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TRADITIONAL COSTING VS. AI BASED COSTING: A COMPARATIVE STUDY

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Abstract
The rapid digital transformation of business operations has significantly altered the landscape of cost accounting and managerial decision-making. This research paper presents a comparative study of Traditional Costing and AI-based Costing using secondary data from academic literature. The study first examines the conceptual frameworks of traditional costing methods such as absorption costing, marginal costing, and activity-based costing and contrasts them with AI-driven costing systems that leverage data analytics, automation, and predictive modeling. The research further investigates the inherent weaknesses of traditional costing approaches in today's data-intensive business environment, highlighting issues such as inaccurate overhead allocation, delayed reporting, limited scalability, and inability for managing massive amounts of both structured and unstructured data. In contrast, the study identifies specific AI technologies including Machine Learning for predictive cost estimation, Robotic Process Automation for automated data extraction and allocation, Natural Language Processing for interpreting unstructured financial documents, and optimization algorithms for dynamic resource planning that are currently transforming cost estimation and allocation practices. Additionally, the paper evaluates how the shift to AI-based costing enhances management's capacity to optimize pricing strategies, allocate resources efficiently, and reduce operational waste. By enabling real-time analytics, improved forecasting accuracy, and data-driven insights, AI-based costing supports proactive and strategic decision-making. The findings suggest that while traditional costing systems remain foundational for compliance and reporting purposes, AI-based costing provides a more adaptive, accurate, and strategically valuable framework in modern organizations. The study concludes that integrating AI technologies into costing systems offers a significant competitive advantage in an increasingly complex and data-driven business environment.

Keywords: Traditional costing, Absorption Costing, Activity Based Costing, AI, Machine Learning, Robotic Process Automation.

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Introduction:

Cost Accounting also known as Costing is a specialized branch of accounting that records, analyses and interprets costs associated with products or services. Its acts as a crucial management tool for decision making. It emerged during the Industrial Revolution as business needed better ways to track manufacturing costs and improve efficiency. The cost accounting technique used since its emergence was Traditional costing which assigns manufacturing costs to products based on volume driven metrics like direct labour or machine hours using a single overhead rate. It is widely

used for external reporting and inventory valuation due to its simplicity though it may distort product costs in complex automated or high overhead environment. It includes techniques such as:

- Absoption costing, often referred to as full costing, this accounting technique allocates a product's entire cost, both direct and indirect.
- Marginal costing also referred to as direct costing is a technique which includes only variable cost to determine the cost of product or service.
- Activity based costing also known as ABC costing is a costing technique which determines and allocates expenses to activities according to resources they utilize.

Whereas, AI based cost accounting began to emerge in the late 2010's with significant widespread adoption accelerating around 2016-18 as a part of broad digital transformation in finance. It is the integration of Artificial Intelligence such as Machine Learning (ML), Natural Language Processing (NLP) and Robotic Process Automation (RPA) into the cost management process to automate, analyze and optimize cost data in real time.

To bridge the gap between historical reporting and real-time strategy, organizations are pivoting toward Artificial Intelligence (AI)-based costing. Unlike its predecessors, AI-driven costing utilizes advanced technologies such as Machine Learning (ML) and Robotic Process Automation (RPA) to process unstructured data streams. This transition marks a paradigm shift from Cost Accounting i.e. recording the cost spent to Cost Intelligence i.e. predicting and optimizing what will be spent.

Literature Review:

1. Mbonigaba Celestin (2018). The study aimed to compare traditional costing methods with digital costing based on efficiency, accuracy and cost implications using secondary analysis of financial reports and industry surveys from 2013 to 2017. It employed statistical analysis including T-test and regression modelling. It concluded that digital costing is superior in optimizing cost allocation, reducing financial inefficiencies and enhancing corporate profitability. It implies that firms should adopt AI driven financial systems for improved cost tracking.
2. Adedokun Adetayo, Ashamu Abosede, Ogunniyi Olajumoke, Adedokun Aderemi (2025). The study poised to investigate a comparative study of traditional and activity based costing techniques using some existing studies as research methods. It concluded that the activity based costing method gives management more detailed, accurate and objective information in the decision making process than the traditional costing methods.
3. Bernice Brown (2025). This paper explores ten critical dimensions where AI augments ERP based cost management. Through in depth analysis the study uncovers how AI enables organizations to shift from reactive to proactive cost management, facilitating transparency, agility and strategic foresight. It contributes to the growing knowledge of ERP system and AI offering actionable insights for financial controllers, supply chain managers and ERP developers seeking to unlock the full potential of intelligent enterprise costing.
4. Eigbe Emmanuel Taylor Isiwele (2019). The research aims to determine how AI driven tools such as robotic process automation, real time dashboards and machine learning enhance accuracy, reduce manual errors and support faster decision making in financial management. The findings reveal that AI significantly improves cost accounting performance by streamlining repetitive tasks, enabling real time tracking and facilitate predictive cost model. It concludes that AI offers advantages for modern cost accounting and recommends strategic investments in AI infrastructure, workforce training and implementation.

Objectives of the Study:

1. To examine the conceptual frameworks of Traditional Costing and AI based costing methods.
2. To investigate the inherent weaknesses of traditional methods in the modern, data-heavy business environment.
3. To identify the specific AI technologies (Machine Learning, Robotic Process Automation, etc.) currently being applied to cost estimation and allocation.
4. To determine how the shift to AI-based costing influences management's ability to optimize pricing, resource allocation, and waste reduction.

Research Methodology:

This article uses secondary sources for its data. Various published sources such as websites, reference books, papers, journals and reports were used to collect the secondary data sources. The nature of the study is descriptive and exploratory.

Problem Statement:

Despite the theoretical superiority of AI, many firms remain anchored to traditional costing due to its simplicity and regulatory familiarity. Traditional methods have been shown to cause cost distortions of up to 35%, particularly in manufacturing, leading to profit margin erosion. Conversely, while AI offers precision, it's "black-box" nature and the complexity of its conceptual framework present significant implementation hurdles. There is a critical need to synthesize existing research to understand the tangible benefits and systemic challenges of moving from traditional to AI-based frameworks.

Conceptual Foundation:

1. Concept: Traditional Costing is based on predefined accounting principles and standardized allocation methods such as absorption costing, marginal costing, and activity-based costing (ABC). It allocates overhead using predetermined bases like labor hours, machine hours, or material cost. The system is largely rule-based and retrospective in nature. AI-Based Costing on the other hand, uses advanced technologies such as Machine Learning (ML), Robotic Process Automation (RPA), Natural Language Processing (NLP), and predictive analytics. It relies on real-time data, dynamic cost drivers, and automated decision models to estimate and allocate costs more accurately.

2. Data Processing Capability: Traditional costing systems handle structured financial data and depend heavily on manual data entry and periodic reporting. They struggle in data-heavy, fast-changing environments. AI-based costing processes large volumes of structured and unstructured data in real time. It can integrate data from ERP systems, supply chains, market trends, and operational sensors, providing more comprehensive cost insights.

3. Accuracy and Flexibility: Traditional costing may result in inaccurate overhead allocation due to reliance on limited cost drivers and fixed assumptions. AI-based costing improves accuracy by identifying multiple cost drivers simultaneously and continuously updating models based on new data. It adapts quickly to market fluctuations and operational changes.

4. Decision-Making Support: Traditional costing supports historical analysis and compliance reporting but offers limited predictive capability. AI-based costing enhances managerial decision-making through forecasting, scenario simulation, dynamic pricing recommendations, and optimization of resource allocation.

5. Implementation Complexity and Cost: Traditional costing is relatively simple and inexpensive to implement, requiring basic accounting systems and trained personnel. AI-based costing involves higher initial investment in technology infrastructure, data management systems, and skilled professionals. However, it offers long-term efficiency gains and competitive advantage.

6. Strategic Impact: Traditional costing focuses on cost control and financial reporting. AI-based costing enables strategic cost management, waste reduction, real-time monitoring, and proactive planning.

Thus, traditional costing remains useful for regulatory compliance and foundational accounting. However, AI-based costing provides greater accuracy, efficiency, adaptability, and strategic value in modern data-driven organizations. The shift toward AI-based systems represents a transformation from static cost accounting to intelligent, predictive cost management.

Weakness of Traditional Costing:

Due to its reliance on historical data, arbitrary overhead allocation, and incapacity to manage product complexity, traditional cost accounting has serious flaws when compared to AI-based systems. While AI offers real-time, precise, and proactive cost analysis, these constraints frequently result in cost figure distortions (up to 35%), which contribute to over- or under-costing products.

1. Inaccurate Overhead Allocation: The allocation of overhead costs is one of the primary flaws in traditional cost accounting. Indirect expenses are typically distributed using straightforward metrics like direct labour hours or machine hours. Although a lot of expenses in contemporary businesses are not directly connected to labour or output levels. As a result, certain products may have excessively high costs assigned by the system, while others may have too low costs. This may result in inaccurate pricing choices and a miscalculation of the profitability of the product.

2. Historical Data Reliance: Traditional Accounting is backward looking i.e. it records cost that have already been incurred. Rather than forecasting future expenses, it examines past data. Although historical data is useful for auditing and reporting, managers may not always benefit from using it to guide better decisions heading ahead. Businesses want systems that can deliver forward-looking insights, which traditional costing cannot in the rapidly evolving business world of today.

3. Limited Scope and Rigidity: Traditional Costing does not consider external market factors like competition, demand, etc. rather focusing on internal data such as historical data which reduces its usefulness for decision making.

4. Risk of Misinformation: Traditional costing occasionally displays erroneous profit statistics for departments or products due to inaccurate cost allocation and inadequate analysis. While a product that looks unprofitable could be helpful, another that looks successful might be consuming excessive amounts of resources. This may result in poor management decisions.

5. Low Complexity Handling: Businesses were simpler and produced fewer goods prior to traditional costing techniques emerged. These days, businesses frequently produce an extensive variety of goods and provide specialised services. Because traditional systems do not take into account many cost factors, they are unable to handle this complexity. They might therefore not fairly depict the true consumption of resources in complex processes.

6. Information Delays: Traditional Costing system prepare reports either monthly or yearly which means management receive information after the completion of the prescribed time period.

Decisions frequently need to be made fast in a competitive business environment. The company's capacity to react promptly to issues or opportunities may be hampered by delayed information.

7. **Manual Work and Error Risk***:* Manual data entry and calculations are common in traditional cost accounting. This lengthens the system's processing time and raises the possibility of human error. Financial reporting and managerial choices may be impacted by errors in cost allocation or recording. It also raises the expense of administration.
8. **Neglects Non-Financial Elements:** In addition to actual resources, modern organizations increasingly rely on intangible elements like customer satisfaction, innovation, and brand value. Conventional cost accounting frequently overlooks these non-financial factors in comparison with quantifiable financial costs. This may provide an inadequate picture of the overall performance of the business.

AI Technologies Currently Being Applied to Cost Estimation and Allocation:

The various technologies applied to cost estimation and allocation are explained as follows:

1. **Machine Learning (ML):** Machine Learning is one of the most widely used AI technologies in cost estimation. ML algorithms such as regression models, random forests, gradient boosting methods, and deep neural networks analyze historical project data to identify patterns and relationships between cost drivers like labor, materials, and timelines. By learning from past projects, these models can predict future costs more accurately than traditional rule-based approaches. In cost allocation, ML can segment expenses into appropriate categories and highlight potential overruns early in the planning phase.
2. **Robotic Process Automation (RPA):** Robotic Process Automation uses software robots to automate repetitive, rules-based tasks that human estimators traditionally handle manually. For cost estimation and allocation, RPA can automatically extract data from invoices, spreadsheets, ERP systems, and project management tools, and then organize this data into standardized formats. It accelerates the allocation of costs to various budget categories based on predefined logic, reducing errors and freeing up human workers for analytical and strategic tasks.
3. **Natural Language Processing (NLP):** NLP enables AI systems to interpret and process unstructured text data from documents such as contracts, requests for proposals, change orders, and engineering specifications. In cost estimation, NLP can read and extract quantitative details like quantities, rates, and scope descriptions from text that would otherwise require manual interpretation. This capability improves accuracy and reduces time spent on data gathering, and when integrated with cost models, it supports more complete cost allocations by understanding the context and intent in project documentation.
4. **Computer Vision:** Computer Vision technology analyzes visual data, such as site photos, drone images, or architectural drawings, to support cost estimation. By recognizing physical attributes like dimensions, material quantities, or site progress indicators, computer vision can automate quantity takeoffs a traditionally manual and error-prone step. For example, it can calculate the number of bricks or meters of piping from images, feeding that information directly into cost models to estimate expenses and allocate resources more precisely.
5. **Time Series Forecasting with AI:** AI-enhanced time series forecasting models including ARIMA with ML features, Long Short-Term Memory (LSTM) networks, and hybrid forecasting methods are used to predict future cost trends based on historical cost and market data. These models help organizations anticipate changes in labor rates, material prices, or operational costs over time. Forecasted trends are then integrated into estimation frameworks, enabling organizations to make proactive decisions about budget allocations and risk buffers.

6. Reinforcement Learning (RL): Reinforcement Learning is applied in dynamic cost allocation problems where resource distribution decisions evolve with real-time feedback. For example, RL can help allocate budget and labor across competing tasks to minimize total costs while responding to changes in productivity or project delays. Through continuous learning, RL models improve allocation strategies by simulating outcomes and adjusting decisions based on performance rewards.

7. Optimization Algorithms with AI: AI-driven optimization techniques such as genetic algorithms, particle swarm optimization, and simulated annealing support cost allocation by identifying the best distribution of limited resources under multiple constraints i.e. budget limits, deadlines, quality requirements. These algorithms evaluate many potential allocation scenarios and recommend the optimal balance for instance, whether to assign more budget to critical vs. non-critical tasks thereby supporting strategic resource planning.

8. Expert Systems and Cognitive Automation: Rule-based expert systems and artificial intelligence (AI) are combined in cognitive automation to encode domain knowledge into automated processes. In cost estimation, these systems embed industry standards and expert logic into automated checks and guidance. For instance, they can flag unusual cost assumptions, ensure allocations comply with regulatory or contractual requirements, and maintain consistency across estimates. This provides a layer of intelligent oversight in automated estimation pipelines.

How Does the Shift to AI-Based Costing Influences Management's Ability to Optimize Pricing, Resource Allocation, and Waste Reduction?

The shift from traditional costing systems to AI-based costing significantly enhances management's ability to optimize pricing decisions, resource allocation, and waste reduction. Unlike conventional costing methods that rely on historical averages and static allocation bases, AI-based systems use real-time data, predictive analytics, and pattern recognition to support more strategic and dynamic decision-making. The influence can be understood as follows:

1. Influence on Pricing Optimization: AI-based costing improves pricing strategies by providing more accurate, data-driven cost insights. First, machine learning models analyze large volumes of historical cost, sales, demand, and market data to determine true product or service profitability. Traditional systems often allocate overhead using broad averages, which may distort actual costs. AI reduces this distortion by identifying precise cost drivers and linking them directly to products or customers. Second, predictive analytics allows management to simulate different pricing scenarios. For example, AI can forecast how price changes may affect demand, margins, and competitor responses. This enables dynamic pricing strategies rather than fixed mark-ups. Third, AI systems detect unprofitable customer segments or product lines in real time. Managers can then adjust pricing, discontinue low-margin offerings, or redesign cost structures to maintain competitiveness.

Result: Pricing decisions become proactive, flexible, and aligned with real-time cost realities, improving profitability.

2. Influence on Resource Allocation: AI-based costing enhances how management allocates financial, human, and material resources. Traditional allocation methods often rely on predetermined bases such as labor hours or machine hours. AI systems, however, use advanced algorithms to identify multiple cost drivers simultaneously and determine which resources generate the highest value. Through predictive modeling, AI forecasts future demand, production bottlenecks, and cost fluctuations. Management can then allocate budgets, labor, and materials more efficiently to high-performing departments or projects. Additionally, reinforcement learning

models can continuously adjust resource distribution based on performance feedback. For example, if one production line becomes inefficient, AI can recommend reallocating resources to maintain optimal output levels.
Result: Resource allocation becomes data-driven, adaptive, and strategically aligned with organizational objectives.

3. Influence on Waste Reduction: AI-based costing plays a critical role in identifying inefficiencies and minimizing waste. By analyzing operational data, AI systems detect patterns of excess material usage, idle machine time, or unnecessary overhead expenses. These systems can highlight deviations from standard cost benchmarks almost immediately, unlike traditional systems that identify issues only after periodic reporting. AI can also support lean management practices by predicting surplus inventory, reducing overproduction, and optimizing supply chain coordination. Predictive maintenance algorithms minimize equipment downtime, reducing repair costs and production waste. Furthermore, anomaly detection tools identify unusual cost spikes or fraudulent transactions, thereby reducing financial leakage.
Result: Waste is detected earlier, operational inefficiencies are minimized, and overall cost control improves.

4. Strategic Impact on Management Decision-Making: The shift to AI-based costing transforms the role of management from reactive cost monitoring to proactive strategic planning. Instead of merely analyzing past cost data, managers gain access to predictive insights, scenario simulations, and real-time dashboards. This enhances:

- Strategic planning accuracy
- Risk management capabilities
- Competitive advantage through cost leadership
- Faster decision cycles

AI-based systems also improve transparency and accountability, as cost drivers and allocation logic are supported by analytical models rather than subjective assumptions.
Thus, the transition to AI-based costing significantly strengthens management's ability to optimize pricing, allocate resources efficiently, and reduce waste. By leveraging predictive analytics, automation, and intelligent data processing, organizations move from static and retrospective cost control toward dynamic, forward-looking cost management. This shift ultimately supports higher profitability, improved operational efficiency, and stronger strategic positioning in competitive markets.

Implementation Complexity and Cost:

The implementation complexity and cost associated with Traditional Costing and AI-based Costing differ significantly in terms of infrastructure, expertise, scalability, and long-term investment requirements. Traditional costing systems such as absorption costing and activity-based costing are relatively easier and less expensive to implement, particularly in small and medium-sized organizations. They rely on standardized accounting procedures, existing ERP systems, and trained accounting personnel. The primary costs involve staff training, system configuration, and periodic data collection. However, while initial implementation costs are lower, traditional systems may incur hidden long-term costs due to inefficiencies, inaccurate overhead allocation, manual data processing, and limited adaptability to business expansion. In contrast, AI-based costing involves higher initial investment and greater implementation complexity. Organizations must invest in advanced digital infrastructure, cloud computing platforms, data integration systems, and cybersecurity measures. The adoption of technologies such as Machine

Learning, Robotic Process Automation, and Natural Language Processing requires skilled data scientists, IT professionals, and continuous system maintenance. Data preparation, model training, validation, and integration with existing accounting systems add further complexity. Additionally, resistance to change and the need for employee reskilling may increase transition costs. However, secondary data evidence suggests that despite high upfront expenditure, AI-based costing offers substantial long-term cost benefits. Automation reduces manual labor expenses, predictive analytics minimizes cost overruns, and optimization tools improve resource utilization. Over time, these efficiencies can offset implementation costs and generate higher returns on investment. Therefore, while traditional costing is simpler and less costly to implement initially, AI-based costing, though complex and capital-intensive, provides scalable and strategic advantages that justify its adoption in data-driven business environments.

Conclusion:

This comparative study examined Traditional Costing and AI-based Costing systems using secondary data to evaluate their conceptual foundations, limitations, technological advancements, and managerial implications. The analysis of traditional costing frameworks including absorption costing, marginal costing, and activity-based costing revealed that while these systems provide structured and standardized approaches for cost allocation, they were primarily designed for relatively stable and less data-intensive environments. Their dependence on predetermined overhead rates, limited cost drivers, and periodic reporting reduces their effectiveness in modern organizations characterized by complexity and real-time data flows. The study further identified inherent weaknesses of traditional methods in today's data-heavy business environment, including inaccurate overhead distribution, limited scalability, slower responsiveness, and insufficient integration with digital systems. These limitations often restrict management's ability to make timely and strategic decisions.

In contrast, AI-based costing integrates advanced technologies such as Machine Learning for predictive cost estimation, Robotic Process Automation for automated data processing, Natural Language Processing for interpreting unstructured financial information, and optimization algorithms for efficient resource allocation. These technologies enhance accuracy, speed, and adaptability in cost management processes. The findings indicate that the shift to AI-based costing significantly improves management's ability to optimize pricing strategies, allocate resources dynamically, and minimize operational waste through real-time insights and predictive analytics. However, traditional costing remains relevant for compliance, regulatory reporting, and foundational accounting purposes.

Overall, the study concludes that while traditional costing provides structural stability, AI-based costing offers strategic agility and competitive advantage. Organizations that integrate AI technologies into their costing systems are better positioned to achieve efficiency, profitability, and sustainable growth in an increasingly data-driven business environment.

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