Note

A Study of Activity-based Costing System

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(Received 19 December 2014, revised 25 January 2015)

Abstract: Traditional costing had relevance lost. Activity-based costing (ABC) was established around 1990. The first stage of ABC lacked accuracy. Nowadays, ABC has the problem of measurements. This research note creates trace sheet for possible measurement of activity costs. The ABC system with trace sheets enables easy measurement and cost management by activity-based budgeting. This system solves the problem of measurement, and provides cost information, hence contributes to continuous improvement.

Key words: activity-based costing, activity-based management, trace sheet, kaizen, waste non-added value activity

1. Introduction

According to Charles T. Horngren, et al., “Cost accounting provides information for management accounting and financial accounting. Cost accounting measures, analyzes, and reports financial and nonfinancial information relating to the costs of acquiring or using resources in organization [1].” In Japan, there is Schedule of Cost of Goods Manufactured for financial accounting. Standard of Costing was published in 1962 by the Ministry of Finance for management accounting. To be exact, the Standard has provided purposes of financial and management accounting. The present goal is to revise the Standard of Costing. Because of the use of allocation of indirect cost, we cannot evaluate the exact product-cost. Workers at a firm say “we are working very hard, but the costs never go down.” This Costing is called conventional or traditional costing.

Activity-based costing was first explained by R. S. Kaplan and Cooper. Afterwards, Peter B. B. Turney wrote “Activity-based costing: the performance breakthrough,” in 1996. A cost driver and a cost pool make a cost driver rate. Exactly, many activities performances are evaluated the by the cost driver rate. He said “Resources are economic element directed toward the performance of activities. They are the sources of cost. … Resources flow to activities, which are processes or procedures that cause work [2].” There are some problems between the resources and activities.

The work usually generates some value, but sometimes it does not generate any value at all. For example, while a machine dose not generate any value, it consumes its cost. Resources must be measured by value chain of performance. There are many wastes in manufacturing processes. This problem is described in chapter 2, Structure of Activity-based Costing.

After we recognized the non-added value, we considered internal transactions. Internal transactions are based on organization of bookkeeping accounts. We must design system to calculate activity-based costing by computers, because of huge numbers of transactions. So the author
designed an activity-based costing system, and programmed the algorisms of Activity-based costing. These methods are explained in section 3, Design for ABC System.

Finding out the purpose of activity-based costing is for activity-based management (ABM). To achieve its purpose, we need accurate measurement of activities. Some scholars analyze the non-added value of activities. For example, J. A. Brimson analyzed actual capacity cost into theoretical capacity cost and unused capacity cost [3]. The unused cost is non-added value which does not generate any value, so called waste. This note uses a different method from an analysis, measures non-added value itself by using bookkeeping system. Routine works of activity-based management are activity-based budgeting (ABB) explained in section 3–4. This system provides flexible budget information, and evaluates activities’ costs, so we could manage cost controls.

Japanese manufacture, Toyota, has managed to eliminate non-added value through its production processes. This management is called Seven Types of Waste. Some aspects of TPS’ management (Toyota Production System) and valuation of activity-based cost bring us efficiency of works and effectiveness of organization. Combination of cost information and treatments of non-added value activity would bring our organization innovational management.

2. Structure of Activity-based Costing

Basic structure of activity-based costing (ABC) is stated by Peter B.B. Turny as Exhibit 1. ABC has two views, cost assignment view and process view. Turny says on cost assignment view, “It reflects an organization’s need to assign costs to activities and cost objects (including customers as well as products and services) in order to analyze critical decisions. These decisions include pric-
ing external and internal products and services, product mix, sourcing, product design decision, and setting priorities for improvement efforts. [4]’’ What are resources? Many resources are evaluated by accounts of Schedule of Cost of Goods Manufactured. The accounts are material, wage, depreciation of machines and expense of electric, etc. These figures of accounts are not assigned to activities, but are traced to those. Essence of costing is to match value consumed with value created. He settled resource drivers for resources and activity drivers for activities because of difference between resources and activities. If a machine did not operate in a firm, the depreciation accrued, but no value was served. We must trace this type of internal transactions to non-added value account of ledger. The other resources are assigned to activities. If a worker operated two activities, 20 days of processing and 5 days of inspecting in a month, and if the wage of the worker is $250 per month, the working resource assigns processing activity $200 and inspecting activity $50.

Structure of activity-based costing was illustrated by Peter B.B. Turny as Exhibit 1. Resources to products are assigned by resource drivers. For example, rent for a building is assigned by the area of each activities. Correctly saying, resources should be traced by value consumed.

Key point of process view has a unit of measurement, so called cost driver. Turny explains ‘’cost drivers are factors that determine the workload and effort required to perform an activity. They include factors relating to the performance of prior activities in the chain as well as factors internal to the activity. [5]’’ Another essence of costing is calculation by a unit. If we cannot find any product unit, we cannot calculate unit costing. ABC center requires cost pool and cost driver. There are process activities and cost object and more over support activities in an ABC center. The support activities (secondary process) are under level of the process activities. We can trace transfers of value chain using cost driver rate. For example, maintenance activity in a support process costed $10,000 and worked 200 hours in a month. And processing activity accepted 150 hours of maintenance and assembly activity accepted 50 hours of maintenance. Then the cost driver rate was $50 per hour, therefore processing activity added up to $7,500 and assembly activity added up to $2,500. Both activities were traced from the other resources. An activity cost of activities in process view is traced by driver rate to cost objects. Non-added value has two meanings. One is wastes in production processes. The other is what a customer does not recognize a part of value attached by manufacture.

Many scholars recognize that activities involve non-added value. To gain a correct valuation of an activity, we must trace internal transactions through the value chain in Exhibit 2. Economic resources are not cost, but expense, because cost is to consume some value and because expense has cash payment. ABC center in Exhibit 2 contains activity-based costing with supply and consume of value. It is important that there is much non-added value at each hierarchy. We do not trace non-added value to activities, we must settle non-added value accounts to pool cost.

In the level of resources, depreciation of not movable machines is posted to non-added value account in ABC center. In the level of support activity, for example, the cost which computer support activity is stopped is posted to the non-added value account. In the level of process activity, if an assembly line worked half of a month and stopped half of a month, the half of cost of the assembly activity is posted to the non-added value account. In the level of cost object, if a product as a cost object does not sell out, the cost object is to value waste. Waste is defined that a valued item is consumed, but does not supply the other useful item. Waste would be recognized, measured and
3 Design for ABC system

3-1 Requirements for ABC system

The problem of traditional costing is pointed that allocations of overhead cost have some defects. Allocations of overhead are not correct because of calculation of allocations. Therefore, valuation of products brings decision makers miss reading. Activity with cost driver and cost pool is required.

Theory of ABC with cost driver increases the accuracy of costing, but there is the problem of measuring. The essence of costing is value accounting. Transactions of value change must be recorded and traced. System of account with non-added value account must exist. This bookkeeping system enables us to trace transactions of value change.

R. S. Kaplan, S. S. Anderson indicate “The system attempted to measure product cost and customer profitability each month, certainly desirable goals for stimulating process improvement, product pricing, and customer relationship action. But the process required seven hundred employees at more than 100 facilities to submit monthly surveys of the time. The company employed 14 full-time people just to collect and process the data and prepare management reports, which took more than thirty day to prepare [6].” ABC system provides information of an activity which

reduced in all of organization.
must be improved, accurate product cost and gross margin of cost object. ABC system has benefits, but no cost benefit. A requirement of ABC system is development of effective computer system.

Pierre Mevellec indicates the autoclosure in Exhibit 3. And he states ‘‘This autoclosure of the costing system provides an illusory comfort, but it is appreciated by the users who are seldom aware of the conditions which have led to the attainment of this comfort.’’[7]’’ Turnny illustrated resource drivers and activity drivers in Exhibit 1. There are huge internal transactions in the two drivers. The ABC cross of Turny is theoretical work, but problems of measurement remain. This Mevellec’s method is one step of a breakthrough of the measurement problem. There are two sectors in the autoclosuer, cost drivers on the left side sheet and resources sector on the right sheet in Exhibit 3. The lines of the sheet mean cost drivers inputted to cost drivers. The column of the sheet means activities outputted. For example, if a worker (n1) repaired machines of machine activity (O1) for 10 hours and assemble activity (O2) for 12 hours, the cell number ‘a1’ on the sheet is 10 and ‘a2’ is 12. Resources sector has many costs of manufacture charges. The autoclosure indicates only relationship between cost driver and cost pool. One of the requirements for ABC system is treated in one sheet about cost pool and cost driver. To measure costs of activities easily, statements of accounting are outputted by programmed commands. The word ‘closure’ of the autoclosure means procedures of month ends, because cost of a depreciation of fixed assets per month, which is closing data of transaction, is calculated to one year depreciation divided 12. The measurement of ABC requires the journal and the ledger of bookkeeping, because ABC belongs to accounting. The measurement of ABC requires development of ABC system by computer. ABC system not always requires Activity-based budgeting (ABB). Account system of ABC is treated easily for ABB. Information of ABB is available to cost management.

3-2 Accounts System of ABC

C. T. Horngren, et al. state ‘‘One of the best tools for refining a cost system is activity-based
Activity-based costing (ABC) refines a costing system by identifying individual activities as the fundamental cost objects. An activity is an event, task, or unit of work with a specified purpose — for example, designing products, setting up machines, operating machines, and distributing products. More informally, activities are verbs; they are things that a firm does. To help make strategic decisions, ABC systems identify activities in all functions of the value chain, calculate costs of individual activities, and assign costs to cost objects such as products and services on the basis of the mix of activities needed to produce each product or service.[8] The destination of ABC system calculates a cost of a cost object. A cost object is mixed with several activities, and an activity is combined with expenses of resources. Accounts system of a manufacture in Exhibit 4 shows relationships of cost objects and activities and resources by accounts of bookkeeping.

Many events become entry data to the journal. Depreciation expenses of fixed assets used at a factory are entry data too. Non-added value accounts are important to measure the flows of value chain. If an account in resources isn’t used to production, the unused cost traces to non-added value account. An activity cost pool by this trace does not contain unused costs, so we can compare the cost driver rate with former rate. Transactions among cost objects and customers are not categories of ABC, but gross incomes are calculated from revenues from customers matched with the cost objects.

**3-3 Computerized ABC System**

How is the problem of huge transactions tracing at internal value chain handled. Computer must be used, and moreover an algorithm of transaction problem must be solved. This writer has created ‘trace sheet’ which generates the transactions of internal value change automaticity. See Exhibit 5 Trace Sheet of ABC. The trace sheet has 3 segments which are economic resources, support activities and process activities from left side. Items of driver in resource segment and volume numbers of support activities and process activities are important especially. These items are used to create the journal. If the command button on the sheet is cricked, items needed to journalize are created automatically by programmed procedure. Exhibit 6 indicates the journal of transaction among resources and activities. The characteristic of the ABC system is to hold volume figure of cost driver in each record, so driver-rate of an activity in schedule is computed automatically. See the column of volume in Exhibit 6. In spite of the fudge internal transactions, the trace sheet ena-
bles us to handle the internal transactions, and generates automatically data of the journal in Exhibit 6. Calculation of costing is done at the end of every month. To ABC, only variable volumes and amounts are updated in the trace sheet at the end of month. Data for closing entries is necessary to accurate activity cost. Therefore, this ABC system will not use to control the daily operation. This ABC system would be able to monthly cost management, and find errors and wastes of works heuristically.

Measuring all of internal transactions on ABC, including non added value activities gives us new knowledge. Activities are evaluated the cost driver late which divided cost pool with cost driver. These activities are comparable to last month’s activities. Former ABC including non added value items cannot compare last month’s activities immediately. There were precedence researches to eliminate non added value from computed activity cost.

“Activity cost pool is the total cost associated with an activity. [9]” Each cost pool is showed by each account of the ledger. The Ledger from the Journal in Exhibit 7 shows the activity cost pool of system activity. Activity of computer system is combined with several economic resources. Lack of any element of resources will not work. The combined Activity is traced to next process activities, occasionally is traced to non-added value activity. Debit amount of system activity is equal to its credit amount at the end of the month. Each activity of the process activity is traced to cost objects through the second trace sheet.

See Schedule of Accounts in Exhibit 8. Each debt of account is added by expended resources or activity. Each credit of account is traced to activities, cost objects or non added value activity.
A Study of Activity-based Costing System

Exhibit 7 the Ledger from the Journal

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>CD</th>
<th>Driver</th>
<th>Unit</th>
<th>Account</th>
<th>Rec-No</th>
<th>Dr.</th>
<th>Cr.</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 A</td>
<td>Restate</td>
<td>27</td>
<td>Mt*2</td>
<td></td>
<td>805</td>
<td>Rent</td>
<td>Exp</td>
<td>13</td>
<td>18,518</td>
</tr>
<tr>
<td>30 B</td>
<td>Marchant</td>
<td>10</td>
<td>Yen</td>
<td></td>
<td>812</td>
<td>Sup</td>
<td>Exp</td>
<td>19</td>
<td>40,000</td>
</tr>
<tr>
<td>30 M</td>
<td>Depre</td>
<td>10</td>
<td>Yen</td>
<td></td>
<td>823</td>
<td>Machin</td>
<td>Depre</td>
<td>22</td>
<td>200,000</td>
</tr>
<tr>
<td>30 M</td>
<td>Lease</td>
<td>10</td>
<td>Yen</td>
<td></td>
<td>824</td>
<td>SoftWear</td>
<td>Depe</td>
<td>24</td>
<td>400,000</td>
</tr>
</tbody>
</table>

Exhibit 8 Schedule of Accounts(1), at the End of a Month

<table>
<thead>
<tr>
<th>CD</th>
<th>Account</th>
<th>CD</th>
<th>Driver</th>
<th>Dr.</th>
<th>Cr.</th>
<th>Cost</th>
<th>Volume</th>
<th>D-rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>30010</td>
<td>Maintenance</td>
<td>254,219</td>
<td>254,219</td>
<td>254,219</td>
<td>1</td>
<td>254,219</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30030</td>
<td>System</td>
<td>658,518</td>
<td>658,518</td>
<td>658,518</td>
<td>72</td>
<td>9,146</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30040</td>
<td>Control</td>
<td>199,034</td>
<td>199,034</td>
<td>199,034</td>
<td>2,500</td>
<td>79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30999</td>
<td>NonAdded</td>
<td>20,000</td>
<td>20,000</td>
<td>20,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61010</td>
<td>Conversion</td>
<td>891,139</td>
<td>891,139</td>
<td>891,139</td>
<td>2,000</td>
<td>445</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62010</td>
<td>Assemble</td>
<td>80,227</td>
<td>80,227</td>
<td>80,227</td>
<td>2,000</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63010</td>
<td>Check</td>
<td>130,164</td>
<td>130,164</td>
<td>130,164</td>
<td>79</td>
<td>1,647</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64010</td>
<td>Delivery</td>
<td>396,430</td>
<td>396,430</td>
<td>396,430</td>
<td>933</td>
<td>424</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69999</td>
<td>NonAdded</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each amount of cost pool is equal to debt amount of its account at post closing. At each line of activity accounts, cost and volume of the activity is indicated, and the cost driver-rate is computed. In this system, these figures are calculated automatically because data of driver exist in the journal. So each activity driver rate is computed by the system. These driver rates are comparative to former same activity rates, because non-added value activities are excluded. Tow accounts of non-added value excluded from the transaction are in Schedule of Accounts in Exhibit 8. To measure non-added value at each level of ABC flow is available to discover evidences of wastes. The account of non-added value shows waste at each level of non-added value activity.

Cost objects have the sum of the debt balance, as shown in Exhibit 9. Calculating cost object is the last step of ABC flow. Terny settles activity drivers between activity and cost object as shown in Exhibit 1. The second trace sheet is used between activity and cost object. Cost objects are evaluated by product cost and product volume, and are computed to unit price of cost object by the two elements as shown in Exhibit 9.

ABC is using tracing instead of allocation of overhead, and is eliminating non-added value. Therefore, the decision of sales price depend on a cost object, and the sales price supplied to a customer minus cost of the cost object indicates a useful profit to decision making.

3-4 Activity-based Budgeting

Horngren points out “Three Feature of cost accounting and cost management across a wide range of applications are as follows:

1. Calculating the cost of products, services, and other cost objects
2. Obtaining information for planning and control and performance evaluation
3. Analyzing the relevant information for making decisions [10]”

Traditional costing and the first stage ABC have relevance lost. Calculated costs must be available to make decisions. Costs eliminating non-added values are available to performance evaluation. Plan and control is known as activity-based budgeting (ABB). ABB is not static budget, but flexible budget. At first, flexible budget of ABB is settled variable cost and fixed cost to each activity, which is indicated in Exhibit 10.

“Relevance Lost: The rise and Fall of Management Accounting” written by H. T. Johnson, R. S. Kaplan pointed out relevance lost of traditional costing. The defect of the costing was allocation of over head costs. Moreover, increase of over head costs causes a doubtful cost of goods manufactured. The relevance costs depend on internal transactions that are traced on the value chain. The cost which does not generate a value is traced to non-added value account. The cost which does not include non-added value has comparability, so the cost driver rate of an activity in full operation and the cost driver rate of the activity in low operation are almost same figure. Every cost of driver is the mixed cost which has the fixed cost and the variable cost. The variable cost and the fixed cost of ABB are calculated from 6 or 12 month’s costs and volumes of an activity by least squares method. After each activity cost is computed from journal data, ABB of flexible budget is calculated by the volume times the variable cost and the fixed cost, as shown in Exhibit 10. ABB by the ABC system evaluates each activity visibly. The activities with triangle in Exhibit 11 will be improved. Horngren notes “Kaizen budgeting explicit incorporates continuous improvement anticipated during the budget period into the budget numbers. Many companies that have cost reduction as a strategic focus, including General Electric in the United States and Citizens Watch and Toyota in Japan, use kaizen budgeting to continuously reduce costs.[11]” Kaizen is working with original idea and design of a human being. His or their works would be evaluated by ABB.

Non-added value activity is recognized theoretically and evaluated by the ABC system. Toyota eliminates non-added value activity which is called Seven Types of Waste. These are waste of over-production, waste of waiting (time on hand), waste in transportation, waste of processing, waste of inventory, waste of motion, and waste of making defects.

Waste of over-production increases cost of inventory controls. If the over-products are not sold, all of the cost is non-added value. Waste of waiting increase cost of labor, and cost driver rate is down, because the cost does not create value. Waste in transportation increases the delivery cost, because the materials are sent back, are readjusted to the shelf, and are delivered again. Waste of processing increases cost of resources and the other supported activities. Maintenance activities,
which replace and repair the parts of machine, are needed to keep the normal driver rate of the processing activity. Waste of inventory increases storage cost and keeper cost. Almost all manufactures need inventory of materials and parts and so on. Toyota production system (TPS) eliminates unnecessary inventory. Waste of motion, which is similar to waste in transportation, is the cost of non-added value. One result of waste of motion is layout of workshop. Waste of making defects increases the cost of inspection activity. If the product is defected, its combined costs become waste. The key point to kaizen is quality control. TPS inspects several steps of assembling. Eliminating waste has cost reduction effect, it is important to recognize non-added value of costing.

4. Conclusions

Input data into the ABC system is on two trace sheets. The first sheet is used to enter resource drivers mainly. The second sheet is used to enter activity drivers. Output from the ABC system is the journal, the ledger and the schedule. Usually, the journal is entered for accounting events by hand. One of the columns in the journal is cost driver figure. Therefore, data of cost pool and data of cost driver rate are computed automatically by this system. The problem of measurement with ABC is solved.

Cost information is available for managers for cost management. Especially non-added value activity cost allows elimination of wastes. Eliminating waste reduces cost and gains operating revenue and therefore contributes to cash gain. Evaluating an activity by ABB promotes continuous improvement and contributes to smooth operations of a firm. It is important that many works and the actual correct cost information are linked. If there is a variance of budget, kaizen is desired. Effective usage of the ABC system would bring our company excellent one.
Exhibit 12  ABC System

Reference


