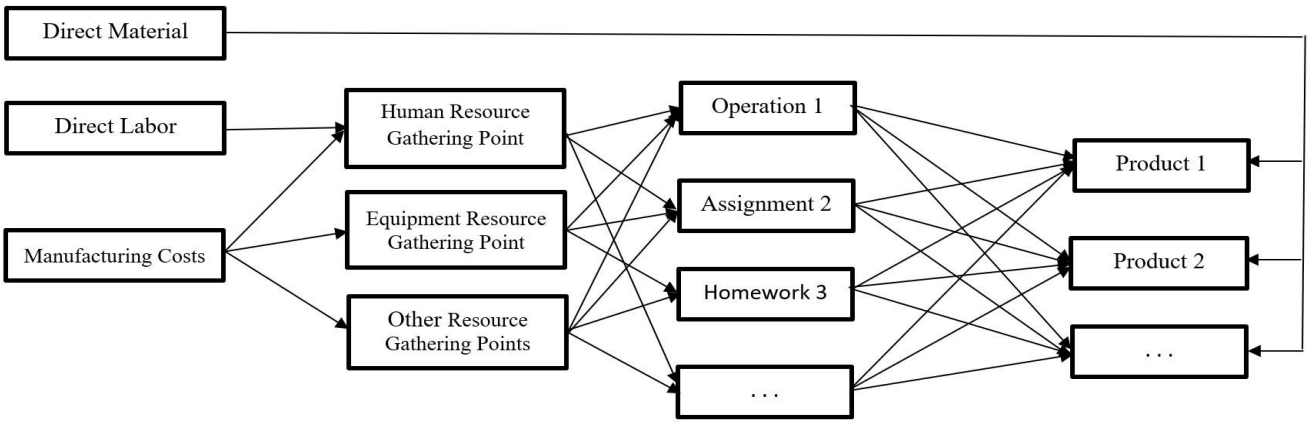

Figure 2: Product Cost Accounting

Following the crucial steps of job identification and job definition, it becomes imperative to identify the cost drivers, establish measurement units for these drivers, and define job attributes. This process culminates in the creation of a standardized job dictionary. The job definitions specific to component manufacturing enterprises are thoughtfully detailed in Table 3, encapsulating the key attributes and parameters that define each job.

Table 3: Job Identification and Job Definition

Department	Process	Operation	Work Motivation	Unit Of Measure	Job Properties
Pipe pile workshop	Cutting	Cutting Rebar	Number Of Cuts	Frequency	Unit Level Operations
	Stir	Mix Concrete	Mixing Volume	Mixing Volume	Unit Level Operations
	Workshop Management	Workshop Management	Management Services	Labor Hours	Support Horizontal Work
House Facilities		Provide Venue	Venue Size	Ground Level	Support Horizontal Work

4. RESULT AND DISCUSSION

The costs associated with resources and operational outputs, as discussed in this context, are meticulously categorized into two distinct classifications: variable costs and fixed costs. This categorization is illustrated comprehensively in Table 4, which is presented below for a more detailed understanding: Table 4: Breakdown of Resource and Operation Output Costs

(i) Variable Costs: These are expenses that fluctuate in direct proportion to the level of production or operational activity. In other words, as production output increases or decreases, variable costs respond accordingly. Variable costs typically encompass:

(ii) Raw Materials: Costs related to the acquisition of raw materials, components, or supplies directly used in the production process.

(iii) Direct Labor: Expenses associated with the wages, salaries, and benefits of employees directly involved in the production or operational processes.

(iv) Utilities: Costs attributed to essential services like electricity, water, and gas, which are directly tied to production levels.

(v) Production Supplies: Expenditures on consumable items necessary for the manufacturing or operational activities.

(vi) Fixed Costs: These represent expenses that remain constant over a certain period regardless of

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Vol. 34, May, 2024
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changes in production or operational levels. Fixed costs include:

- Depreciation: The gradual reduction in the value of long-term assets, such as machinery and equipment, over their useful life.
- Salaries of Supervisory Personnel: Compensation for managerial or supervisory roles that do not directly engage in production but oversee operations.
- Rent or Lease Payments: Costs related to renting or leasing facilities, machinery, or equipment, which do not vary with production output.
- Insurance Premiums: Expenses associated with insuring assets or operations, which remain stable irrespective of production fluctuations.

This detailed breakdown of costs into variable and fixed categories allows for a granular understanding of how different expenses behave concerning changes in production levels. It enables businesses to make informed decisions regarding cost control, pricing strategies, and resource allocation based on the dynamics of these cost components.

Table 4: Resource consumption and job output

Process	Contents Of Homework	The cost of resources consumed				Job output			
		resources consumed	Amount of resources consumed	Variable costs	Fixed costs	Unit Of Measurement For Output	Output	Unit Variable Cost	Unit Fixed Cost
Cutting	Cutting Rebar	Artificial	2735	6746.3	0	Number Of Cuts	1073	8.36	1.13
		mechanical	379	2216.16	1181.36				
Welding	Welded Steel Bars	Artificial	1824	4497.53	0	Welding Meters	19483	0.45	0.23
		mechanical	869	4333.97	4217.94				

The distribution of workload to specific products is carried out by using activity drivers as a basis. This allocation method considers the total cost incurred by product consumption activities, which is derived from both the workload associated with each product and the unit cost of the operations involved. The processing costs incurred during the production of each product are meticulously compiled and computed, as exemplified in Table 5.

Ultimately, the culmination of this process involves aggregating the direct material costs and processing costs to compute the unit production cost, unit variable cost, and unit fixed cost for each individual product. These essential cost components are presented in a comprehensive format in Table 6, providing a clear and detailed breakdown of the cost structure associated with each product's production.

Table 5: Job Consumption and Unit Cost

product	product consumed	Consumption workload and costs			Job output and unit cost			Pipe pile cost per meter		
	contents of homework	Amount of work consumed	Variable costs	fixed costs	Product quantity	unit variable cost	unit fixed cost	Variable cost per meter	fixed cost per meter	Total cost per meter
Pipe pile 800	cutting rebar	812	6772	893	810	8.36	1.10	0.53	0.07	0.60
	welded steel bars	12849	5825	2782	12850	0.41	0.27	0.45	0.22	0.67
	Workshop management	3063	9698	227	1	9698.49	226.99	0.75	0.02	0.77
	Subtotal		118807	23867		0.00	0.00	9.25	1.86	11.10

Table 6: Complete Production Cost Per Unit of Pipe Piles

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 34, May, 2024
ISSN: 2749-3628,

product	cost item		unit	Actual unit price	The actual amount	Variable costs	fixed costs	total cost
Pipe pile 800	Direct material	Prestressed steel bars	T	617.81	287	177311.0	0	177311.0
		Non-prestressed steel bars	T	538.49	83	44694.9	0	44694.9
		cementitious material	T	39.73	1714	68090.4	0	68090.4
		yellow sand	T	6.71	2278	15290.7	0	15290.7
		stones	T	7.12	3808	27125.5	0	27125.5
		Water reducing agent	Kg	0.96	17820	17087.7	0	17087.7
		end plate	Piece	49.86	1620	80778.1	0	80778.1
		Subtotal				430378.2	0	430378.2
		unit cost				33.5	0	33.5
	Processing cost	Subtotal				118807.3	23867.26	142674.5
		unit cost				9.2	1.86	11.1
	Total cost for the current period					549185.5	23867.26	573052.7
	total cost per unit					42.7	1.86	44.6

One of the distinctive attributes of Resource Consumption Accounting (RCA) lies in its ability to furnish valuable insights into product marginal benefit and the utilization of remaining or idle production capacity. By implementing RCA for systematic cost calculations, these critical decision-making metrics are presented through an RCA management accounting income statement. This statement serves as a pivotal source of information, offering a multifaceted view of product cost details and profitability. It's important to note that RCA operates on the foundation of projected unit costs for different departments, which underpin the generation of this comprehensive financial statement.

Table 7: Management Accounting Income Statement

	Project	Pipe pile 800	Pipe pile 1000	Pipe pile 1200	Total
	1.Production quantity	12849	935	5711	19495
	2. Average sales price	45.21	65.75	82.19	
	3. Unit variable cost	42.74	58.72	69.15	
	4. Unit fixed cost	1.86	2.32	1.69	
	5. Total unit cost (3+4)	44.60	61.04	70.84	
Operating profit calculation	6. Product sales revenue (1*2)	580890.4	61413.7	468493.2	1110797.3
	7. Product sales cost (1*5)	573052.7	57012.7	403812.5	1033877.9

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Available Online at: https://www.scholarexpress.net
Vol. 34, May, 2024
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	8.Profit from product sales (6-7)	7837.7	4401.0	64680.7	76919.3
	9. Gross profit margin (8/6)	1.35%	7.17%	13.81%	6.92%
	14. Total fixed cost (1*4)	23867.26	2166.44	9642.19	35675.89
	15. Total variable cost (1*3)	549185.48	54846.30	394170.27	998202.05
Margin calculation	16. Marginal profit (6-15)	31704.93	6567.40	74322.88	112595.21
	17. Unit profit margin (2-3)	2.47	7.03	13.04	22.54
	18. Marginal Profit Rate (16/6)	5.46%	10.69%	15.86%	10.14%

5. CONCLUSION

This paper investigate Resource Consumption Accounting (RCA) emerges as a potent tool for optimizing cost management within enterprises, offering a multitude of advantages across several critical dimensions:

Accurate Cost Allocation: RCA's ability to allocate costs based on well-defined cost drivers ensures a more precise calculation of product costs. This precision helps in avoiding the distortion of cost information, facilitating informed decision-making.

Unit Cost Insights: RCA provides valuable insights into unit variable and unit fixed costs, furnishing essential data for conducting marginal benefit analyses of products. This empowers businesses to make strategic pricing and production decisions.

Capacity Utilization Analysis: By accounting for remaining or idle production capacity, RCA provides crucial information regarding the efficient utilization of corporate resources. This data aids in the judicious acceptance of orders and the efficient arrangement of production schedules.

Clarity in Responsibility: RCA establishes clear cost limits for responsible departments, fostering effective internal economic responsibility management. This transparency ensures accountability and promotes cost-conscious practices.

As RCA gains increasing recognition among financial professionals and business managers, its application across various enterprises is poised for growth. RCA's versatility in providing multifaceted data perspectives positions it as a pivotal tool for informed decision-making. Furthermore, RCA is expected to evolve toward standardization, a journey where it can learn from Germany's practical experience in management accounting standardization. Standardization not only streamlines the implementation of the system but also enhances the generation of high-quality management accounting statements. In essence, the path to standardization represents a key milestone in harnessing RCA's full potential, reducing implementation costs, and delivering robust management insights to organizations.

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