

An Improved Methodology For Absorption Costing: Efficiency Based Absorption Costing (EBAC)

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ABSTRACT

This paper presents an improved, efficiency based absorption costing method. Efficiency based absorption costing EBAC represent an algorithm that absorbs costs based on efficiency as the main driver and we compare its results with other methods such as ABC as proof-of-concept. EBAC results in significant cost changes compared to ABC and the traditional costing system (TCS). Businesses could embrace the more efficient EBAC for a host of their pertinent cost control and decision making needs. The EBAC methodology is both easy and convenient to apply as firms currently using ABC could instantly explore EBAC without the need to gather extra information.

Keywords: Absorption costing, Efficiency Based Absorption Costing, Activity Based Costing, Traditional Costing System

INTRODUCTION

The efficiency of traditional cost and management accounting practices, especially in the area of absorption costing in coping with the requirements of the modern business environment and technology have been of major concern for a number of years. The perceived gap in timeliness and accuracy of the Traditional Costing System (TCS) (Cooper and Kaplan 1991; Gunasekaran et al. 1999) has become a major impetus for management accounting innovation (Chenhall 2003; Smith 2000; Lukka and Shields 1999). The nature of the current manufacturing environment for example, which are more capital intensive compared to the traditional labor intensive environment render the TCS less applicable. The solution to the much needed change in the TCS came in the form of Activity Based Costing (ABC), (Johnson and Kaplan 1987). Eventually the many articles published on the design and implementation of ABC includes (Coskins 1997; Lyne and Friedman 1996; Scheeweiss 1998; Sohal and Chung 1998; Zhuang and Burns 1992).

Shields (1995) reported the growing interest over the two decades of firms seeking to implement the ABC systems as the more accurate way of allocating operating costs to various cost objects. ABC was seen as sophisticated enough to measure the multiple level resources required to produce different products (Nazmi et al. 2007; Ruhl and Hartman 1998). Subsequently ABC has been applied to a variety of companies and economic sectors, for example education (Acton and Cotton 1997; Nazmi et al. 2007), health care (Aird 1996; Michela and Irvine 2005, financial services (Adams 1996), logistic (Baykasoglu and Kaplanoglu 2007) food and beverage (Magdy and Luther 2006), manufacturing (Ruhanita and Daing, 2007; John Innes and Sinclair 2000; Steve R. and Ken 1994; John A. et al. 2001; Dhavale 1993; Zhuang and Burns 1992; (Baykasoglu et al. 2006) and retail (Tony and Philip 2001). Although ABC was hailed as being able to allocate overheads to products more accurately, provide better pricing decisions and better resource allocations (John A. et al. 2001) one of the key weaknesses of ABC and TCS is the use of the “blanket overhead absorption rate” to allocate costs. To understand this phenomenon, it is important to explore the evolution of the TCS and ABC in more detail.

THE ABSORPTION COSTING PROBLEM

Disagreement still exist, albeit not as heated as decades ago, on the merits of variable or marginal costing versus full costing or absorption costing. In full costing, fixed production costs or overheads are allocated to products so that the reported product cost measure total manufacturing costs. In variable costing, the fixed costs are not allocated and product costs reflect only the marginal cost of manufacturing (Cooper and Kaplan 1988). Debate on the merits of cost allocation and its impact used to be prominent decades ago as pointed by earlier studies, for example, (Zimmerman 1979). However despite the arbitrary nature of cost allocations (Thomas 1969), behavioral pricing studies have suggested that different decision outcomes are related to the method of cost allocation (Bloom et al. 1984; Barnes and Webb 1986). It was found that unitization and allocation of fixed cost to products can result in decisions that lead to less than optimum output level, if decisions makers treat these cost measures as if they were variable. However while accounting literature and academics concentrated on the merits of variable costing or full costing, businesses continued to use absorption costing as the fundamental input in pricing, (Cooper and Kaplan, 1988; Govindarajian & Anthony 1983; Gordon et al. 1981). Among the reasons for the wide spread adoption of full costing as opposed to marginal costing is because managers rejected the idea that product decisions have short term time horizon impact but in fact, decisions to offer a product creates long term commitment to manufacturer, market and support that product and hence the short term based marginal costing is inadequate to measure product cost (Cooper and Kaplan 1988). Analytical works have also revealed that absorption costing more closely represents the underlying cost functions facing firms, (Lere 1986a; Dickhaut and John C. 1983; Lere 1982). In this regard, the traditional costing (TCS) coined in this study denote the full costing or absorption costing.

Traditional costing systems (TCS) have its roots in the manufacturing industry. The TCS is characterized by absorption of production overheads (excluding selling and administration overheads) into product costs, the use of direct labor hours or labor costs as a “convenient” or “easy” way to allocate total overhead to products and the use of the blanket overhead recovery costs for simplicity purposes (Steve R. and Ken 1994; Gunasekaran et al. 1999). The exclusion of selling and administration overheads from being absorbed into products costs originate from the annals of financial accounting and reporting requirements for stock valuation purposes. While the inclusion of the selling and administrative costs is desirable for product related decisions, their exclusion from being absorbed caused Johnson and Kaplan (1987) to lament that management accounting has become of secondary importance in comparison to financial accounting. Similarly Bailey (1991), Drury et al. (1993), and Drury and Tayles (2000) found that product cost information tend to prepared on a similar basis to financial accounting. As the labor intensive manufacturing industry gradually shifted towards more capital intensive, companies started using machine hours instead of labor hours to allocate costs from cost pools to products (Cooper and Kaplan 1998). However the increased use of automation and computerized services would mean relying primarily on direct labor or machine hours can produce large distortions in the allocation of overheads costs (Snyder and Davenport 1997). Additionally the support departments costs of companies have been among the fastest growing in relation to overall cost structure of manufactured goods (Baykasoglu et al. 2003). In other words, increasingly labor costs accounted for a smaller proportion of a company’s overall costs. In this regard, the use of the blanket overhead recovery to allocate total overheads does not take into account the actual usage of overheads, either by department or by product.

Thus the need for more accurate costing of products and services has led to the widespread adoption of ABC. ABC has been developed to provide more accurate ways of assigning the costs of indirect and support resources to activities, business processes, products, services and customers (Kaplan R. 1998). In ABC an attempt was made to track overheads to cost units (which are the units that generated the overhead cost) as accurately as possible. In reality, this represents a return to the kind of costing methods used before the need for financial reports (Steve R. and Ken 1994).

Figure 1 represents the cost assignment process in ABC, (Tsai and Kuo, 2004). The first stage of cost accumulation in ABC is the activity centers. In the first stage resources are allocated to the activity centers or in other words the actions are aggregated into activities. Once the resources are allocated to the activity centers, the cost of the activity centre is reported. The second stage of ABC is the allocation of activity costs to cost objects. First selection of appropriate cost drivers have to be made. Following this cost will be allocated to the cost objects. It should be noted that ABC has rightfully pointed out the vagueness of analyzing and allocating total overheads to products and therefore the need to analyze or segregate total overheads into more detailed-defined overheads for

absorption purposes. Secondly, ABC exposed the weakness of using a single blanket overhead recovery rate and therefore the need to absorb each type of overheads based on their respective cost drivers. In essence ABC is an extension of the TCS. It extended the bases for splitting the overheads into multiple bases from the previous single base. Next ABC demonstrated the need for the inclusion of support department overheads into product costs. Whilst the above three major improvements are salient and reflected the leap in management accounting practices, one key weakness of the TCS remains partly unresolved in ABC, which is the use a single standard absorption rate for each cost pool, determined by its cost driver .

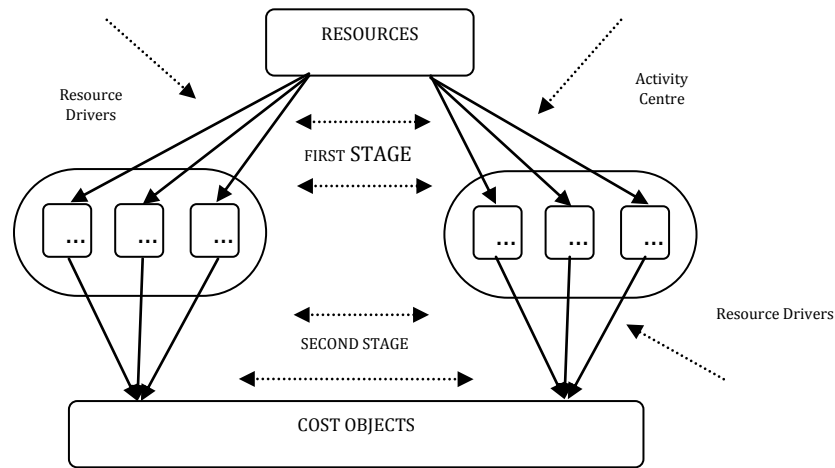


Figure 1 – Cost Assignment of ABC
Source: Tsai & Kuo, 2004.

The use of the single standard absorption rate for each cost pool, determined by its cost driver. Currently ABC derives the absorption rate for each of its cost pool by dividing the total costs of each pool with total number of units of cost drivers for that particular cost pool, thus using the overhead absorption rate per cost driver. The absorption rate per cost driver is then used to calculate and absorb the cost absorbed for each cost objects or products. In order to demonstrate the point discussed, an illustration in Scenario 1 is given below:

Scenario 1

Ruth Book Publishing Plc publishes two types of books. One is a children’s book (CHB) and one is a magazine (MGZ). One of the overhead costs incurred by Ruth is quality control cost which amounts to \$ 800,000. The cost driver of the quality control cost is number of inspections.

The details of Ruth’s annual output are as follow:

<i>Book</i>	<i>Output (copies)</i>	<i>Cost driver – No of inspections</i>
CHB	1,000,000	180 times
MGZ	120,000	20 times

Using the ABC the overhead absorption rate calculated would as follow:

$$\text{Quality control cost/driver} = \frac{\$800,000}{200} = \$4,000 / \text{driver}$$

The total quality control cost overhead absorbed by CHB would therefore be \$720,000 (i.e. 180 X \$4,000) and MGZ \$80,000 (i.e. 20 X \$ 4,000).

It should be noted in the scenario above ABC uses a single standard absorption rate of \$4,000 per driver to absorb the quality control costs incurred by CHB and MGZ. The apparent weakness of this approach is that it ignores the different level of efficiency of each product (CHB or MGZ) in using or incurring the quality control

costs. It is clear that the efficiency of CHB and MGZ in incurring the quality control cost is different as CHB needed 180 inspections for 1,000,000 of its output while MGZ needed 20 inspections for 120,000 of its output. Therefore assigning a standard absorption rate of \$4,000 for both products is therefore fundamentally incorrect and unfair to both products as each have possess different efficiency characteristics in incurring the quality control costs. In today's modern and competitive business environment companies have adopted efficient concepts such as Just-in-Time (JIT), Total Quality Management (TQM) and lean manufacturing where efficiency rules as the central theme of operations. Assigning a single standard absorption rate for all products that jointly incur a particular overhead cost would result in high degree of cross subsidization between more efficient and less efficient products. As a result of this, an improved, efficiency based absorption costing methodology is required to rightfully absorb overheads.

METHODOLOGY

We propose an efficiency based absorption costing (EBAC) and it takes into account the different level of overhead utilization efficiency of different products. The management accounting literature gives four possible methods for determining the denominator activity level used to calculate overhead rates. These four methods are the theoretical maximum capacity, practical capacity, normal capacity and budgeted capacity (John A. et al. 2001). ABC has rightfully argued that it is resource consumption based model and should therefore use the practical capacity as the denominator level (Cooper and Kaplan 1992). The proposed EBAC also adopts the practical capacity to determine the overhead absorption rate, based on the same ground as ABC, which rejected the use of budgeted capacity on the grounds that is could lead distorted product costs and incorrect decisions.

The EBAC uses efficiency as the main determinant to calculate the absorption rate. Efficiency is defined here as the ratio of input required to produce an output. An output or product or service is efficient if it requires lesser input to produce a given number of outputs. For example if Product A needs 10 set up to produce 100 of its units and Product B needs 20 set up to produce 100 of its units, Product A is more efficient. This is because Product A needs lesser input or drivers to produce a given number of outputs. In the literature, the efficiency defined here is also called yield. However, this paper adopts the term efficiency to explain the ratio of input required to produce an output.

In this regard, using the same information from Scenario 1 above, the following methodology for efficiency based absorption costing (EBAC) is proposed;

Scenario 1 (a)			
Efficiency rate of CHB	=	180 / 1,000,000	= 0.0002
Efficiency of rate MGZ	=	20 / 120,000	= <u>0.00016</u>
Total efficiency			<u>0.00036</u>
<i>EBAC absorption rate</i>			
CHB		0.0002 / 0.00036	
MGZ		0.00016 / 0.00036	

The efficiency rate is obtained by dividing the number cost drivers for a particular product with the total number of units or volume of that product. The total quality control cost overhead absorbed by CHB would therefore be \$ 415,385 [i.e. (0.0002 / 0.00036) X \$800,000] and MGZ 384,615 [i.e. (0.00016 / 0.00036) X \$ 800,000]

MGZ has been slightly more efficient than CHB in incurring or using the quality control overhead cost. This is indicated by the efficiency rate of 0.0002 and 0.00016 for CHB and MGZ respectively. A product with a lower value of efficiency rate indicates better efficiency and thus enjoys a lower absorption rate compared to its less efficient counterparts. The results of the overhead absorption using the EBAC are in stark contrast with results obtained using ABC. The quality control cost overhead absorbed by using EBAC for CHB is lower by 42% and higher by 381% for MGZ in absolute amounts as compared to ABC. These results show significant distortion of cost information of CHB and MGZ. As argued earlier, assigning a single standard absorption rate for all products that jointly incur a particular overhead cost would result in high degree of cross subsidization between more efficient and

less efficient products. The results of Scenario 1 clearly show by using ABC, CHB has been penalized with a high share of the overhead cost while both CHB and MGZ has been nearly similar in their efficiency level in utilizing overhead cost.

Since EBAC is applicable like ABC to all industries, three comprehensive cases comprising one each from the manufacturing, retail and service industry is given below, clearly showing the accuracy of EBAC versus ABC and TCS.

Manufacturing Industry Scenario

Kino Publishing Co publishes two forms of book. The company publishes a children’s book (CHB) and second a magazine (MGZ). The direct costs and other information per unit for each of the two books are as follows:

	CHB	MGZ
Paper costs	\$0.8	\$0.1
Printing costs	\$1.5	\$4.5
Machine costs	\$1.2	\$2.0
Machine hours	6 minutes	10 minutes
Selling price	\$9.30	\$14.00
Total output units	1,000,000 units	120,000 units
No of inspection	180	200
No of set up	4	12
Total machine hours	100,000	20,000

CHB needs six minutes of machine time to produce each book, whereas the MGZ needs 10 minutes per book. The machines cost \$12 per hour to run. The three overheads of Kino Publishing are:

	\$	Cost driver
Property costs hours	2,160,000	Machine
Quality control	668,000	Inspection
Production set up costs	52,000	Set up
<i>Total</i>	<u>2,880,000</u>	

Total output of CHB would be 1,000,000 and MGZ 120,000. Therefore total machine hours consumed by CHB would be 100,000 hours or 6,000,000 minutes and MGZ would be 20,000 hours or 1,200,000 minutes. The absorption of total overhead under the traditional costing system (TCS) is based on the machine hours. The ABC and EBAC use the cost driver information to calculate the absorption rate for each type of overhead.

Table 1 Calculation of TCS overhead absorption rate - Kino Publishing Co

Cost Pool	RM	Driver	AR
Total overhead costs	2,880,000	Machine hours	2,880,000/ 120,000 = 24 per hour

Note: a) AR = absorption rate

Table 2 Calculation of ABC overhead absorption rate- Kino Publishing Co

Cost Pool	RM	Driver		AR/ Driver	CHB	Overhead/ unit	MGZ	Overhead/ unit
Property costs	2,160,000	Machine hours	120,000	18.00	18 X (6/60)	1.8	18 X 10/60	3.00
Quality control	668,000	Number of inspections	200	3340.00	(180 X 3340) / 1,000,000	0.6012	(20 X 3340) / 120,000	0.56
Production set up	52,000	Number of set ups	16	3250.00	(4 X 3250) / 1,000,000	0.013	(12 X 3250) / 120,000	0.325
	2,880,000							

Note: a) AR = absorption rate

Table 3 Calculation of EBAC overhead absorption rate- Kino Publishing Co

Cost Pool	RM	Driver	CHB	No of units	ER	MGZ	No of units	ER	Total ER
Property costs	2,160,000	Machine hours or min	6,000,000	1,000,000	6.00	1,200,000	120,000	10.00	16.00
Quality control	668,000	Number of inspections	180	1,000,000	0.0002	20	120,000	0.000166667	0.0003
Production set up	52,000	Number of set ups	4	1,000,000	0.000004	12	120,000	0.0001	0.000104
	2,880,000								

Note: a) ER = Efficiency rate
 b) Property cost ER for
 (i) $CHB = 6,000,000 / 1,000,000 = 6.00$, (ii) $MGZ = 1,200,000 / 120,000 = 10.00$
 c) Quality control cost ER for
 (i) $CHB = 180 / 1,000,000 = 0.0002$, (ii) $MGZ = 20 / 120,000 = 0.0001667$
 d) Production set up cost ER for
 (i) $CHB = 4 / 1,000,000 = 0.000004$, (ii) $12 / 120,000 = 0.0001$

Table 4 Cost and Profitability of CHB and MGZ under different costing methods - Kino Publishing Co

	CHB			MGZ			Percentage of Change vs. EBAC			
	TCS	ABC	EBAC	TCS	ABC	EBAC	CHB		MGZ	
							TCS	ABC	TCS	ABC
Sales price	9.3	9.3	9.3	14.0	14.0	14.0				
Paper costs	0.8	0.8	0.8	0.1	0.1	0.1				
Printing costs	1.5	1.5	1.5	4.5	4.5	4.5				
Machine cost	1.2	1.2	1.2	2.00	2.00	2.00				
Contribution	5.8	5.8	5.8	7.4	7.4	7.4				
Overheads	2.4			4.00						
Property costs		1.8	0.81		3.00	11.25				
Quality control (QC)		0.6012	0.35		0.56	2.68				
Production set up		0.013	0.002		0.33	0.42				
Profit	3.4	3.39	4.64	3.40	3.52	-6.94	36.5%	37%	-304%	-298%

Note: a) TCS Overheads absorption rate for
 (i) $CHB = 6 \text{ mins at RM } 24/\text{hr} = 2.4$, (ii) $MGZ (10 \text{ mins at RM } 24/\text{hr} = 4.00$
 b) ABC Overhead absorption rate of Property Costs for
 (i) $CHB = 18 \times (6 / 60) = 1.8$, (ii) $MGZ = 18 \times (10 / 60) = 3.00$
 c) ABC Overhead absorption rate of QC Cost for
 (i) $CHB = (180 \times 3340) / 1,000,000 = 0.6012$, (ii) $MGZ = (20 \times 3340) / 120,000 = 0.56$
 d) ABC Overhead absorption rate of Production set up Cost for
 (i) $CHB = (4 \times 3250) / 1,000,000 = 0.013$, (ii) $MGZ = (12 \times 2350) / 120,000 = 0.33$
 e) EBAC Overhead absorption rate of Property Costs for
 (i) $CHB = [(6 / 16) \times 2,160,000] / 1,000,000 = 0.81$, (ii) $MGZ = [(10 / 16) \times 2,160,000] / 120,000 = 11.25$
 f) EBAC Overhead absorption rate of Quality Control Cost for
 (i) $CHB = [(0.0002 / 0.0003) \times 668,000] / 1,000,000 = 0.35$, (ii) $MGZ = [(0.000167 / 0.0003) \times 668,000] / 120,000 = 2.68$
 g) EBAC Overhead absorption rate of Production set up Cost for
 (i) $CHB = [(0.00004 / 0.000104) \times 52,000] / 1,000,000 = 0.002$, (ii) $MGZ = [(0.0001 / 0.000104) \times 52,000] / 120,000 = 0.42$

The information given in Table 4 is costing information calculated for each unit of CHB and MGZ. It can be seen from the analysis above that the profitability of the CHB and MGZ using the TCS or ABC is almost the same. However using EBAC, it clear that CHB is the profitable one, and MGZ has actually been making a loss. The more efficient CHB have been subsidizing MGZ when the overhead cost is absorbed using the TCS or ABC. The percentage of change in profitability from adopting the more accurate EBAC as compared to TCS or ABC is very significant at 36.5 % and 37% for CHB and -304% and -298% for MGZ.

Trading/ Retail Industry Scenario

Home Style owns several home furnishing stores. Consultants give personalized attention to potential customers and also visit their homes in necessary. Customers visit the store to make their selections after which sales staff collect payment and raise purchase order. Customers then collect their Do-It-Yourself (DIY) goods from the warehouse, using the purchase order as authority to collect. Administration staffs process orders and also arranges consultations. Each store operates an absorption costing system and costs other than the cost of goods sold are apportioned on the basis of sales floor area under the Traditional Costing System (TCS).

Results of Home Style for the first six months are as follows:

Department	Kitchens \$	Bathrooms \$	Dining Rooms \$	Total \$
Sales	210,000	112,500	440,000	762,500
Cost of goods sold	63,000	37,500	176,000	276,500
Other costs	<u>130,250</u>	<u>81,406</u>	<u>113,968</u>	<u>325,624</u>
Profit	<u>16,750</u>	<u>113,968</u>	<u>150,032</u>	<u>160,376</u>

The ‘Other costs’ above consist of fixed overheads for Home Furnishing is made up of the following:

	\$	Employees
Sales staff wages	64,800	12
Consultation staff wages	24,960	4
Warehouse staff wages	30,240	6
Administration staff wages	30,624	4
General overheads (light, heat, rates, etc)	<u>175,000</u>	
	<u>325,624</u>	

The following information of Home Furnishing is available to calculate the overhead absorption rate using ABC and EBAC.

Department	Kitchens	Bathrooms	Dining Rooms
Number of items sold	1,000	1,500	4,000
Purchase orders	1,000	900	2,500
Floor area (square meters)	16,000	10,000	14,000
Number of consultations	798	200	250

The calculation of the overhead absorption rate using the TCS, ABC and EBAC is given below:

Table 5 Calculation of TCS overhead absorption rate - Home Style

Cost Pool	\$	Driver	OAR
Total overhead costs	325,624	floor area	325,624 / 40,000 = 8.141

Table 6 Calculation of ABC overhead absorption rate- Home Style

Cost Pool	RM	Driver	AR/Driver
Sales staff wages	64,800	no of purchase orders	4,400
Consultation staff wages	24,960	no of consultations	1,248
Warehouse staff wages	30,240	no of items sold	6,500
Administration staff wages	30,624	no of tasks	5,648
General overheads (light, heat, rates, etc.)	175,000	floor area	40,000

Note: a) AR = Absorption rate

Table 7 Calculation of EBAC overhead absorption rate - Home Style

Cost Pool	\$	Driver	Kitchens		ER	Bathrooms		ER	Dining Rooms		Total number of drivers	Total ER	
			No of drivers	No of units		No of drivers	No of units		No of drivers	No of units			
Sales staff wages	64,800	No of purchase orders	1,000	1000	1.00	900	1500	0.600	2,500	4000	0.625	4,400	2.225
Consultation staff wages	24,960	No of consultations	798	1000	0.80	200	1500	0.133	250	4000	0.063	1,248	0.994
Warehouse staff Wages	30,240	No of items sold	1,000	1000	1.00	1,500	1500	1.000	4,000	4000	1.000	6,500	3.000
Administration staff wages	30,624	No of tasks	1,798	1000	1.80	1,100	1500	0.733	2,750	4000	0.688	5,648	3.219
General overheads	175,000	Floor area	16,000	1000	16.00	10,000	1500	6.667	14,000	4000	3.500	40,000	26.167

- Note:
- a) ER = Efficiency rate
 - b) Sales staff wages cost ER for
 - (i) Kitchen = 1,000/1,000= 1.00, (ii) Bathroom = 900/1,500 = 0.6, (iii) Dining Room = 2,500/4000 = 0.625
 - c) Consultation staff wages cost ER for
 - (i) Kitchen = 798/1,000= 0.8, (ii) Bathroom=200/1,500=0.133, (iii) Dining Room=250/4,000=1.00
 - d) Warehouse staff wages cost ER for
 - (i) Kitchen=1,000/1,000=1.00, (ii) Bathroom=1,500/1,500=1.00,(iii) Dining Room=4,000/4,000=1.00
 - e) Administration staff wages cost ER for
 - (i) Kitchen = 1,798/1,000=1.80, (ii) Bathroom=1,100/1,500=0.733, (iii) Dining Room=2,750/4,000=0.688
 - f) General overhead cost ER for
 - (i) Kitchen =16,000/1,000=16.0, (ii) Bathroom=10,000/1,500=6.667, (iii) Dining Room=14,000/4,000= 3.50

Table 8 Cost and Profitability of Products under different costing methods - Home Style

Product	Kitchens			Bathrooms			Dining Rooms (DR)			Total		
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
	TCS	ABC	EBAC	TCS	ABC	EBAC	TCS	ABC	EBAC	TCS	ABC	EBAC
Sales	210,000	210,000	210,000	112,500	112,500	112,500	440,000	440,000	440,000	762,500	762,500	762,500
Cost of goods sold	63,000	63,000	63,000	37,500	37,500	37,500	176,000	176,000	176,000	276,500	276,500	276,500
Contribution	147,000	147,000	147,000	75,000	75,000	75,000	264,000	264,000	264,000	486,000	486,000	486,000
Other costs: total	130,250			81,406			113,968			325,624		
Sales staff wages		14727	29124		13255	17474		36818	18202		64800	64800
Consultation staff wages		15960	20042		4000	3349		5000	1570		24960	24960
Warehouse staff wages		4652	10080		6978	10080		18609	10080		30240	30240
Administration staff wages		9749	17106		5964	6977		14911	6541		30624	30624
General overheads (Light, heat, rates, etc.)		70000	107006		43750	44586		61250	23408		175000	175000
Profit	16,750	31,911	-36,358	-6,406	1,053	-7,466	150,032	127,412	204,200	160,376	160,376	160,376

Note:

- a) TCS Overheads absorption rate for
 - (i) Kitchen = $(325,624/40,000) \times 16,000 = 130,250$, (ii) Bathroom = $(325,624/40,000) \times 10,000 = 81,406$,
 - (iii) Dining Room = $(325,624/40,000) \times 14,000 = 113,968$
- b) ABC Overhead absorption rate of Sales Staff wages for
 - (i) Kitchen = $(64,800 / 4,400) \times 1,000 = 14,727$. (ii) Bathroom = $(64,800 / 4,400) \times 900 = 13,255$,
 - (iii) Dining Room = $(64,800 / 4,400) \times 2,500 = 36,818$
- c) ABC Overhead absorption rate of Consultation Staff wages for
 - (i) Kitchen = $(24,960 / 1,248) \times 798 = 15,960$, (ii) Bathroom = $(24,960 / 1,248) \times 200 = 4,000$,
 - (iii) Dining Room = $(24,960 / 1,248) \times 250 = 5,000$
- d) ABC Overhead absorption rate of Warehouse Staff wages for
 - (i) Kitchen = $(30,240 / 6,500) \times 1,000 = 4,652$, (ii) Bathroom = $(30,240 / 6,500) \times 1,500 = 6,978$,
 - (iii) Dining Room = $(30,240 / 6,500) \times 4,000 = 18,609$
- e) ABC Overhead absorption rate of Administration Staff wages for
 - (i) Kitchen = $(30,624 / 5,648) \times 1,798 = 9,749$, (ii) Bathroom = $(30,624 / 5,648) \times 1,100 = 5,964$,
 - (iii) Dining Room = $(30,624 / 5,648) \times 2,750 = 14,911$
- f) EBAC Overhead absorption rate of Sales staff wages for

- (i) Kitchen = $(1.00/2.225) \times 64,800 = 29,124$, (ii) Bathroom = $(0.6/2.225) \times 64,800 = 17,474$,
- (iii) Dining Room = $(0.625/2.225) \times 64,800 = 18,202$
- h) EBAC Overhead absorption rate of Consultation staff wages for
 - (i) Kitchen = $(0.8/0.994) \times 24,960 = 20,042$, (ii) Bathroom = $(0.133/0.994) \times 24,960 = 3,349$,
 - (iii) Dining Room = $(0.063/0.994) \times 24,960 = 1,570$
- i) EBAC Overhead absorption rate of Warehouse staff wages for
 - (i) Kitchen = $(1.0/3.0) \times 30,240 = 10,080$, (ii) Bathroom = $(1.0/3.0) \times 30,240 = 10,080$,
 - (iii) Dining Room = $(1.0/3.0) \times 30,240 = 10,080$
- j) EBAC Overhead absorption rate of Administration staff wages for
 - (i) Kitchen = $(1.8/3.219) \times 30,624 = 17,106$, (ii) Bathroom = $(0.733/3.219) \times 30,624 = 6,977$,
 - (iii) Dining Room = $(0.688/3.219) \times 30,624 = 6,541$
- k) EBAC Overhead absorption rate of General Overheads
 - (i) Kitchen = $(16.0/26.167) \times 175,000 = 107,006$, (ii) Bathroom = $(6.667/26.167) \times 175,000 = 44,586$,
 - (iii) Dining Room = $(3.5/26.127) \times 175,000 = 23,408$

Table 9 Percentage of Change in Profit from TCS and ABC to EBAC - Home Style

Percentage of change vs. EBAC					
Kitchens		Bathroom		Dining Room	
TCS	ABC	TCS	ABC	TCS	ABC
-317%	-214%	17%	-8	36%	60%

The information given in Table 8 is the costing information calculated for total units of Kitchen, Bathroom and Dining Room. The results for Kitchen by using TCS show a profit of \$16,750. However by using ABC the profits go up to \$31,911. When compared to TCS, ABC is known to move cost from the high volume products to the low volume products. However moving overheads costs from high volume to low volume products without taking into account each product’s level of efficiency in using or incurring those overheads is wrong. Kitchen has in fact been making losses when overheads are absorbed using EBAC. The results for Bathroom are even more contradicting under all three methods. The TCS reported Bathroom as making a loss of \$6,406 while ABC seems to suggest that it is actually making a profit of \$1,053.

However using EBAC actually makes a loss of \$7,466. Home style would have made a wrong decision on whether to continue or shutdown the Bathroom division based on ABC as compared to EBAC. Dining Room, which shows a reduced profit of \$127,412 based on ABC as compared to TCS, was actually performing well at a profit of \$204,200 based on EBAC. The more efficient Dining Room has been subsidizing the less efficient Kitchen and Bathroom. The percentage of change in profitability for Kitchen by adopting the EBAC as compared to TCS and ABC are -317% and -214% respectively while for Bathroom 17% and -8% respectively and for Dining Room 36% and 60% respectively.

Service Industry Scenario

Pantai is a privately owned profit oriented hospital that specializes in operations Throat and Nose operations. Pantai traditionally determines its prices by adding a 10% mark up to the budgeted full cost of an operation. The fixed overheads are absorbed on the basis of operating hours under the Traditional Costing System (TCS). The financial information of Pantai for the most recent year is as follow:

Department	Throat	Nose	Total
Operating hours	2,988	4,572	7,560
Average duration of operation	3.0 hours	3.6 hours	276,500
Number of operations undertaken	996	1,270	
Variable cost per operation	\$ 1,450	\$1,254	
Fixed Overheads Total			\$ 12,000,000

The breakdown of fixed overheads to be used for ABC and EBAC are as follow:

Activity	Cost driver	Throat	Nose	Fixed Overheads
a) Consultations with potential patients	Number of consultations	3,000	2,000	\$8,980,000
b) X-rays	Number of X-rays	6,200	6,200	\$1,800,000
c) Post-operative care	Days of care	7,860	23,580	\$1,220,000

The calculation of the overhead absorption rate using the TCS, ABC and EBAC is given below:

Table 10 Calculation of TCS overhead absorption rate - Pantai

Cost Pool	\$	Driver	AR
Total overhead costs	12,000,000	Operating hours	12,000,000 / 8,000 = 1,500

Note: a) AR = Absorption rate

Table 11 Calculation of ABC overhead absorption rate- Pantai

Cost Pool	\$	Driver	AR/Driver
Consulting	8,980,000	No of consultations	1796
X-ray	1,800,000	Number of X-rays	145.2
Post operative care	1,220,000	Days of care	38.8

Table 12 Calculation of EBAC overhead absorption rate- Pantai

Cost Pool	\$	Driver	Throat			Nose			Total no of drivers	Total ER
			No of drivers	No of units	ER	No of drivers	No of units	ER		
Consulting	8,980,000	No of consultations	3,000	996	3.01	2,000	1,270	1.57	5,000	4.59
X-ray	1,800,000	Number of X-rays	6,200	996	6.22	6,200	1,270	4.88	12,400	11.11
Post operative care	1,220,000	Days of care	7,860	996	7.89	23,580	1,270	18.57	31,440	26.46

Note: a) ER = Efficiency rate
 b) Consulting cost ER for (i) Throat = 3,000/996= 3.01, (ii) Nose = 2,000/ 1,270 =1.57
 c) X-Ray cost ER for (i) Throat = 6,200 / 996 = 6.22, (ii) Nose = 6,200 / 1,270 = 4.88
 d) Post operative care cost ER for (i) Throat = 7,860 / 996 = 7.89, (ii) 23,580 / 1,270 = 18.57

Table 13 Cost and Profitability of Products under different costing methods- Pantai

	Throat			Nose			Percentage of Change vs. EBAC			
	\$	\$	\$	\$	\$	\$	Throat		Nose	
	TCS	ABC	EBAC	TCS	ABC	EBAC	TCS	ABC	TCS	ABC
Variable costs	1450	1450	1450	1254	1254	1254				
Fixed Costs	4500			5400						
Consulting		5,409.6	5920.6		2,828.3	2427.6				
X-ray		903.6	1012.9		708.7	623.0				
Post operative care		306.2	365.3		720.5	674.1				
Total costs	5950	8069.5	8748.8	6654	5511.5	4978.7				
10% Mark Up	595	807	874.9	665.4	551.1	497.9				
Price	6545	8876.4	9623.7	7319.4	6062.6	5476.6	47%	8%	-25%	-10%

Note: a) TCS Overheads absorption rate for
 (i) Throat = (12,000,000/8,000) X 3 = 4,500, (ii) Nose = ((12,000,000/8,000) X 3.6 = 5,400
 b) ABC Overhead absorption rate of Consulting cost for
 (i) Throat = [(8,980,000/5,000) X 3,000]/996 = 5,409.6,
 (ii) Nose = [(8,980,000/5,000) X 2,000]/1,270 = 2, 828.3
 c) ABC Overhead absorption rate of X-ray cost for
 (i) Throat = [(1,800,000/12,400) X 6,200] / 996 = 903.6,
 (ii) Nose == [(1,800,000/12,400) X 6,200] / 1,270 = 708.7
 d) ABC Overhead absorption rate of Post operative care for
 (i) Throat = [(1,220,000/31,440)] X 7,860] / 996 = 306.2,
 (ii) Nose = [(1,220,000/31,440) X 23,580] / 1,270 = 720.5
 e) EBAC Overhead absorption rate of Consulting cost
 (i) Throat = [(3.01/4.59) X 8,980,000] /996 = 5,920.6,
 (ii) Nose = [(1.57/ 4.59) X 8,980,000] /1,270 = 2,427.6,
 f) EBAC Overhead absorption rate of X-ray cost
 (i) Throat = [(6.22/11.1) X 1,800,000] / 996 = 1,012.9,
 (ii) Nose = [(4.88/11.1) X 1,800,000] / 1,270 = 623.0
 g) EBAC Overhead absorption rate of Post operative care cost
 (i) Throat = [(17.89/26.46) X 1,220,000] / 996 = 365.3,
 (ii) Nose = [(18.57/26.46) X 1,220,000] / 1,276 = 674.1

The information given in Table 13 is costing information calculated for each unit of Throat and Nose operation. The cost information for X-ray cost is a good example of the different absorption characteristics of ABC

versus EBAC. The number of X-rays, which is the cost driver for X-ray cost, is the same for both Throat and Nose i.e. 6,200. The X-rays cost allocated by using ABC in total to Throat operations would be \$900,000, i.e. ($\$145.2 \times 6,200$) and to Nose would be also \$900,000. The same amount of allocation of cost happens because ABC allocates the X-rays cost using a standard absorption rate of \$ 145.2 and since both Throat and Nose utilized the same number X-rays, they are both given an equal share of the total X-rays cost. ABC however does not take into account the different number of operations carried for Throat and Nose as an important criteria for cost absorption. EBAC on the other hand, recognizes the different level of efficiency of both operations in using or utilizing X-rays cost although the number of cost drivers utilized is the same. Therefore EBAC allocates X-rays cost in total to all Throat operations to \$1,008,826, i.e. $[(6.22/11.1) \times 1,800,000]$ and Nose to \$ 791,174, i.e. $[(4.88/11.1) \times 1,800,000]$. EBAC did not allocate the same proportion of total X-rays cost to both operations because although the numbers of cost drivers incurred by both operations are the same, the number of operations for Throat is 996 while for Nose is 1,270. In this regard, Nose has been more efficient than Throat in utilizing the X-rays cost and therefore allocated lesser total cost compared to Throat.

The price charged for Throat operation under TCS is \$6,545 and under ABC is \$8,876.4 while under EBAC is \$9,623.7. The price charged for Nose operation under TCS is \$7,319.4 and ABC is \$6,062.6 while under EBAC is \$5,476.6. ABC has no doubt moved the fixed cost from the high volume Nose operation to the low volume Throat operation. However it is clear by using EBAC, that Nose has been more efficient in incurring overheads and therefore subsidizing the less efficient Throat. Pantai has been over charging its customers for the Nose operation while under charging for the Throat operation. Throat has therefore been making a loss under the price charged by the TCS and ABC. The percentages of change in profitability by adopting the EBAC as compared to TCS and ABC for Throat are 47% and 8% respectively. The percentages of change in profitability by adopting the EBAC as compared to TCS and ABC for Nose are -25% and -10% respectively.

DISCUSSION

In the past researchers have learnt and highlighted some of the weakness of traditional costing system (TCS) and activity based costing. As a result the search for a more accurate methodology for absorbing cost has ensued ever since. However the domain of absorption costing has not evolved much since ABC and only two methodologies have been put forward thus far. The first methodology has been termed 'transaction costing' (TC) (Cooper and Kaplan, 1988).¹ Transaction costing proponents saw the weakness of the traditional costing system that assigns costs to products using a single volume-related base in distorting costs. TC reasoned that a different type of allocation base should be used for overhead costs that vary with the number of transactions performed, as opposed to volume of product produced. In the traditional costing system, the costing element is the product or service or it is the product or service that gets costed while in TC the costing element is any element that affects transaction. One the other hand the weakness of ABC is using a single blanket standard absorption rate for each cost pool was not highlighted by TC. However TC never gained the momentum ABC enjoyed both in practice (and teaching). In TC system, costs are assigned to the units that caused the transaction to be originated. An example of a transaction is set up and its costing element will be production lot because each production lot requires a single set up. In a TC system, the unit cost of a product is determined by dividing the cost of transaction (production lot cost) by the units in the production lot. However TC has a number of weaknesses. For example any firms' set up cost would be made up of staff costs, maintenance costs, lubricants costs and etc. Difficulty lies in deciding, for example how to split the set up unit or department staff costs to the various production lots carried out in a period. Although it is possible to track the hours spend by the set up staff for each production lot, such measures would not be feasible in practice due to the high level of resources required to gather, store and make available staff hour data for calculation of costs. As a result some sort of arbitrary allocation technique is still needed to determine each production lots' cost. In this regard, the better way to arbitrarily allocate overhead costs is to allocate it to its final destination i.e. its product or service as directing overhead to other destinations like transactions could only further distort costs. The next weakness of TC lies in its inability to cope with the cost data generating demands of businesses with highly heterogeneous products, services or customers, (Barret 2008). Certain type of business like retail banking, parcel delivery and custom-made-manufacturing produce or offer highly heterogeneous product and service that needs cost

¹ The concept of Transaction Costing and its methodology is explained in detail by Cooper and Kaplan (1988) in their article titled "How cost accounting distorts product costs".

data to be generated at granular level of detail in order to use the TC. However the ability, resource and time needed to produce thousands of individual cost data for each parcel delivery or each customer order is so laborious in that many organizations shy away from adopting TC.

The second methodology for absorption costing comes from Kaplan and Anderson (2005).² The traditional ABC seemed to have come under fire from its earliest and most active proponents (Tony 2008). The traditional ABC will hereafter be referred to as simply ABC for clarity purposes. The new or modified methodology was termed the Time-Driven Activity Base Costing (TDABC). However seasoned practitioners in the cost management field recognized that this “new” methodology was anything but new. The application of TDABC is said to require only two parameters, which is the unit cost of supplying capacity and the time required to perform a transaction or an activity. TDABC is also said to be a pull-based system, simpler, less costly and faster to implement. The literature on absorption costing post-ABC identifies two types of cost drivers, which are the transactional cost drivers and duration cost drivers (Cooper 1988). The transactional cost drivers count the number of times an activity is performed and examples include number of set ups, number of production runs, number of shipments, number of purchase orders and number of customer orders. The duration cost drivers estimate the time required in performing each activity and examples include set up hours, material handling time, direct labor hours and machine hours. The duration cost drivers are generally more accurate but also more expensive to measure (Kaplan and Anderson 2005). Most ABC systems have been found to use a large number of transactional cost drivers although some have incorporated the use of duration cost drivers. Both types of drivers could be easily used for ABC and EBAC cost calculations without any additional arithmetic techniques done as shown by the analysis of the three scenarios earlier in this paper. TDABC uses the practical capacity of the resources supplied to calculate its absorption rate and primarily uses the duration cost drivers for its analysis. The absorption rate in TDABC is obtained first by dividing the cost of capacity supplied with the practical capacity of resources supplied to obtain the cost per minute and next multiplying the cost per minute with the number of activity. For example a customer service department which is a supplying capacity incurs \$ 630,000 and requires 30 customer services employees with each employee supplying 30,000 minutes per quarter. The practical capacity is assumed to be at 80% or 24,000 minutes per employee and in total 720,000 minutes per quarter. Using TDABC, the cost per minute would therefore be \$ 0.875- (\$630,000/\$720,000). Assuming the customer service department services are divided into three customer-related activities i.e. handling customer orders, process customer complaints and perform credit checks. The ‘handling customer orders’ estimated capacity is 40 minutes and therefore the cost absorbed would be \$ 35 – (\$0.875 X 40). TDABC uses the estimated capacity to absorb costs (e.g. 40 minutes for handling customer orders) and not the practical capacity unlike ABC and EBAC and would therefore reveal the portion of unused capacity of the practical capacity. The unused capacity information is said to be used in TDABC to obtain information about the cost and the underlying ‘efficiency’ of each activity as well as the quantity or hours and cost of the unused capacity in the resources supplied to perform the activity. However TDABC would still need to carry out a second round allocation of the total cost assigned to each activity to individual product for certain decision making situation like pricing. In this regard, TDABC has the same weakness of Transaction Costing (TC) where overhead cost is not initially directed straight towards products or services but to transactions and activities before being redirected to products and services. EBAC eliminates this phenomenon by straight away directing overhead costs to products and services. Additionally TDABC does not link to the cost of unused capacity to the ultimate output of firms i.e. product and services. It would not also be clear as to which product or service should benefit when an improvement in unused capacity is achieved because different product and services have different efficiency level in utilizing or using the overheads as pointed out by EBAC. In EBAC the responsibility of the overhead utilization efficiency partly lies with the managers of each product or division. It is recognized that the efficiency of product or services in utilizing overheads is in part also contributed by the overhead department or units’ productivity. TDABC tries to unearth the productivity or ‘efficiency’ level of the overhead departments by highlighting the unused capacity. However TDABC does not clearly link unused capacity to products and services but reveals it in total for the firm. The TDABC information on unused capacity would therefore be unable to assist management in crucial decisions scenarios like make or buy, to accept or reject a special order, to continue or shut down a cost/revenue centre, how much to price products and services. EBAC on the other hand which is more similar in methodology to ABC as

² The concept of Time Driven ABC (TDABC) by Kaplan and Anderson (2005) in their article titled “Rethinking Activity Based Costing” gives an overview of TDABC and provides few scenarios with numerical illustration. Readers could refer this article to obtain a full picture on TDABC’s methodologies and to better apprehend the example discussed above in this paper above.

compared to TDABC provides the information needed for the decision making scenarios highlighted above. Next the proponents of TDABC claim that it is easier and faster to estimate than ABC. TDABC is said to eliminate the need to interview, observe and record estimate the amount of time spent on each activities because in TDABC managers will estimate the units of time required to perform an activity. This change of method to obtain information on the time spend on each activity is not necessarily better. This is because the estimate given by the managers might not be accurate and allow them to introduce budget slack in the estimation process. In contrast, the collection of activity information in EBAC and ABC is a more wide-ranging technique and could prevent bias and error in information collected. Furthermore TDABC is found to only suit certain firms and is not a one-size-fits-all methodology unlike EBAC or ABC. ABC is proven to be successfully implemented in a variety of industries. EBAC is envisaged to applicable to all industries as it is modeled more closely with ABC and as shown by the analysis of the three scenarios above. In practice, like TC, TDABC also never gained the momentum and popularity ABC enjoyed.

The positive side of TDABC is it could be useful for budget-variance analysis as managers can compare the planned capacity versus the estimated capacity and thereby take corrective actions. Both TDABC and EBAC have different methodologies to arrive at their calculation from different directions to account for the same overheads. TDABC could therefore be applied alongside EBAC for firms who could afford having two systems as the unused capacity information could be useful in assessing the performance of each overhead department in totality.

EBAC is a methodology that is both easy and convenient to apply. Firms currently using ABC could instantly explore the more accurate EBAC as no new data collection effort is required. EBAC utilizes all the existing information like cost drivers and cost pools that ABC system provides without the need for any extra information. More firms currently using TCS is anticipated to adopt the more accurate and efficient based EBAC as results of empirical studies reveal an increasing trend among firms adopting better and accurate costing methodologies.

CONCLUSION

An attempt has been made in this paper to present an improved, efficiency based absorption costing methodology coined the efficiency based absorption costing (EBAC). EBAC represent an algorithm that absorbs costs based on efficiency as the main driver and we compare its results with other methods such as ABC as proof-of-concept. This research is timely due to the current global financial crisis which exerts heightened demands on firms to ensure survival. Possession of accurate and efficient information is vital for firms to make the best business decisions. A shift in mindset and methodology is therefore crucial because we really have to rethink as to how costs are inefficiently absorbed leading to inaccurate cost planning and decision making. The potential benefits that EBAC offers management accounting practices and businesses in general are really enormous. As indicated by the analysis given above, using the more accurate and efficient EBAC results in significant cost changes as compared to ABC or TCS. Businesses could embrace the more efficient EBAC for a host of their pertinent cost control and decision making needs like to make or buy, to accept or reject a special order, to continue or shut down a cost/revenue centre, how much to price products and services and how much resources to allocate to different products and establish output volume levels. The full products costing approach like EBAC are the main determinant of product prices (Drury et al. 1993; Friedman and Lyne 1995). The process of performance measurement and appraisals of managers of cost/profit/investment centers and business units will also result in improved accuracy and fairness under EBAC. Our approach in introducing improved methodologies to enhance results would be greatly appealing to management accountants, project management executives, cost planners, manufacturers and etc. as they become more competent in cost analysis and make better and more accurate decisions.

While previous studies have found ABC appear to a have a great deal to offer to TQM organizations (Steve and Ken 1994), the potential benefits of EBAC to these organizations should be even greater. The advent of the modern business environment has seen the emergence and adoption of contemporary management philosophies by businesses. These larger- than-life philosophies include Total Quality Management (TQM), Just-in-Time (JIT) and Lean manufacturing. In Lean manufacturing for example, the second out of its five fundamental principles outlines the need to 'identify the value stream for products and services' (Womack and Jones 1996). The EBAC methodology proposed above have been more accurate in calculating the value stream of products and services.

Hence the applications of the more efficient based EBAC on modern business environments is potentially enormous and in need to be empirically tested. The proposed EBAC model is currently being tested empirically in business environments covering TQM, JIT and Lean based and traditional ones. Participating businesses comprise a good mix of different industry sectors and are made up of international and local businesses. The results of the empirical study currently on-going will be reported in the near future. It is also hoped that more research initiatives on EBAC would be carried out by future researchers.

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