Activity-Based Management for E-Commerce

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Abstract

This paper explores the application of Activity-Based Costing and Activity-Based Management in e-commerce. A case study of a fictitious Business-to-Customer (B2C) company is used to illustrate the implementation and effects of an Activity-Based Costing analysis. The analysis is performed by using matrixes in order to trace overhead. The Activity-Based Costing analysis is then used to demonstrate operational and strategic Activity-Based Management in e-commerce.

Keywords: Activity-Based Costing, Activity-Based Management, Costing System, E-Commerce

1. Introduction

The period of initial over-optimism about investing in Internet start-ups has given way to widespread pessimism about the future of technology-related stocks. Between January of 2000 and August of 2001, nearly 600 "dot-coms" have ceased their operations and disappeared from the marketplace [1]. As a result, many investors have lost both their money and their faith in the "New Economy."

Despite this recent slump, most experts still expect the initial growth to continue. Therefore, there are investors yet willing to support Internet start-ups. Today's venture capitalists are, however, much more "choosy" than before [11]. A brilliant idea for a product or service alone is not enough to attract the necessary funding. Now, potential investors must be convinced that their initial investment will pay off in the near future. They expect their investments to be backed by a high standard of management, a sound business model, and the existence of an efficient costing system.

One system which has already proven successful in keeping costs under control for traditional companies, and is currently being investigated for its possible benefits to the e-businesses, is Activity-Based Costing (ABC)[12]. In the late 1980's, ABC was implemented mainly in large manufacturing companies as a replacement for their older, inefficient, and unreliable volume-based costing systems [4,9,13]. During this period, many managers recognized that the inappropriate allocation of overhead previously regarded as not posing a significant problem, had, in fact, become detrimental to decision-making. Not knowing actual product costs had forced decision-makers to guess at the true costs; oftentimes, they had to focus their attention and resources on product lines, markets, or customers which were, in reality, unprofitable. Profitability was often an illusion produced by flaws in their traditional costing systems. In addition, traditional costing systems often hid the true causes of expenses, making cost reduction efforts a "trial-and-error" procedure or a matter of luck and intuition. Overall, outdated volume-based costing systems were regarded as the main cause of poor decision-making.

ABC is more reliable than the traditional costing systems in determining the true cost of objects, such as products, processes, services, or customers [2,3,4,5,6]. ABC outperforms the traditional volume-based costing systems because it uses activities as a medium to trace costs rather than arbitrarily allocating them.

Using the reliable financial information provided by ABC, companies are able to reduce costs, establish new pricing policies, identify opportunities for improvement, and determine a more profitable product mix, all without "guesswork" [7]. In addition, the output of the ABC analysis is the foundation for Activity-Based Management (ABM). ABM is defined as a set of actions that help to increase overall efficiency, lower costs, improve asset utilization, and contribute to the revision of corporate strategy by correctly interpreting information gained from the ABC analysis [8].

In their experience of high overhead (marketing expenses, administrative salaries, rent, and technology related costs, for example), many e-businesses show an astonishing similarity to the "brick-and-mortar" manufacturing companies of the late 1980's. Therefore, it could be expected that ABC/ABM would be an excellent managerial tool for firms who are heavily involved in e-commerce and experiencing problems with costing inefficiency.

Although the ABC/ABM methodology appears to be an excellent managerial tool for e-commerce, this subject has not been featured prominently in the work of academic researchers. For that reason, this paper takes up on this topic and examines the application of ABC/ABM to e-commerce. The major contribution of this paper is to expand on earlier research which only examined ABC in e-commerce [12]. In contrast, this paper extends this investigation to ABM methodology. By providing a step-by-step ABC/ABM implementation procedure, this paper also aims to help managers in companies engaged in e-commerce to gain an understanding of the importance of a professional costing system.

2. Methodology

The particular ABC/ABM implementation methodology discussed below makes use of matrixes (or tables) to trace overhead. This methodology was originally developed for small manufacturing companies and then adapted to e-businesses [12,13]. The implementation procedure is performed in six major steps, which are discussed in the following section.

Step 1: Establish Objective and Requirements of the Costing System

Before the actual ABC/ABM implementation, a company's management must specify major objectives for using the costing system. For example, common objectives of a costing system are measuring profitability and controlling costs. No matter what the primary objectives, the underlying goal of ABC is to target overhead costs. Examples of overhead include administrative salaries, hardware and software maintenance, and employee training. Depending upon the objectives, management must also choose upon the level of accuracy for their costing system. A highly accurate costing system may require a more advanced computer and network infrastructure, which will result in higher cost.

During step 1, management must also decide about which cost objects will be examined in the analysis. For example, a company interested in assessing the profitability of their customers may choose customers as cost objects. Meanwhile, a company primarily interested in controlling costs associated with distribution may decide to use products or product lines as cost objects. The objective and requirements of the ABC system should be consistent with the overall business strategy of a given company.

Step 2: Identify Business Activities

Subsequently, the activities (which cause overhead-related expenses) must be identified and described preferably by "active" phrases [10]. Examples of activities include maintaining Web sites, processing customer orders, handling inventory, and shipping products. In addition, a company may categorize their activities as either direct-value adding activities or supporting activities. Direct value-adding activities are linked directly to the creation of products, the completion of jobs, or other activities serving customers. Activities that support those direct value-adding activities are defined as supporting activities, such as performing human resource duties. This initial categorization of activities will help to prioritize managerial attention when performing ABM later on.

Step 3: Trace Overhead to Activities by Using the Expense-Activity-Dependence (EAD) Matrix
During this step, overhead is traced from expenses to activities. The Expense-Activity-Dependence (EAD) matrix helps to relate activities to expenses and determine their overhead consumption [12,13].

Step 4: Trace Overhead to Cost Objects by Using the Activity-Product-Dependence (APD) Matrix
Next, overhead is traced from activities to cost objects. The Activity-Product-Dependence (APD) matrix is used in order to appropriately assign activities to cost objects [12,13]. The APD matrix is also used to trace the overhead consumption of particular cost objects.

Step 5: Calculate Product Cost of Each Cost Object
An estimate of the costs occurring when generating a cost object, also called product cost, is calculated by adding the direct cost and overhead together.

Step 6: Use of the ABC Analysis for Operational and Strategic Decision-Making
Once the ABC analysis is performed (Steps 2-5), the information gained can be used to perform ABM. As part of ABM, managers would need to properly interpret the results the ABC analysis and then take actions with the objective of improving operational and strategic performance.

3. Applications Example

HighQualityTools.com (HQT, a fictitious company, but an accurate financial and organizational representation of many dot-com's) is a "typical" Business-to-Customer (B2C) company that sells a wide variety of tools and work-related apparel. The main customers are do-it-yourselfers, craftsmen, and industrial workers. HQT started its operations a few years ago with practically no customers. In order to establish a critical customer base, HQT performed aggressive marketing campaigns combined with substantial incentives for the first-time buyers. These incentives often included substantial price reductions and free shipping. Since the initial sales are not profitable, HQT hopes that most of the first-time buyers will become loyal customers and will eventually contribute to their profits.

There are two main objectives in using the ABC analysis for HQT. The first is to validate the assumption that their loyal customers are profitable. The second objective of the ABC analysis is to determine which product lines are profitable, and which are not.

To perform the first part of the analysis, all existing customers are classified according to the length of their patronization with HQT. Customers who placed an initial order (with no subsequent order in the given time period) are put into the category "New," while returning customers are classified according to the length of their patronization as "Short," "Mid," or "Long-term." The information pertaining to the customers, as cost objects, is summarized in Table 1.

Table 1. Customer Classification According to Length of Patronization

Customers	**Length of Patronization**
New	Initial Order
Short-term	Less than 1 year
Mid-term	1 year to 2 years
Long-term	More than 2 years

The actual ABC analysis started with examining financial reports for overhead expenses. Table 2 lists HQT's main overhead expenses.

Table 2. Overhead Expense Categories

Expense Category	Cost
General and Administrative	$200,000.00
Rent and Utilities	$80,000.00
Office Expenses	$30,000.00
Technology	$150,000.00
Depreciation	$40,000.00
Sales and Marketing	$180,000.00
Miscellaneous	$20,000.00
Total	**$700,000.00**

The "General and Administrative" expenses category contains mainly executive and administrative salaries. The "Technology" expense category covers mainly software and hardware acquisition costs; while "Depreciation" reflects the reduction in the value of computers, equipment and software. Most of these expenses are also expected in a traditional "brick-and-mortar" company. Characteristic of HQT, however, is its relatively high sales and marketing costs. Expenses for hardware and software are also high, which is a characteristic that can be seen in most e-businesses. In order to ensure that HQT's overhead expense categories are representative to a "typical" B2C company, financial statements of publicly traded companies were studied.

In step 2, all tasks consuming overhead resources are grouped into eight major business activities. This relatively low number of activities chosen is a reflection of the modest level of accuracy that is required. This simplification is also intended to focus the reader's attention more on methodology than on accounting details. A company looking for a higher level of accuracy from its costing system would be required to use a higher number of activities. In reality, the average number of activities would range between 20 and 60 for a costing system that is mainly strategic, while a primarily operational costing system would require several hundred activities [8]. Table 3 shows the eight main business activities for HQT.

Table 3. Major Business Activities of HighQualityTools.com

Activity
Market Products
Maintain Web Pages
Manage Customer Orders
Manage Customer Inquiries
Acquire Goods
Receive and Handle Goods
Monitor Quality
Prepare Goods for Shipment

Most of the major business activities could also be found in a traditional "brick-and-mortar" firm. A distinguishing characteristic of an e-business, however, lies in the importance (and, therefore cost) of particular activities such as "Maintain Web Pages" or "Market Products." These two activities are crucial to e-commerce due to the nature of their marketplace.

In step 3, the cost of each activity is determined by using the Expense-Activity-Dependence (EAD) matrix [13]. In the EAD matrix, the columns represent the overhead expense categories and the rows represent the activities. If the given activity contributes to (or is responsible for) a given expense, the percentage of its overall expense (ranging from 0 to 100 and represented by a number between 0 and 1) is placed on the intersection. This number represents the proportion of the expense category consumed by a particular activity. It can be determined from reviewing financial records, or, in the event that the data is not available, by educated guessing or estimation. For example, the activity "Market Products" is responsible for $20,000.00, or 10 percent of the expense category "General and Administrative" costs, which is $200,000.00. Therefore, the figure of 0.1 is placed on the intersection of the expense category "General and Administrative" and the activity "Market Products." After all numbers are placed in the matrix, the cost of each activity is calculated by multiplying the percentage by the total expenses. For example, the total cost for the activity "Monitor Quality" would be $45,000.00 ($0.1 \times 200 + 0.1 \times 80 + 0.1 \times 150 + 0.1 \times 20$). The total activity cost for all activities should be equal to the total expenses for all expense categories. Table 4 presents the EAD matrix for HQT.

Table 4. Expense-Activity-Dependence (EAD) Matrix (in thousands)

Activity	**Expense Category**							**Total Activity Cost**
	General and Administrative	Rent and Utilities	Office Expenses	Technology	Depreciation	Sales and Marketing	Miscellaneous	
Market Products	0.1	0.1	0.4	0.1		0.4	0.1	**129**
Maintain Web Pages	0.1	0.1	0.1	0.3	0.5	0.1	0.1	**116**
Manage Customer Orders	0.2	0.1	0.1	0.1	0.1	0.2	0.2	**110**
Manage Customer Inquiries	0.1	0.1	0.1	0.1	0.1	0.2	0.1	**88**
Acquire Goods	0.2	0.1	0.2	0.1	0.1	0.1	0.2	**95**
Receive and Handle Goods	0.1	0.2	0.1	0.1	0.1		0.1	**60**
Monitor Quality	0.1	0.1		0.1			0.1	**45**
Prepare Goods for Shipment	0.1	0.2		0.1	0.1		0.1	**57**
Total Expenses	**200**	**80**	**30**	**150**	**40**	**180**	**20**	**700**

In step 4, the Activity-Product-Dependence (APD) matrix is used to trace the overhead from activities to cost objects [13]. In the APD matrix, the columns represent the activities, while the rows represent the cost objects. If the given cost object triggers the need to carry out the particular activity, a number between 0 and 1 (representing the percentage) is placed on the intersection. As in the EAD matrix, this number can be determined from reviewing financial records or by estimation. After all numbers are in place, the cost of each cost object is calculated by multiplying the percentage by the total expenses. Table 5 presents the APD matrix for HQT.

Table 5. Activity-Product-Dependence (APD) Matrix (in thousands)

Cost Object (Customers grouped according to length of patronization)	**Activity**								**Total Overhead Cost of each Object Cost**
	Market Products	Maintain Web Pages	Manage Customer Orders	Manage Customer Inquiries	Acquire Goods	Receive and Handle Goods	Monitor Quality	Prepare Goods for Shipment	
New	0.7	0.4	0.4	0.7	0.25	0.25	0.25	0.25	**307**
Short-term	0.1	0.2	0.2	0.1	0.25	0.25	0.25	0.25	**131**
Mid-term	0.1	0.2	0.2	0.1	0.25	0.25	0.25	0.25	**131**
Long-term	0.1	0.2	0.2	0.1	0.25	0.25	0.25	0.25	**131**
Total Expenses	**129**	**116**	**110**	**88**	**95**	**60**	**45**	**57**	**700**

In step 5, the cost of servicing each customer group, is calculated by adding the previously traced overhead costs for each customer group to the direct cost, as summarized in Table 6.

Table 6. Estimated Product Cost for Each Customer Group

Cost Object	Direct Cost	Overhead Cost	Product Cost
New	$187,000.00	$307,000.00	$494,000.00
Short-term	$166,000.00	$131,000.00	$297,000.00
Mid-term	$165,000.00	$131,000.00	$296,000.00
Long-term	$182,000.00	$131,000.00	$313,000.00
Total	**$700,000.00**	**$700,000.00**	**$1,400,000.00**

In order to determine the amount of operating profit (or operating loss) generated from each customer group, product costs are subtracted from revenues as depicted in Table 7.

Table 7. Profitability Analysis for Each Customer Group

Cost Object	Revenues	Product Cost	Operating Profit
New	$290,000.00	$494,000.00	-$204,000.00
Short-term	$300,000.00	$297,000.00	$3,000.00
Mid-term	$260,000.00	$296,000.00	-$36,000.00
Long-term	$250,000.00	$313,000.00	-$63,000.00
Total	**$1,100,000.00**	**$1,400,000.00**	**$-300,000.00**

The category of newly acquired customers shows a high amount of loss. The operating profit for “Short-term” customers is marginally positive, while the more established “Mid-term” and “Long-term” customers once again show losses. The profit from “Short-term” customers, as the managers later discovered, was oftentimes an illusion caused by delays between the purchase and the return of items and the accumulated costs associated with the correction of processing and shipping errors. Initial recorded profit often turned out to be a subsequent recorded loss. The losses from “Mid-term” and “Long-term” customers are also attributed to a high return rate and order processing errors, but there is no illusionary profitability because the duration over which these transactions were monitored was long enough to take returns (losses) into account.

A traditional volume-based approach, on the other hand, would allocate overhead instead of tracing it. Overhead, which comprises $700,000.00 (or 50 percent) of HQT's overall expenses, could then be allocated based on direct costs. In other words, according to the traditional approach on each one dollar of direct cost, one dollar of overhead would be allocated. Based on this kind of allocation, the product cost for "New" customers would be $374,000.00 ($187,000.00 + $187,000.00) instead of $494,000.00 as shown by the ABC analysis. The traditional approach would, therefore, tend to underestimate the total cost related to customer acquisition.

As previously mentioned, the second objective of the ABC analysis is to determine which product lines are profitable and which are not. The cost objects in this part of the analysis are HQT's major product lines instead of customer groups. Therefore, in this part of the analysis, the major product lines are regarded as cost objects. All items offered online are divided into four categories: "Hand Tools," "Power Tools," "Landscaping Tools," and "Work-Related Apparel." Additionally, a fifth category of "Miscellaneous" contains mainly small items such as flashlights, batteries, electrical cords, and electrical testers. The product lines, as cost objects, are presented in Table 8.

Table 8. Product Lines

Product Line
Hand Tools
Power Tools
Landscaping Tools
Work-Related Apparel
Miscellaneous

The ABC analysis procedure for product lines, however, was conducted in the same manner as it was for analyzing customer profitability. Therefore, the following tables present only the final results of the analysis, rather than all the intermediate steps. Table 9 presents the estimated product cost for each product line, while Table 10 presents profitability analysis.

Table 9. Estimated Product Cost for Each Product Line

Cost Object	**Direct Cost**	**Overhead Cost**	**Product Cost**
Hand Tools	$130,000.00	$110,000.00	$240,000.00
Power Tools	$290,000.00	$300,000.00	$590,000.00
Landscaping Tools	$120,000.00	$120,000.00	$240,000.00
Work-Related Apparel	$80,000.00	$80,000.00	$160,000.00
Miscellaneous	$80,000.00	$90,000.00	$170,000.00
Total	**$700,000.00**	**$700,000.00**	**$1,400,000.00**

Table 10. Profitability Analysis for Each Product Line

Cost Object	**Revenues**	**Product Cost**	**Operating Profit**
Hand Tools	$230,000.00	$240,000.00	-$10,000.00
Power Tools	$400,000.00	$590,000.00	-$190,000.00
Landscaping Tools	$180,000.00	$240,000.00	-$60,000.00
Work-Related Apparel	$170,000.00	$160,000.00	$10,000.00
Miscellaneous	$120,000.00	$170,000.00	-$50,000.00
Total	**$1,100,000.00**	**$1,400,000.00**	**-$300,000.00**

As expected, the ABC analysis confirms that some of the product lines are marginally profitable, while most are not. The "Miscellaneous" product line, which contains primarily small and relatively inexpensive items, is losing money. A reason is the fact that the sales cannot compensate for the amount it costs to inventory, stock, pack and list the small items. In addition, the "Power Tools" product line is even less profitable than the "Miscellaneous" product line. This line contains mainly large and expensive items, such as generators, table saws, air compressors, and pressure washers. HQT 's management felt that there were many explanations for the "Power Tools" product line's lack of profitability. Because items such as generators are relatively more expensive, customers were very concerned with comparison-shopping. Often, HQT was forced to lower the price in response to special offers made by their competitors. High storage and shipment preparation costs were cited as a secondary reason for the lack of profitability of this product line. HQT 's management also believed that because they sold less of these items than their larger competitors, they were not able to take part in the principles of "economy of scale" or "bargaining power," which resulted in higher procurement costs.

After recognizing that a more radical change is needed to reach the profitability, HQT's management was influenced to actively engage in ABM as part of a new corporate strategy.

4. Activity-Based Management

ABM is an approach to management which involves implementing a number of actions derived from the output of the ABC analysis [8]. In general, these actions can be divided into two major categories: operational and strategic ABM. Operational ABM seeks to improve what already exists, while strategic ABM implements major changes. Therefore, operational ABM utilizes the ABC analysis in order to perform the existing activities in a more efficient way. In contrast, strategic ABM utilizes the ABC analysis to shift the demand from activities that consume an excessive level of resources to those that consume only a minimal level, which enables the most valued overhead resources to be assigned as efficient as possible.

Both operational and strategic ABM can be applied in the case of HQT. Improvements in order processing and handling of customer complaints are two options for improvement using the operational ABM approach. Numerous mistakes in shipping and the subsequent customer complaints (which are often handled slow and incompetently) are causing substantial costs. The solutions using operational ABM include the implementation of a powerful Customer Relationship Management (CRM) system and comprehensive training methods for both storage workers and customer service representatives. This would limit shipment mistakes and help to solve many problems the first time. An incentive system could be combined with this approach to reward diligent and error-free work.

The strategic ABM approach also offers other possibilities. As previously mentioned, the existing strategy of HQT is based on the assumption that the aggressive acquisition of new customers is their first priority. It was hoped that these new customers would eventually make enough purchases to become profitable, enabling the company to generate attractive returns for investors. The ABC analysis reveals that the current passive strategy of waiting until the unprofitable customers became profitable was not very promising. One of the many strategic options to remedy this was to develop a new, more focused, strategy of customer acquisition. Such a strategy could be devised by extracting useful information from existing sales records. In other words, HQT can use data mining and create a general profile of a "desirable" buyer. This profile could then be used in targeting more specific prospective customers.

The ABC analysis also reveals that some of the product lines are highly unprofitable. For example, the "Power Tools" product line was responsible for more than half of HQT's overall losses. The initial investigation suggests that this product line is not likely to be profitable in the future because of fierce competition and high storage and handling costs. Discontinuing this unprofitable product line would be another example of strategic ABM due to the drastic nature of the change for HQT's product mix. This

strategic approach could be used either to reduce overhead resources or to shift them to new, more profitable product lines.

5. Conclusions

The case of HQT shows that ABC/ABM is not only useful to establish "brick-and-mortar" companies but to emerging e-businesses as well. Moreover, ABC/ABM appears to have the potential to lead e-businesses toward efficient levels of operations and more professional business strategies. The ABC analysis allows managers to reliably measure costs associated with e-commerce, helping them to weigh the costs and benefits and to prioritize their attention. In addition, it provides them with a better understanding of how these costs are generated and subsequently allows them to actively perform ABM.

Overall, it is expected that implementation of ABC/ABM will benefit companies engaged in e-commerce, enabling a better operational performance and improve business strategies. In summary, it could be expected that for the companies engaged in e-commerce, ABC/ABM could be one of the most important managerial tools that will lead them toward the main goals of a for-profit-organization: competitiveness and profitability.

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