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ACTIVITY-BASED COSTING AND EFFECTIVE PRODUCT OFFERING STRATEGIES: EVIDENCE FROM MANUFACTURING ORGANISATION

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ABSTRACT

Research Aim: This research utilizes a case study approach to demonstrate the difference between traditional volume-based approach and activity-based costing in determining the profitability of manufacturing companies that offer multiple products. The primary objective of this comparison is to show how the latter method enables effective real-time decisions that are aimed at maximizing the contribution of individual products to the bottom line.

Design/ Methodology/ Approach: The method deployed in this research is a qualitative approach through content analysis of financial documents provided by the organisation where the case study was conducted. The documents included details about how traditional cost accounting was being applied in the company along with the method of distribution of overhead costs, plus how the accounting information processing changed after application of activity-based costing.

Research Finding: The case example provides evidence of how managers can effectively determine accurate information regarding cost generated from each product that in turn enables the management to evaluate and re-design their product offerings based on profitability from each product.

Theoretical contribution/ Originality: These studies strengthens the arguments made by proponents of activity-based cost accounting that modern-day accounting should avoid arbitrary allocation methods based on volume and identify units of activities to which costs can be assigned. The basic contention is that mere financial information is of no consequence unless the accounting information is presented in a useful way for managers to make market-based decisions.

Practitioner/ Policy implication: Most application of ABC research has been emphasized in the field of health care services to determine the exact cost of medical care. In contrast, relatively fewer studies have been published to support application in manufacturing industries. This study attempts to makes a compelling case for the inclusion of product-level cost information generated by ABC into external reporting for the consideration of regulators and policymakers. Such information will enable stakeholders to gauge the health of the company and the performance of the management. Furthermore, the outcome of this research

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lays another set of bricks on the pavement towards a better appreciation of activity-based costing for industry practitioners involved in companies that offer multiple products in their portfolio.

Research limitation/ Implication: The fact that the study is based on a single manufacturing company, limits the ability to generalize the findings. Therefore, future researchers should attempt to obtain data from a large enough sample size to be able to draw broader inferences. Furthermore, the study did not cover the service industry, which represents the vast majority of business organisations nowadays.

Keywords: Activity-Based Costing, ABC, Traditional Accounting, Volume-Based Accounting

Type of article: Case Study

1.0 INTRODUCTION

Senior management of business organizations constantly searches for increased profitability in order to meet stakeholder expectations. Most of these firms whether they operate locally or internationally, witness growth in common parameters such as growth in sales volume, yet they find their bottom-line results getting thinner. "Many U.S. companies are battling persistent economic headwinds as they strive to attain profitable growth. Executives are finding that the growth levers that have traditionally served them well — boosting volume, pushing up prices, cutting costs, and investing in growth opportunities — have become less effective." (Jones and McCue, 2017).

An often-overlooked source of enhancing profitability that offers a path towards sustainable growth in improving the mix of the products and services a company sells, the customers to whom it sells, and the geographic markets in which it operates. For any company, profitable growth opportunities are almost always highly concentrated within its products, customers, and geographies. Some segments or some products can generate profits 10 to 100 times higher than other segments or products. Mapping these variances, then growing the most profitable segments or products and focusing cost improvements on the least profitable ones, can yield sustainable, profitable growth, even in the face of economic headwinds. Most companies today, struggle with identifying which of their offerings and which of their customers are the most profitable. They can measure revenue but not the profit associated with the product — which means they make decisions about what to sell, in which markets, to which customers, and at what price based on partial or inaccurate information. They operate without a single version of the truth. Methods used to allocate large buckets of costs such as sales, advertising and customer service can be arbitrary and potentially inaccurate (Axson and Rosander, 2019).

In light of the aforementioned dilemma, market-oriented managerial accounting practices are now becoming more popular as companies appreciate the need to frequently evaluate their product portfolios. This is especially true when companies operate in a globalized marketplace without having safeguards against competition that may be derived from sources

such as product differentiation or exclusivity due to patents and/or regulatory protection (Ballings et al., 2018).

Hence, organisations especially manufacturing companies are realizing the necessity of total cost and profitability information at the individual product-level (Al-Hebry and Al-Matari, 2017; Jarvinen and Vaatja, 2018). Therefore, product-offering strategies are not only meant to maximize market share, but also to ensure that the offerings are maximizing company profitability. Organisations are realizing that traditional accounting methods are not able to provide sufficient information to managerial decision-makers to understand how to optimize product portfolios with the objective of maximizing profitability (Dalci et al., 2010; Kaplan et al., 2015).

One of the panaceas for the above dilemma may be found in more modern cost accounting systems such as Activity-Based Costing (ABC) originally proposed by Cooper and Kaplan (1988). Through ABC, managers can allocate indirect costs to different products and/or services of a business organisation by breaking the end-to-end value chain into cost pools where all costs are assigned based on relevance to cost objectives (i.e., products, services or departments) and the summation of the activity costs yields the cost of producing each of their goods and/or services (Barret, 2005; Elias and Mehrotra, 2018). Therefore, ABC is able to provide more accurate micro-level information on cost distribution of indirect costs across goods and services produced, which was not the case with traditional volume-based accounting approach (Banker et al., 2008; Kuchta and Troska, 2007). Without finer-grained information on costs, management may not be able to identify which of their products in their portfolio are yielding significant profits as compared to those that are low-profit yielding or are possibly even loss-making product offerings (Ellis-Newman, 2003).

The current research presents a case study of a manufacturing company in Southeast Asia that produces outboard (motorboat) engines. The company started its' operations with the traditional accounting system and were content with the system for several years before feeling pressure from emerging competition. The management recognized the necessity of determining exact profitability contribution of each of their products to strategize on whether to make changes in their product offerings. In order to achieve the stated goal, the company adopted the Activity-Based Costing (ABC) that has been in place over the last 3 years in the company, in parallel to the traditional accounting system that is required for external reporting under the guidelines of the Generally Accepted Accounting Principles (GAAP). This study presents the accounting processes used in both systems and presents a discussion on how the adoption of ABC enabled effective product offering strategies by the company.

2.0 LITERATURE REVIEW

Costing systems are basically information systems. They present a specific type of information such as direct labour hours and units produced, such that the information presented is of value to the decision-maker. Therefore, cost information is based on two sources; the input data that drive costs and the specific costing methodology adopted by an organization. The results obtained depend on which system is deployed since the same input data could be used in different ways. This study examines both the traditional volume-based

costing (VBC) system and the activity-based costing (ABC) system. The following sub-sections describe the two costing systems, prior to presenting the case study.

2.1 Traditional Cost Accounting Systems (Volume-Based Costing)

The traditional method of cost accounting refers to the allocation of manufacturing overhead costs to the products manufactured. The traditional method (also known as the conventional method or volume-based cost accounting) assigns or allocates the factory's indirect costs to the items manufactured on the basis of volumes such as the number of units produced, the direct labour hours, or the production machine hours. The traditional costing is best used when the overhead of a company is low compared to the direct costs of production. It gives reasonably accurate cost figures when the production volume is large, and changes in overhead costs do not create a substantial difference when calculating the costs of production (Cooper and Kaplan, 1991). However, traditional costing methods are inexpensive to implement.

In a manufacturing setting, traditional cost accounting systems typically have a single plant-wide overhead cost rate that is measured through metrics such as machine-hours or labour-hours, etc. (Peacock and Juras, 2010). The total overheads are divided by these metrics such as machine-hours that generates a single plant-wide overhead rate (Cooper and Kaplan, 1992). Traditional Volume-Based Costing or VBC is more suitable for generating reports for external viewers, such cost of goods sold, etc. In fact, the GAAP recognizes the traditional accounting system for generating financial statements such as income statements, etc. (Perkins and Stovall, 2011). However, the reality is that the traditional cost accounting approach tends to present a distorted view of cost distribution (Afonso and Santana, 2016).
To illustrate how traditional VBC approach misallocates overhead (indirect) costs, a suitable example would be when cost is reported based on a number of orders received from customers, the traditional cost accounting approach allocates indirect overhead costs on the basis of volume-drivers such as units sold (Cooper and Kaplan, 1988). Nevertheless, activities such as processing sales orders, in fact, do not vary in relation to the number of units sold, instead, are driven by the number of times customers place orders. Therefore, if one set of customers place orders for small quantities of goods but frequently, the cost of order processing for such customers will be more than that for customers who order larger quantities but less frequently. However, the traditional approach based on volume will assign higher-order processing costs to customers that place larger volume of orders although they are not ordering as frequently, while those that order in smaller amounts but a greater number of times will be shown to generate lower order processing costs. Therefore, the traditional cost accounting approach tends to improperly allocate costs without regard to the nature of the activity, thus distorting cost figures (Everaert et al., 2008).

By using only metrics such as machine hours to allocate the manufacturing overhead to products, it is implying that the machine hours are the underlying cause of the factory overhead. Traditionally, that may have been reasonable or at least sufficient for the company's external financial statements. However, in recent decades the manufacturing overhead has been driven or caused by many other factors. For example, some customers are likely to demand additional manufacturing operations for their diverse products. Other customers simply want great quantities of uniform products (Axson and Rosander, 2019).

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If a manufacturer wants to know the true cost to produce specific products for specific customers, the traditional method of cost accounting is inadequate (Jones and McCue, 2017). As a solution to the shortcomings of the VBC, new systems such as the ABC were developed. Instead of just one cost driver such as machine hours, ABC uses many cost drivers to allocate a manufacturer's indirect costs. A few of the cost drivers that would be used under ABC include the number of machine setups, the quantity of material purchased or used, the number of engineering change orders, the number of machine-hours, and so on. The next section presents an elaborate discussion on the ABC system.

2.2 Activity-Based Costing (ABC)

ABC is a method of assigning costs to products or services based on the resources that they consume with the aim to change the way in which costs are counted (The Economist, 1998). ABC is an alternative to traditional accounting in which a business's overheads (indirect costs such as indirect overheads and marketing) are allocated in proportion to an activity's direct costs. This was always a challenge with the traditional costing approach because two activities that absorb the same direct costs can use very different amounts of overhead. For instance, a mass-produced industrial product can use the same amount of labour and materials as a customised product. But the customised product uses far more of the company engineers' time (an overhead) than does the mass-produced one. ABC identifies the real nature of cost behaviour and helps in reducing costs and identifying activities that do not add value to the product. With ABC, managers are able to control many fixed overhead costs by exercising more control over the activities that have caused these fixed overhead costs. This is possible since the behaviour of many fixed overhead costs in relation to activities now become more visible and clearer.

In the 1980s, Cooper and Kaplan developed the ABC system with the goal of reducing arbitrary cost allocations that are associated with traditional volume-based costing systems, thus providing a relatively more accurate base for product cost information (Baird, et al., 2004). Following the seminal work of Cooper and Kaplan (1988), many studies have provided further empirical evidence to support the benefits of this new system (e.g., Anderson and Young, 1999; Spicer, 1992). Gosselin (1997) notes that besides providing more accurate product cost information, ABC offers numerous other benefits in improving strategic decisions, optimum allocation of resources, and policymaking on product mix, market segment and pricing. The application of ABC has been found to be more effective in specific environmental conditions especially in manufacturing where indirect overhead costs are typically high (Almeida and Cunha, 2017). The finer-grained allocation of indirect overhead cost by using ABC can facilitate the identification of how individual customer influences the supply cost (Innes and Mitchel, 1997). Other researchers found that when ABC system is utilized in such manner, the customer profitability profiles and more actionable analysis are possible enabling real-time response to market dynamics (Bellis-Jones and Hand, 1989).

In the earlier period, the application of ABC system was more common in the manufacturing environment where the identification of activities associated with the products was still less complex and in some cases, the activities were directly related to the production of units. However, in later times, the service sector adopted the new system as it provided a

mechanism to identify the cost of each activity involved in producing and delivering a particular service, thus providing a more rationale mechanism to decision-makers for critical issues such as pricing strategies (Relich and Pewlewski, 2018). The ABC system achieves improved accuracy in cost estimation by identifying multiple cost-drivers to trace the cost of activities to the resources consumed in producing the products. Typically, in a manufacturing environment, the number of activities, are vast in numbers and hence it is sensible to cluster them together under relevant cost-drivers for a product or service (Pember and Lemon, 2012). Therefore, implementing the ABC system entails two important decisions; a number of cost drivers and which cost drivers to assign to which activity (Babad and Balachandran 1993).

ABC system recognizes that although some overheads increase in proportion to the volume of products produced, the rest of the overheads are not directly proportional to volume. Allocation of costs under the ABC system, may be assigned based on the following considerations: (a) assigned on unit-level basis that assumes that inputs vary in proportion to the number of units produced, (b) assigned on batch-level basis, that assume that inputs vary in proportion to the number of batches produced, (c) assigned on product-level basis, which assume that inputs are necessary to produce each different type of product, and (d) assigned on facility-levels basis that sustains a facility's general manufacturing process (Gunasekaran and Sarhadi, 1998).

The fundamental premise of ABC is that activities are the real cause of all overhead costs, and hence the approach assigns costs to products (or product lines) that are actually demanding the activities necessary to produce them (Hansen and Mowen, 2000). Thereafter, the share of the cost of goods and services of such activities can be computed depending on the number of activity-drivers consumed by the goods or services (Kaplan et al., 2015). The method starts by breaking down the processes into cost-pools and then assigning each cost from each cost-pool to cost-objectives (i.e., products, product lines, services, service areas or departments) based on activity cost-drivers (Onat and Anitsal, 2014; White, 2009; Kont, 2012).

A hypothetical example is shown below (Figure 1.0) to illustrate how overhead costs from different cost-pools are allocated to different products in the ABC approach. The example shows a cost-pool under the activity name; 'machine adjustment', which comprises of cost-drivers (in this case calibration of the machine needed for each product). Thereafter, based on the number of machine calibrations, needed for each product, the machine adjustment costs are assigned to each product.

Although ABC has been widely adopted by both goods and service-producing organisations, the system has many drawbacks mainly due to the complexity involved in implementing the system (Kaplan, 2006; Lima, 2011). The cost-pools and cost-drivers need to be determined through various methods including interviews and surveys among the employees of the organisation in different activities, to identify details about the cost-pools and the cost-drivers. The complexity often leads to misallocation of costs partly due to overstated time allocations by employees (Kaplan et al., 2013). Furthermore, if the company make changes in their production systems or any part of the value chain, then the information in the cost-pools have to be updated which often require re-interviews and fresh surveys (Ng and Ritter, 2016).

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ABC systems have to be kept in parallel along with traditional accounting systems, as ABC is for internal decision-making while the traditional accounting system is required for presenting information such as cost of goods sold and for generating financial statements required by the law (Perkins et al., 2011; Estermann and Claeys-Kulik, 2013). This leads to the fact that maintaining 2 systems simultaneously becomes costly for organisations to keep up with. Despite the challenges, ABC provides more accurate information regarding overhead cost distribution across products, product lines, etc. to enable effective decision-making (Onat and Anitsal, 2014).

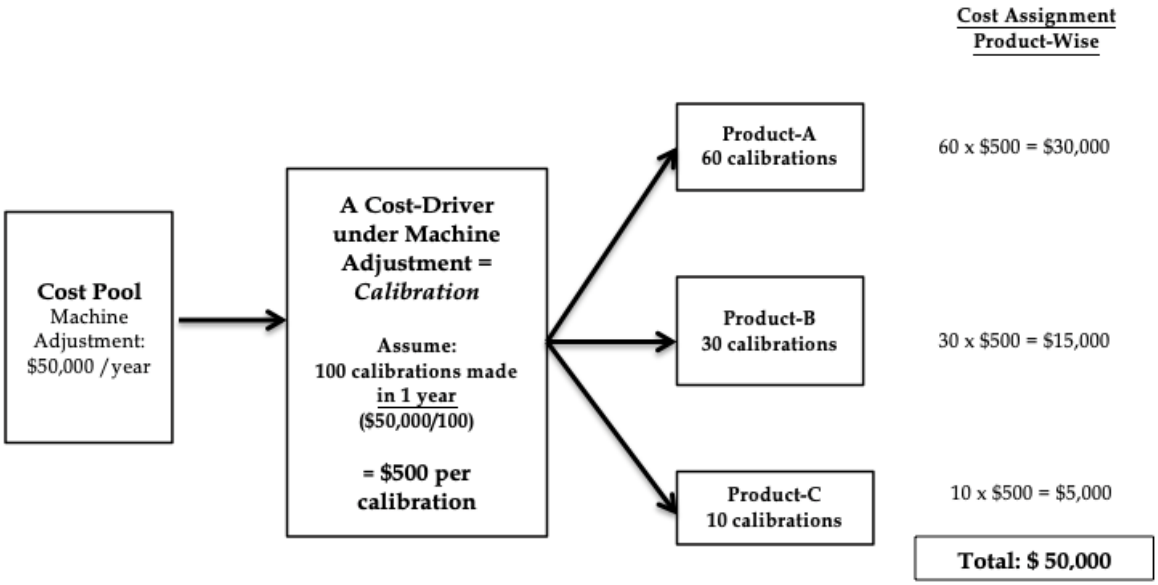

Figure 1: Illustration of Cost Assignment in ABC

3.0 METHODOLOGY

The method deployed in this research is a qualitative approach through content analysis of financial documents provided to the researcher by the organisation where the case study was conducted. The documents included details about how traditional cost accounting was being applied in the company along with the method of distribution of overhead costs. Furthermore, the organisation provided documents related to the ABC records including details about cost-pools and cost-drivers. Along with standard financial records such as annual reports, budget and general ledger items connected to traditional accounting, the following set of documents related to the implantation of ABC system were also provided:

(i) Transcript of interviews taken with employees at the factory.
(ii) List of cost-pools and cost drivers.
(iii) How costs were allocated to the cost-pools.
(iv) Calculation of activity costs.

Following the examination of the documents, the researcher held interviews with the chief financial officer and executives from the company accounting and finance department.

Finally, an interview was held with the chief executive officer of the company to understand how the adoption of ABC enabled more nuanced decision-making for the organisation. The company maintains both the traditional system for preparing financial reports according to GAAP and also ABC for internal decision-making purpose.

3.1 Case Study

The organisation selected for this case study is a manufacturer of outboard engines used for small boats. The company has 30 employees at their factory where they produce 2 basic models of motor board engines. The first model is a 4-stroke engine with 25 HP, that has a sale price of USD $ 500 per unit. Another model is a 2-stroke engine with 15 HP, which sells for USD $ 220 per unit.

Before the adoption of ABC in the company, the company experienced sales growth each year without a corresponding increase in profits. With increased competition in the market they were serving, the senior management decided that they needed to take a closer look at the profits generated by each of their products. Prior, this management was relying on aggregate cost and profit figures generated by the company without having any accurate data on how much profit was coming out of each product. Therefore, the company decided to adopt the ABC system to generate such pertinent cost information so that management could re-evaluate its product portfolio. The subsequent sections describe how the company allocates indirect costs to its' products based on the traditional approach as well as through the ABC approach.

3.2 Information Based on Traditional Accounting System

In the traditional VBC approach material and labour costs are directly assigned to products, while overheads are allocated through a 2-step process (Hansen and Mowen, 2000). The first step is to accumulate all the information on indirect costs related to production into a cost-pool for overheads, which are often referred to as 'support-pool'. In the next step, the management spreads these support-pool costs over a number of units of its' products using a plant-wide measure such as budgeted direct labour costs or machine hours or a number of component/parts, etc.

The company is studied in this case assigns materials and labour directly to a unit of engines produced and allocates all other production-related costs to their products using an overhead-rate based on their budgeted annual direct labour-hours. For instance, in the case of their product-packaging centre, the company applies labour cost as a direct cost, whereas in the product-assembly centre labour cost is treated as an indirect cost since their workers operate multiple machines together making it difficult to assign labour cost in this centre on the per unit basis.

The company has 4 centres connected to production at the factory that are classified as follows: Components, Pre-Production, Assembly and Packaging. The 4 centres directly involved in production are supported by a fifth centre known as; 'Support' which has costs that have to be allocated to each centre.

Table 1 displays each of the cost centres and the distribution of costs at each centre. Furthermore, there are 30 persons under support, out of whom 19 individuals are involved in supporting the other 4 centres.

Table 1. Information on Cost Distribution at Each Centre

Centre	Support	Components	Pre-Production	Assembly	Packaging
Head Count (#)	4	3	2	2	12
Salary/person	$ 24,000	$ 24,000	$ 24,000	$ 24,000	$ 24,000
Training (%)	10%	5%	10%	5%	5%
Preventive Maintenance (%)				10%	5%
Factory Space (%)	5%	10%	5%	50%	5%
Practical Capacity	30	40,000	1,800	30,000	24,000
Costs based on:	Head Count	Number of Components	Time in Hours	Time in Hours	Time in Hours

Table 2 shows costs across each centre based on material, labour, machinery and space. The costs of each of these areas are allocated across the 5 centres.

Table 2. Costs across the 5 Centres

Centre	Support	Components	Pre-Production	Assembly	Packaging	Total
Material	$30,000	$30,000	$30,000	$30,000	$30,000	$150,000

Labour	$96,000	$72,000	$48,000	$48,000	$288,000	$552,000
Machinery	$5,000	$15,000	$10,000	$800,000	$20,000	$850,000
Space	$5,000	$10,000	$5,000	$50,000	$30,000	$100,000
Totals	$136,000	$127,000	$93,000	$928,000	$368,000	$1,652,000

Table 3 above presents product-wise information for both engine models including sale price, the unit cost of components that go into each product along with a number of components, size of each production lot (batch), the time required for each model and each production-related centre.

Table 3. Information Product-Wise

Engine Model	4-Stroke (25 HP)	2-Stroke (15 HP)
Budgeted Quantity to be Produced over 1 year	3,000 units	4,000 units
Product Price	$500/unit	$220/unit
Component Costs	$ 60/part	$ 35/part
Number of Components needed in each model	6	4
Batch Size	15	20
Time for Pre-Production	3 hours	2 hours
Time for Assembly	2 hours	4 hours
Time for Packaging	5 hours	1 hour

Table 4 displays the cost and profitability information for each product based on direct costs and also the allocation of indirect (overhead) costs using the volume-based traditional costing approach.

Table 4. Cost and Profitability based on Traditional (Volume-Based) Approach

Model	4-Stroke (3000 units)		2-Stroke (4000 units)		Totals
		Total		Total	
Price	$500/unit	$1,500,000	$220/unit	$880,000	$2,380,000
Component Cost	$60/unit	$180,000	$35/unit	$140,000	$320,000
Labour Cost	$75.79/unit	$227,368	$15.16/unit	$60,632	$288,000
Overhead Cost Allocation*	$358.95/unit	$1,076,842	$71.79/unit	$287,158	$1,364,000
Total Cost of Product	$494.74/unit	$1,484,210	$121.95/unit	$487,790	$1,972,000
Profit Margin		$15,790		$392,210	$408,000

*Allocation of Overhead Costs: Explained below with Example of Packaging Centre

Labour hours in packaging:

4-Stroke Model: 3000 units x 5 hours/unit = 15,000 hours

2-Stroke Model: 4000 units x 1 hour/unit = 4,000 hours

Total: 19,000 hours / year

Labour Rate within Packaging Centre: Total annual labour cost at packaging/total hours

$288,000 / 19,000 hours = $15.158 / hour

Budgeted Overhead Costs for Packaging Centre:

Total Cost at Packaging Centre: $1,652,000 (taken from Table 2.0)

Less: Direct Labour in Packaging: $288,000 (taken from Table 2.0)

Budgeted Overhead Cost for Packaging: $1,364,000

Application of Overheads: Budgeted overhead costs**/direct labour hours in packaging

$1,364,000 / 19,000 hours = $71.789/hour

3.3 Information Based on Activity-Based Accounting System

The first step for the company was to classify each of the production-related centres as cost-pools. Based on information derived from employee interviews and observations by supervisors, the company determined the cost-drivers related to each cost-pool.

Table 5 displays the activity cost-pools for the company's factory.

Example of calculations of allocation of overhead costs

Assignment of support personnel to the 4 cost-pools is based on number of persons (head count) assigned to each cost-pool = (3+2+2+12 = 19 persons)

(Total cost under support / number of persons allocated by support to other 4 centres)

$136,000 / 19 persons = $7,157.89 / person

(information taken from Table 1 and 2)

Table 5. Activity Cost-Pools

Centres	Components	Pre-Production	Assembly	Packaging	Totals
Direct Costs (see Table 2)	$127,000	$93,000	$928,000	$368,000	$1,516,000
Support Cost:	$21,474	$14,316	$14,316	$85,894	$136,000

Personnel*					
Total	$148,474	$107,316	$942,316	$453,894	$1,652,000
Cost-Driver Capacity (see Table 1)	40,000 parts	1,800 hours	30,000 hours	24,000 hours	
Cost in $ per Cost-Driver	$3.7119/part	$59.62/hour	$31.411/hour	$18.912/hour	

*Personnel cost to the cost pool is based on head count shown in Table 1

The most difficult and complex part of the ABC system is to develop the information shown in Table 5 above. Once, this information is available, the next step is to allocate costs to products from cost-pools to cost-objectives (i.e., products in this case) based on cost-driver information.

Table 6 presents the detailed costing and profits generated by each product based on the allocation of support costs (i.e., indirect overheads) to the products based on activities where overhead costs are relevant.

Table 6. Cost Allocation based on Activity-Based Costing

	Model 2-Stroke Engine (4000 units)		4-Stroke Engine (3000 units)		Totals
	Per Unit	Total	Per Unit	Total	
Sales Price	$500	$1,500,000	$220	$880,000	$2,380,000
Parts	$60	$180,000	$35	$140,000	$320,000
Components	$22.27	$66,810	$14.85	$59,400	$126,210
Pre-Production	$11.93	$35,790	$5.96	$23,840	$59,630
Assembly	$62.82	$188,460	$125.64	$502,560	$691,020
Packaging	$94.56	$283,680	$18.91	$75,640	$359,320
Total Product	$251.58	$754,740	$200.36	$801,440	$1,556,180

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Cost					
Gross Margin	$248.42	$745,260	$19.64	$78,560	$823,820
Overhead Cost Distribution: Driver Cost-Rates x (# of parts or # of hours under each cost-pool)					
Components	6,000 parts x $3.7119 / part = 22,264				$22,264
Pre-Production	800 setup hours x $59.62 = 47,686				$47,686
Assembly	8000 production hours x $31.41 = 251,296				$251,296
Packaging	5000 finishing hours x $18.91 = 94,574				$94,574
Total					$415,820
Profit Margin					$408,000

4.0 ANALYSIS OF THE RESULTS

The two accounting methods; traditional volume-based approach (Table 4) and ABC approach (Table 6) present two completely different ways of displaying cost information to management. The traditional approach shows that the 4-Stroke engine is yielding the negligible amount of profit margin ($15,790) compared to the 2-Stroke engine ($392,210). Whereas, the ABC approach shows that the profit margin for the 4-Stroke engine is $745,260 compared to the 2-Stroke engine, which is $78,560. Such a disparity between the information displayed by each approach would lead to a vastly different understanding of how each product is contributing the company's profitability and consequently strategic decisions by management with regards to how their product offerings would be different.

The figures based on traditional approach suggest that the 4-Stroke model despite having a much larger sales volume makes a very small contribution to the profitability of the company compared to the 2-Stroke model. If management relies on this information to decide which product to continue offering which one to discontinue, they may take a decision to stop offering the 4-Stroke model, which appears to consume a lot of overheads without significant returns. While the ABC approach indicates that the 4-Stroke model generates almost 10 times the amount of profits compared to the 2-Stroke model. This great disparity in cost information occurred because the traditional approach allocates overhead costs based on volume, which resulted in a distorted view of the allocation of overhead cost to the 4-Stroke model ($358.95/unit) where the allocation for the 2-Stroke engine was only ($71.79/unit). In the case of ABC, the overheads are based on relevant cost-drivers that connect each cost-pool to each of the products. For example, the cost-driver for components was $3.7119/part and the cost-drivers for pre-production, assembly and packaging were $59.62/hour, $31.411/hour and $18.912/hour respectively. The actual indirect cost allocation was then made based on the number of parts or number of hours times the driver-rates which yielded a more accurate picture of indirect cost allocation to the two engine models.

The senior management of the company under study could visualize from the information

from the ABC system that the 4-Stroke engine was contributing significantly more to the company's profit margins compared to the 2-Stroke model. Although, in terms of unit sales, the 2-Stroke engines had a higher market demand, in terms of revenue and profitability the contribution to the margin was not appealing. Based on the information, the company decided to conduct market research to find out if they should continue to offer 2-Stroke engines, or offer a different model of 4-Stroke engines with a different power rating. Such strategic re-evaluation of product offerings is vital for the sustainability of companies especially those that produce products in an industry where there is no substantial barrier to entry.

5.0 CONCLUSION

Senior management of companies involved in advanced manufacturing are striving to leverage modern management techniques to gain and sustain competitive advantage Basically, they focus on reducing the cost of the product without sacrificing quality, and hence are very much dependent on the accuracy of costing information made available to them. In this connection the ABC system can be used to identify non-value adding activities so that they may be eliminated if possible, to improve productivity. The same argument can also be made for the elimination of products that are making an insignificant contribution to the company's profitability. Managers need to delineate products within their product-mix that are making a substantial contribution to the bottom-line form those that are simply cannibalizing the margins generated by the profitable products.

The information provided through activity-based costing presents managers with the ability to make analysis to significantly improve productivity and profitability. For instance, each product requires a number of activities such as design and engineering, purchasing, production and quality control, and maintenance. Each of these activities demands-resources of various categories. For example, in case of purchasing, the steps involved are activities such as order processing, inventory control, supplier selection, monitoring lead-time and delivery and payments to vendors according to terms. Furthermore, each activity has sub-components. For example, the order processing activity may entail sub-activities such as work-time of purchasing managers and staff, communication-related actions, secretarial and other personnel support, etc.

Cost drivers are often measuring activities performed (e.g., number of set-up hours or number of times ordered, etc.). The cost drivers are factors that drive the costs related to each activity. For instance, the number of suppliers and the number of parts used in the product influences the purchasing cost. Therefore, decision-makers have to match the cost drivers with the resources consumed. In the case of purchasing, a reduction in the number of parts used in a product and also the use of fewer suppliers can improve the performance of the purchasing function. Therefore, the usefulness of the ABC system can permeate to micro-levels of the operational value-chain.

The traditional accounting system allocates overhead cost as a percentage of direct labour hours, Although, such a system may be simple and easy to execute, it does not accurately reflect the actual product cost. For example, parts or products that are more complex to manufacture will need more activities, and therefore arbitrary allocation of costs will be unjustified. Furthermore, manufacturing of high-volume of units produced in large batches

will require fewer activities from support departments compared to low-volume products that are produced in smaller batches. There will be fewer set-ups, less scheduling activities, less material retrieval, fewer inspections, and also a smaller number of transactions with resource providers. Hence, the approach of arbitrary cost-allocation in systems such as the volume-based costing distorts information.

Another phenomenon that is making costing information from traditional accounting less useful is the advances being in manufacturing and production technologies. The role of direct labour is diminishing because of the emergence of more capital-intensive manufacturing systems. Therefore, allocating direct labour hours to determine product cost is becoming redundant. More contemporary manufacturing concepts such as design for quality, design for assembly and disassembly and design for distribution are based on ABC with the idea of eliminating non-value adding activities from production functions. The advances in computer technology have encouraged the use of more non-financial parameters such as manufacturing cycle time and a number of defects that are more synched with the ABC system. Especially, with the advent of Industry 4.0 with the application of artificial intelligence and robotics, the role of labour in manufacturing will further diminish. Such rapid changes in the manufacturing environment are fundamentally altering the role of traditional cost inputs such as labour, rendering the application of arbitrary cost allocation meaningless.

Despite the usefulness of the ABC, the implementation of the ABC accounting systems, have challenges from the perspective of their complexity in gathering information of activity cost-pools and cost-drivers. However, once in place the information generates a fairly dependable cost and profit scenario based on which organisations can fathom how much their products or services are costing to produce. Consequently, management can determine the profitability of the products offerings in their portfolio. Whether to adopt ABC or not would depend on the context of the organisation's business activities.

The traditional costing approach is more relevant when highly labour-intensive manufacturing environments are considered where the indirect costs are negligible compared to the direct costs, and allocation of labour-based costs are quite sufficient. In such a situation the distortions created cost misallocation are insignificant. However, with the advent of more modern manufacturing environments, where substantial investments are made into infrastructure and IT support systems, the misallocation of overheads will provide a highly distorted set of cost information that may lead to incorrect decisions. Therefore, traditional cost allocations do not reflect the cost of products adequately as the allocation is based on disproportionate amounts of indirect manufacturing resources.

ABC approaches were designed to provide internal cost information for decision-makers, and not as a source for generating financial statements for external stakeholders. Therefore, organisations still have to maintain the traditional accounting system for computing overall cost information such as cost of goods sold or inventory in hand, etc. that are required for financial accounting reports. Hence, maintaining parallel accounting ledgers is a challenge for management, nevertheless with the advent of powerful enterprise resource management software such as SAP, and development of more recent cost accounting systems such as Time-Driven Activity-based Costing (TDABC) and Resource Consumption Accounting (RCA), etc., it is becoming feasible for business organisations to have the benefit of parallel

systems. The new accounting methods such as TDABC and RCA both have their roots in Activity-Based Costing systems, and hence the ABC approach has a major contribution to enabling the development of cost management systems that can provide pinpoint accuracy to decision-makers.

The goal of the current study was to present a compelling case to move the conversation towards recognizing the need to bring cost accounting methods such as the ABC to being more relevant for inclusion into financial accounting reports that are prepared for external stakeholders. The traditional volume-based accounting method provides an aggregate picture of the financial health of the company, without giving a more nuanced view of a window into the activities of the management. From the perspective of key non-managerial stakeholders such as shareholders, financiers, investors, etc. a more finer-grained reporting of how each of the products in the product mix of a firm is contributing to the bottom-line and how the management is strategizing over relevant and pertinent information will enable a better assessment of how well the company is being managed. Therefore, it is anticipated that such studies will ferment the case for more accurate cost accounting information such as the information provided by activity-based costing system, will be taken up by academic scholars and industry practitioners, regulators and policymakers with an idea of bridging the information gap between the information disclosed by management to other entities that have a major stake in the success of the business organization.

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