

Production Costs Recognition: Time-Based Methodologies

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This analysis presents a review of time-based costing methodologies: Time-Driven Activity-Based Costing (TDABC), Duration-Based Costing (DBC) and Program Accounting Costing (PAC). Cost accounting systems are crucial for businesses to allocate costs to make informed business decisions. TDABC, DBC and PAC are approaches in this domain, offering unique advantages and applications. The concepts, methodologies, advantages, and limitations of each approach are explored to provide insights into their suitability for different industries and organizational contexts. The analysis finds comparing Time-Driven Activity-Based Costing, Duration Based Costing and Program Accounting Costing are analogous methodologies with different applications relating to timing cost recognition and are like comparing triples wearing the same but different colored outfits.

Keywords: costing methods, activity-based cost, duration-based cost, program accounting, time-driven costing

INTRODUCTION

The globalization of economies has transformed the business landscape, facilitating cross-border trade, investment, and integration of markets worldwide. This interconnectedness brings both opportunities and challenges for businesses. As companies globally expand their operations, they encounter diverse regulatory environments, currencies, taxation systems, and supply chains. In such a dynamic context, accurate cost accounting for production and operations becomes crucial. Cost accounting provides insights into the intricacies of these production costs, allowing companies to optimize resource allocation, set competitive prices, and make informed strategic decisions. Moreover, it enables businesses to standardize cost structures across different regions to enhance efficiency and transparency in financial reporting. In an economic society where competition is fierce, and margins are slim, effective cost accounting serves as a cornerstone for sustainable growth and profitability. To remain competitive in the absence of specific costs, companies are constantly working to achieve the most accurate costs for their products and services. Determining an efficient and acceptable cost methodology will depend on the type of work being performed. The drive for accuracy necessitates the need for cost accounting methodologies beyond traditional costing methods based on volume driven allocations based on direct labor costs, machine hours and sales dollars (Cooper & Kaplan, 1992).

In the mid-eighties, Johnson, and Kaplan (1987) report management accounting is driven by the procedures and timing of an organization's financial reporting system. This inherently led to management accounting information lagging the financial reports, being distorted, and/or combined in inappropriate combinations that make the information irrelevant for planning and control decision making. Their challenge was to develop a method that would provide accurate information timely to facilitate cost control measures, and an effective way to measure and improve productivity. To resolve the problem, Johnson and Kaplan (1987) devised a method to provide accurate and timely information to facilitate cost control measures and create effective processes to measure and improve productivity. They introduced Activity-Based Costing, an accounting method that pivots away from allocating project or service overhead cost based on a unique driver, normally direct labor hours or machine hours, and instead allocates overhead and indirect costs on the actual activities of production that drive those costs (Johnson, 1988). Activity-based costing, commonly referred to as ABC, became widely accepted as a viable alternative to traditional cost accounting methods in industry. Simultaneously ABC made its way into business education as a cost accounting method that is part of most business education curriculums in the United States.

TIME-DRIVEN ACTIVITY-BASED COSTING

Manufacturing adoption of ABC was slow due to the excessive data provided by time-consuming surveys used to allocate the time spent on the various activities required for the implementation of the ABC system (Johnson, 1991; Stout & Propri, 2011). Kaplan and Anderson (2007a; 2007b) designed time-driven activity-based costing (TDABC) specifically to simplify the ABC time-consuming data gathering implementation process. The TDABC requires only two elements – the unit cost of supplying the capacity of the resources and the time required to perform the transaction or activity. Hoozee and Hansen (2018) find the TDABC is more accurate than ABC when resources are traceable to activities whereas ABC is more accurate than TDABC when activities are traceable to products.

Advantages

The expanding complexity and diversity of manufacturing and service-based organizations creates the need for a simplistic cost-effective costing method such as TDABC. Advantages of the TDABC for decision-making include the following supported in the literature (Keel, Savage, Rafiq & Mazzocato, 2017; Zaini & Abu, 2020; Ghani, Zaini & Abu, 2020; Zaini & Abu, 2023).

Drivers for Activity or Transactions

Each activity uses a time driver and does not differentiate between direct or indirect resource usage. To determine the time, the estimated time for each activity is based on an analysis or study of the process.

Cost Allocation

Only one stage is used for the cost allocation. To calculate the cost using process mapping, the total time used for the activity or project is multiplied by the capacity cost rate. For a product-based production operation the total time used to create the item is multiplied by the previously determined capacity cost rate. For a service-based activity the number of minutes to perform the service is multiplied by the capacity cost rate.

Activity Modification

When complications develop, managers must identify the cause of the problem but can modify the time drivers or the cost allocations to resolve the issue. These modifications are easily incorporated into the analyses equations to the calculations for the organization's information system.

Information

Application of the TDABC allows for the identification of unused capacity which results in waste and increased operating costs. There is no cost overestimation as the methodology allows for an amendment to the capacity cost rate to assess the full capacity utilization.

Transparency

TDABC is uncomplicated as it stipulates the length of time of each operation. For any activity center, the resources employed by the activity can be calculated. Thus, any over or under resource utilization is apparent regardless of whether the activity is production or service based (Ghani, Zaini & Abu, 2020).

Limitations

While time-driven activity-based costing is more accurate than traditional costing methods using inventory consumption, the adoption can be hindered by the cost and complexity to implement, maintain, and update. The cost methodology relies on determining the appropriate driver for each activity, the duration of the activity, and then identifying the correct allocation of the capacity cost rate for the period. (Krumwiede, 1998; Rankin, 2020). If the incorrect driver or duration are identified, incorrect costing information is the result.

Information Overload

A common issue is the data can be misinterpreted as sometimes there is irrelevant or overgeneralized information within the methodology data that results in inappropriate management decisions.

System Resistance

Managers accustomed to using traditional costing methods to drive operations may insist on allocating all cost activities resulting in cost overstatements that understate margins resulting in pricing mistakes.

The traditional industry cost accounting methods and activity-based costing are still the acceptable cost methodology with no new acceptable methodologies emerging. However, there is a new costing process getting attention. Duration based costing has been introduced as an alternative methodology to activity-based costing. Duration based costing assigns costs based on the duration of activities rather than the volume of output (Kadhim, 2023). This cost accounting method could be a more appropriate and accurate method to use if time has a significant impact on the production of goods and services (Lelkes, 2017).

DURATION BASED COSTING

Duration-based costing is a cost accounting approach that attempts to accurately allocate costs to products or services based on the time they consume during production or delivery (Kadhim, 2023). Unlike traditional costing methods that rely heavily on volume-based allocations such as direct labor hours and/or machine hours, or activity-based costing which relies on a set of activities as drivers for cost allocations, duration-based costing recognizes time as the critical factor in determining the consumption of resources by different activities in the production or operations process. Duration-based costing is intended to be a simplified alternative to activity-based costing, although its concept and methodology has roots in activity-based costing as well as time-driven activity-based costing. Duration-based costing uses the production cycle time for each product that may be part of a particular process or production line (Lelkes, 2013).

While there is a plethora of research regarding activity-based costing and time-driven activity-based costing, little research regarding duration-based costing is available on how it compares with, ABC, TDABC, or other traditional costing methods.

Methodology and Implementation

The methodology for duration-based costing requires costs to be assigned to products or services based on the duration of specific activities or processes involved in their production or delivery. This approach is particularly useful in manufacturing environments where the time spent on production activities varies

significantly or where overhead costs are driven by time-related factors rather than volume (Lelkes, 2017). Utilizing duration-based costs requires the following four actions for its implementation.

Identifying Activities

The first action is the identification of the various activities involved in the production or delivery process. These activities can range from manufacturing tasks on the production line to administrative processes.

Measuring Duration

Once activities are identified, the next action is the measurement of the duration of each activity. This typically involves tracking the time spent by employees, machines, or other actions for each activity. Advanced technologies such as time-tracking software or sensors may be used to capture this data more accurately.

Assigning Costs

With the time spent for each activity available, costs can be allocated to the given activity based on the resources consumed during the time spent. This may include direct costs such as labor and materials, as well as indirect costs such as overhead and support services.

Linking Costs to Products or Services

Finally, costs assigned to activities are linked to the products or services that utilize the activities. This is done by tracing the flow of activities through the production or delivery process and allocating costs accordingly. This often involves the use of cost drivers or cost allocation bases to distribute the overhead costs appropriately.

Advantages

Duration-based costing offers several benefits compared to traditional costing methods based on volume driven allocations including the following.

Accuracy

By focusing on the actual time spent on each activity, duration-based costing provides a more accurate reflection of the resources consumed by different products or services.

Cost Transparency

The transparency of the cost structure allows managers to understand the cost implications of different activities to make informed decisions concerning the composition of the activities or the production process.

Resource Optimization

By identifying activities that consume significant time and resources, duration-based costing assists the identification of opportunities for process improvement and resource optimization.

Fairness

Managing the duration costing activities and assignments ensures costs are allocated fairly, as products or services that require more time and support are assigned proportionally higher resource distribution.

Limitations

Duration-based costing has its challenges and limitations. It requires careful measurement and time tracking which can be resource-intensive and may result in worker resistance. Additionally, determining the appropriate cost drivers or allocation bases for overhead costs can be complex as there is a risk of oversimplification or inaccuracies if not implemented with care.

Despite these challenges, duration-based costing is a valuable tool for organizations seeking accurate cost information and enhanced cost management. By focusing on the time dimension of cost allocation, it provides a nuanced understanding of cost behavior and helps organizations make informed decisions to improve efficiency and profitability.

Differences in costing methods can be found across a multitude of industries. Prior to the introduction of activity-based costing, time-driven activity-based costing or duration-based costing, program accounting was used by the aerospace industry to spread large dollar amounts of upfront development and production cost over the multiple years required to produce aircraft in a model series such as McDonald Douglas that was among the companies using program accounting in the 1990s (Ingram & Aubin, 2016). This accepted accounting principle (FASB, 2024) enables aircraft production industries to accumulate costs over the time to produce the aircraft model rather than the contract period or fiscal year. The following program accounting discussion describes its costing methodology and the similarities to other time-based costing methodologies.

PROGRAM ACCOUNTING COSTING

Program accounting costing is a comprehensive approach to cost management and accounting specifically tailored for the aerospace industry in the United States (U.S.) to spread large dollar amounts of upfront development cost over the multiple years of the aircraft model production. Due to the mergers and consolidation in the U.S. aerospace industry, Boeing Co. is the only commercial aircraft maker presently using program accounting as its methodology to track production and operations costs (Ingram & Aubin, 2016).

Under accounting guidance proposed in 1981 by the American Institute of Certified Public Accountants (AICPA), program accounting may be used only under a very narrow set of conditions that creates a high barrier to market entry for the aerospace company. The program accounting conditions include a) the program product must have high production costs per unit, b) the project requires substantial investment of both resources and time for the project completion, and c) the product development cost has an extensive recovery cycle that can be spread over multiple years. The AICPA criteria also states that the reasons set forth for the use of the accounting method must relate to the economics of producing and marketing the aircraft product (AICPA, 1981).

Program accounting is an accounting method for aircraft manufactured under production-type contracts where the costs are reported by program rather than individual units or contracts. A program consists of the estimated number of units to be produced in a continuing, long-term production effort under existing and/or anticipated contracts. The program becomes the cost center for accumulating the costs and allocating those costs to the sales. Unlike traditional manufacturers, the fiscal year is not compatible with the long-term operating cycle as the aerospace company investment can only be recovered over several years. Program accounting allocates costs based on the expected revenue of the program. If the method is applied by qualified users, GAAP requires annual financial statement notes disclosure to provide information relating to the performance of the reporting entity including the following data.

As one of the world's leading aerospace companies, Boeing develops and manufactures a wide range of products, including commercial airplanes, military aircraft, and space systems. Program accounting costing is integral to Boeing's operations, enabling the company to effectively manage costs throughout the entire lifecycle of its various aircraft programs from initial development to production and testing air worthiness of the aircraft for delivery to the contractor.

TABLE 1
FINANCIAL STATEMENT NOTES DISCLOSURE PROGRAM
ACCOUNTING INFORMATION

1.	A description of the program accounting method.
2.	The estimate of total program quantity and any changes from previous period.
3.	The total number of units delivered and any undelivered units under order.
4.	A discussion of any risks/uncertainties regarding market forecasts, price estimates, and cost estimates.
5.	The excess of deferred program costs over total cost allocated to units in process/delivered as well as the portion of said excess that would not be absorbed in cost of sales.
6.	The balances of the components of deferred costs by type of cost and the balance sheet classification of those balances.

Source: AICPA (1981).

Methodology and Implementation

At its core, program accounting costing methodology involves the systematic allocation and management of costs associated with each aircraft model program. This approach recognizes that aerospace programs are complex endeavors that span multiple years and involve numerous stakeholders ranging from engineers and suppliers to customers and regulatory agencies. As such, traditional costing methods cannot adequately capture the unique program cost dynamics.

Program accounting costing process typically includes the following key elements.

Cost Estimation and Planning

The process begins with the estimation and planning of costs for each program. This involves identifying the activities that are part of the production process, forecasting the resources required including materials, labor, overhead, and other expenses based on the program's scope, complexity, and duration. Program accounting leverages historical data, industry benchmarks, and sophisticated cost modeling techniques to develop the appropriate cost estimates.

Program Baseline Development

Once cost estimates are established, the aerospace company develops a program baseline that serves as the foundation for cost management throughout the program lifecycle. The baseline includes budgeted costs broken down by various cost categories and milestones to provide a clear roadmap for tracking and controlling costs over time.

Cost Tracking and Control

Throughout the program lifespan, the aerospace company diligently tracks actual costs against the established baseline. This involves monitoring expenditures, identifying cost variances, and implementing corrective actions as needed to ensure that the program remains financially on track. Advanced project management tools and systems are used to facilitate real-time cost tracking and reporting.

Risk Management

Aerospace programs are inherently risky endeavors with uncertainties related to technical challenges, market dynamics, and regulatory requirements. As such, risk management is an integral part of program costing. Aerospace programs conduct rigorous risk assessments, identifies potential cost drivers, and develops contingency plans to mitigate risks and minimize cost overruns.

Lifecycle Cost Analysis

Aerospace organizations take an integrated approach to program costing by considering the entire lifecycle of its products from initial concept development through production, operations, and eventual

retirement or replacement. This long-term perspective enables the organization to make informed decisions regarding investments, product improvements, and sustainment strategies that optimize overall lifecycle costs.

Program accounting costing methodology is grounded in a commitment to continuous improvement and excellence in cost management. By systematically analyzing and managing costs throughout the lifecycle of its aerospace programs, the aerospace organization aims to deliver high-quality products to its customers while maximizing value for its shareholders. This disciplined approach to cost management is a key factor in the company's success in the industry.

Advantages

Program accounting offers several advantages, particularly in managing and reporting on complex, long-term projects such as aircraft development. The following are some of the key benefits.

Enhanced Project Visibility

Program accounting provides a comprehensive view of the financial performance of individual projects over their lifecycle. This helps the aerospace organization monitor and control costs, revenues, and profitability from the program design to the delivery of the last aircraft produced in the model series.

Accurate Cost Management

By tracking expenses and revenues on a project-by-project basis, program accounting allows for the efficient management of development costs and schedules. This aids in the early identification of cost overruns and the implementation of corrective actions.

Revenue Matching

This approach aligns revenue recognition with the progress of the project. It helps ensure revenue is recognized in a manner that reflects the actual progress of the project, providing a clearer picture of financial performance.

Long-Term Financial Planning

Program accounting supports long-term financial planning and forecasting by providing detailed projections and tracking of costs and revenues over the life of a project. This can improve strategic decision-making and resource allocation.

Improved Financial Control

With program accounting, aerospace organizations track costs against budgets and financial forecasts more accurately, improving overall financial control and accountability.

Performance Measurement

It allows for the measurement of performance against financial targets and benchmarks, helping to assess the success of individual projects and identify areas for improvement.

Custom Reporting

Aerospace organizations must generate detailed financial reports for each project to comply with GAAP reporting criteria. The required detailed reporting is useful for internal management as well as external stakeholders such as investors and regulatory bodies.

Risk Management

By closely monitoring project costs and revenues, program accounting helps to identify financial risks early allowing for timely intervention and risk mitigation strategies.

Alignment With Contractual Obligations

For aerospace companies that work on fixed-price or cost-plus contracts, program accounting helps to ensure compliance with contract terms and provides accurate reporting for contractual milestones.

Overall, program accounting helps Boeing efficiently manage the financial complexities of large-scale, long-term projects improving financial accuracy, control, and strategic planning.

Limitations

Program accounting is a method used to manage and report the financial performance of long-term projects in the aerospace industry where aircraft projects span many years. While this accounting approach is essential for tracking the complex costs and revenues of the projects, it has some limitations.

Complexity

Program accounting involves intricate calculations and assumptions about future costs and revenues. This complexity can make it challenging to accurately forecast and monitor financial performance.

Estimations and Assumptions

Much of the financial reporting under program accounting relies on estimates of future costs, revenue, and production rates. If these estimates prove incorrect, it can lead to significant variances between expected and actual performance.

Revenue Recognition

The timing and amount of revenue recognized under program accounting can be subject to significant judgment. This can lead to fluctuations in reported earnings and potentially affect financial statements' reliability.

Cost Overruns and Delays

If a project experiences cost overruns or delays, the impact on program accounting can be substantial. These issues can distort financial performance and affect profitability estimates.

Transparency and Comparability

Due to the complexity and use of estimates, program accounting can sometimes lack transparency. This might make it difficult for stakeholders to compare performance across different programs or companies.

Financial Reporting Impact

Changes in estimates or project performance can lead to frequent adjustments in financial reports, potentially impacting investor confidence and perceptions of financial stability.

Regulatory and Accounting Standards

Adherence to specific accounting standards and regulations, such as those set by the Financial Accounting Standards Board (FASB) can be challenging and might result in varying interpretations and applications. While program accounting is a valuable tool for managing large, long-term projects, it requires careful handling of estimates, continuous monitoring, and transparent reporting to mitigate its limitations.

Due to mergers and consolidation in the commercial aircraft manufacturing industry, Boeing is currently the primary user of program accounting in the United States. While it is compliant under GAAP and the U.S. Securities and Exchange Commission permitted its use in the aerospace industry, some claim program accounting allows too much freedom to smooth earnings and hide potential losses (Rich, 2016). In early 2016, though never officially charged, the U.S. Securities and Exchange Commission began an investigation into Boeing's use of the program accounting method based off a whistleblower's complaint. The complaint specifically focused on Boeing's projections regarding long-term profitability of the 787 Dreamliner and the 747 jumbo aircraft, suggesting that sales forecasts were too optimistic (Rich, 2016).

The 787 Dreamliner was first included in Boeing's 2004 annual report with delivery to begin in 2008 (Schwartz & Busby, 2014, p.2). Both the 2005 and 2006 annual financial reports indicate delivery was on track and demand would be met. Due to supplier issues and employee strikes, the first 787 Dreamliner delivery did not occur until 2011 (Schwartz & Busby, 2014, p. 2). By then, production costs of \$8.246 billion were deferred under the program (Gray, Walker & Terrell, 2016, p. 45). Deferred production costs relating to Boeing's use of program accounting were stable prior to the onset of the 787 program and did not result in significant differences in earnings from those that would have been reported had Boeing not chosen to use program accounting (Bechai, 2020).

Following the first delivery of the 787 Dreamliner, Boeing's program accounting cost accumulated until it reached its maximum amount of \$28.65 billion in deferred program costs in the second quarter of 2016 (Bechai, 2020). Since 2016, the program accounting deferred balance has continued to decline reaching \$12,384 million as of December 31, 2023 (BAC, 2023, p.74). In addition to the continued decrease in deferred program costs, Boeing's 2023 revenues were \$7.88 million greater than the 2022 reported revenue due to higher 787 deliveries in 2023 (BAC, 2023, p. 30) with 1836 confirmed 787 orders that bodes well for future revenue (BAC, 2023. p 32).

In the coming years, it will be interesting to determine if Boeing Co. orders the deferred program costs for the 787 and delivers the outstanding aircraft orders or if estimates will be adjusted using the program accounting costing methodology.

DISCUSSION AND CONCLUSION

TABLE 2
COMPARISON OF TIME-BASED COSTING METHODOLOGIES

Characteristics	Time-Driven Activity-Based Activity	Duration Based Costing	Program Accounting Costs
Definition	Cost analysis of the time required for activities and cost rates	Cost analysis of the activities or process time duration	Deferred aggregated of design and production of an aircraft model or series
Time Frame	Short-term (mo to year)	Short-term (mo or quarter)	Long-term (years or decade)
Coverage	Project activities or contract	Production cycle	Aircraft series or model
Cost Basis	Cost of resources used for activity	Cost of time expended on activity	Estimated deferred aircraft design and production costs
Data Collection	Resources usage and cost rates based on studies	Production cycle time basis	Financial data specific to aircraft program
Adaptability	Changes in time and cost rates provide easier recalibration	Requires updates to reflect changes in activity durations	Recognizes changes in program objectives and deferred funding
Functions Performed	Cost control and reduction to add value	Cost control and reduction to add value	Tracks aggregate deferred cost of aircraft program
Complexity	Two-step process- assign cost activities than assign to products	Simplistic as combines fixed and variable cost for activity	Depends upon the number and scope of the aircraft program
Utilization	Manufacturing and service-based activities	Manufacturing and healthcare procedures	Aerospace manufacturing
Accounting GAAP	SOP 81-1 cost of completion	Percent of completion	Accounting Standards Codification (ASC) 912

Time-based costing analyses provide information about activities that managers use to continuously improve operations, answer 'what if' questions, budgeting, accounting information and external reporting. TRDABC, DBC and program accounting are data collecting methodologies that track production or service activity costs as they occur over time. While each use time as a measurement, they have similarities as well as differences as shown in the compiled Table 2. Cost structure associated with resource consumption, processes, output, and profit margin and specifically identifies the accounting basis for the cost method. These findings provide several thoughts for future research using either a survey or case study approach.

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