

## Activity based costing model for inventory valuation

Vineet Chouhan<sup>a\*</sup>, G. Soral<sup>b</sup> and Bibhas Chandra<sup>c</sup>

<sup>a</sup>Assistant Professor, School of Management, Sir Padampat Singhania University, Bhatewar, Udaipur-313601, Rajasthan, India

<sup>b</sup>Professor and Dean, UCCMS, Department of Accounting and Statistics, Mohanlal Sukhadia University, Udaipur-313601 Rajasthan, India

<sup>c</sup>Assistant Professor, Department of Management Studies, Indian School of Mines, IIT-ISM, Dhanbad, 311001, Jharkhand, India

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### ABSTRACT

Activity-Based-Model (ABC) is used for the purpose of significant improvement for overhead accounting systems by providing the best information required for managerial decision. This paper discusses implacability of ABC technique on inventory valuation as a management accounting innovation. In order to prove the applicability of ABC for inventory control a material driven medium-sized and privately owned company from engineering (iron and steel) industry is selected and by analysis of its production process and its material dependency and use of indirect inventory, an ABC model is explored for better inventory control. The case revealed that the necessity of ABC in the area of inventory control is significant. The company is not only able to increase its quality of decision but also it can significantly analyze its cost of direct material cost, valuation of direct material and use its implications for better decision making.

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## 1. Introduction

Inventory or stock is primary element of production and a basis for producing finished product. It is also the first and major cost element since the whole process of production depends on it (Meng, 2006). As per the progress in the area of production with automation and lack of human intervention the use of inventory has not limited to the direct use but now it is required for the other purposes like packing, marketing, sample providing and other indirect use, and its use for various purposes needs a good plan for its efficient consumption. With the automation and technological advancement for the purpose of profit planning, obtaining accurate cost information valuation of inventory is important for the managers. The Inventory Valuation (IV) refers to assigning product costs to the inventory. It plays a significant role in reporting operational result as well as the state of affairs of a business entity. Without casting doubt on the validity of conventional procedures used to compute profit and made it available for dividends and profits subject to taxation, it might be questioned whether those traditional methods are relevant for decision-making purposes. The periodic operating statement will not provide useful information for management without being modified with the adjustment for changes in inventory

\* Corresponding author. Tel.: +91 9772778431

E-mail address: [Vineet.chouhan@spsu.ac.in](mailto:Vineet.chouhan@spsu.ac.in) (V. Chouhan)

(Field, 1960). Empirical literature suggests that IV is one of the devices often resorted to smooth out a firm's operating result (Samal, 2005). Valuation of inventory provides a huge scope for reporting a higher profit so proper disclosure of the valuation principle is needed (Rao, 1996). Indian Accounting Standard-2 (Ind. AS-2) of the Institute of Chartered Accountants of India (ICAI) deals with IV and its disclosure. Para 3 (point no. 9) of this AS lays down the Principle of Inventory valuation i.e. "Inventories shall be measured at the lower of cost and net realizable value" (ICAI, 2013). This principle is at par with International accounting standards (IAS) and International financial reporting standards (IFRS).

Reporting for IV is one of the major subject of concern for management, which is given full consideration by many governmental agencies too. As per the Gazette of India, the proper records of inventory should be maintained for raw material and its consumption for the purpose of production, which shows all receipts, issues and balances in quantities and values of each item of raw material and components required for manufacturing of item referred (Gazette of India, 2001). The importance of inventory has also pointed out by Herrick (1950) who stated that it is an important factor in the determination of net income; and the amount stated by the inventory is carried forward against the income of future period. Thus, when the cost of inventory increases in the cost structure of a company, new methods are required to calculate and report proper cost of direct and indirect cost of inventories. ABC is one of the methods often used for providing better cost information regarding indirect cost of inventory. Thus for the valuation of inventory on ABC basis first the cost functions of its valuation is to be analyzed, which include: Costs of purchase, receiving raw material (including Shipping), Costs of conversion (Processing), Cost of inventories of a service provider, Cost of agricultural produce harvested from biological assets, Techniques for the measurement of cost and other costs. These cost functions are associated with the direct cost of inventories. In the present time, indirect uses of inventories have also been increased, which has resulted as increase of overall investments in the inventories (Cooper & Kaplan, 1998; Ciechanowski et al., 2000; Knudsen et al., 2004). A classic study of Indian Industries which has included 50 companies out of 23 industries 22 companies out of eight industries on the basis of market capitalization, assets size and total sales value, has shown that maximum 41.27% of the companies under study were subscribing to the general disclosure of inventory valuation as opposed to item wise disclosure (Chouhan, 2014).

Under ABC the inventory reporting can be divided in two parts, first reporting of direct expenses/cost, and second reporting of indirect expenses/overheads. Reporting of direct expenses can be based on direct allocation or traditional methods but these methods fail to provide better cost information in terms of indirect expenses including inventory. Thus, for effective valuation, traditional methods should be supported by other methods like, ABC (Cooper et al., 1988). Use of ABC is more appropriate when a firm is producing more than one product and various indirect costs are involved in the valuation under such circumstances and the valuation must be based on the level of stock and an ABC implementation (Malmi, 1999; Themido, et al., 2000; Kee et al., 2000). Thus for the purpose of accounting and valuation of inventory ABC can be used as one of strategic tool (Drury & Tayles, 1994).

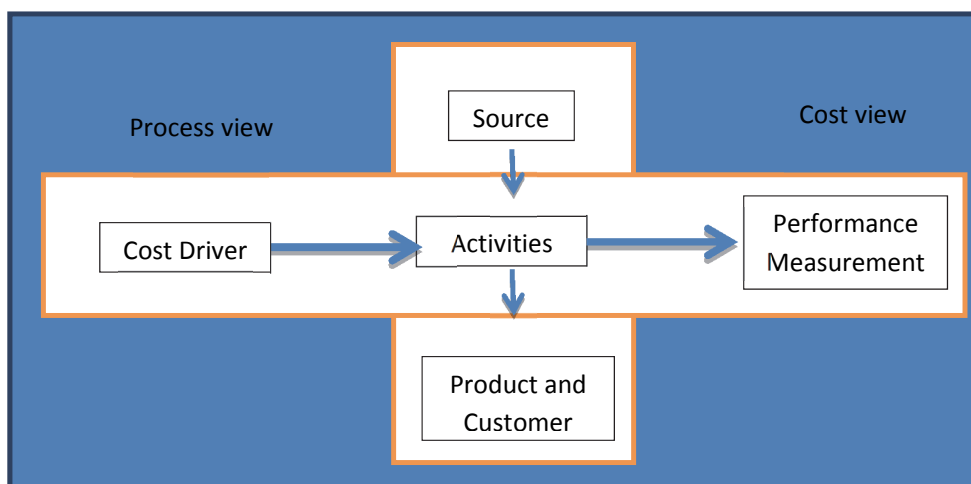
## **2. Historical perspective of ABC**

ABC has emerged in the 1980s due to the increasing lack of relevance of traditional cost accounting methods. The traditional cost accounting methods were designed around 1870-1920 and when industry was labor intensive, less automotive and less varied in terms of the product variety with low overhead costs (Panda, 1999). However, since the 1960s, rapid changes in the field of cost accounting were observed, particularly after 1980s (Khozein & Dankoob, 2011), overhead cost were increased in the percentage of total cost. Thus, the companies were facing with the problem of overhead allocation and a gap was created between the available methods of overhead allocation. The technique which has emerged as a solution of overhead allocation problem is known ABC (Cooper & Kaplan, 1992). The emergence of ABC is timely because of rapid technological change and global competition which has

increased the need for accurate cost information. It is a methodology that measures the cost and performance of activities, resources, and cost objects. Resources are assigned to activities first and then activities are assigned to cost objects based on their use. ABC recognizes the causal relationships of Cost Drivers to activities (Computer Aided Manufacturing International, CAM-I). It recognizes that individual products or customers do not consume indirect expenses in those proportions. Instead, they focus on the work activities of people and equipment required to produce each product or provide each service, and their consumption of each of those activities (IMA, 1992).

The underlying assumption of ABC is entirely different from that of conventional costing systems. The conventional costing system assumes that products cause costs while under ABC systems it is assumed that activities increase costs and cost objects create the demand for activities (Cooper & Kaplan, 1992; Marx, 2013). Activity-based cost/management (ABC/M) has now maintained a high profile status as an important management accounting innovation for well over a decade (Bjornenak & Mitchell, 1999). However, despite the strong and durable advocacy (Cooper, 1988; Cooper & Kaplan, 1991, 1992, 1998; Kaplan, 1992), several reservations have been expressed concerning (a) the substance of its practical attraction (Bjornenak, 1997; Gosselin, 1997; Malmi, 1999), i.e. that it may be a fad or fashion, engendering a bandwagon effect rather than a genuine and useful technical enhancement, (b) its decision-making relevance (Noreen, 1991; Bromwich & Hong, 1999).

Despite these reservations, ABC has proven itself as a cost accounting system that identifies activities in an organization and assigns the cost of each activity resource to all products and services according to the actual consumption of each. The ABC process is capable of incorporating both physical measures and causal principles in the cost accounting system. The basic idea of ABC is to allocate costs to operations through various activities in place that can be measured by cost drivers. Applying ABC brings different benefits for different organizations. It is a methodology that measures the cost and performance of activities, resources and cost object; assigns 'resources to activities' and 'activities to cost object' based on their use and recognized the causal relationship of cost drivers, to activities (IMA, 1992). Under ABC the activity is formed by task or set of task that require the consumption or utilization of resources while cost object is the final goal or result of a performance of an activity (Mukerjee, 1999). In ABC the activities are analyzed first and then aggregated and after that the major process of selection of cost driver starts. Cost Driver is the measurement of consumption. It is important to select cost driver as per requirement of condition. It is the basis of allocation in ABC (Mukharjee, 1999). Miller (1996) and Turney (1991) suggested the two-stage ABC model as under (Fig. 1);



**Fig. 1.** Activity-based-costing model

ABC is a two-stage allocation process, first costs are traced to activity and then to product. It emphasizes on the need to obtain a better understanding of the behavior of the overhead cost and thus to ascertain its causes and its relation to the product. As the benefits of ABC have already been observed in various firms for strategic decisions but its implication has not been proven in the area of inventory valuation. Thus, this paper presents the applicability of ABC for inventory valuation.

### 3. Review of literature

The reviews of ABC literature support its implementation, Growth and expansion in various companies. Anderson and Young (1999) explored the relationship between organizational and contextual variables, such as organizational structures, task characteristics, management support, information technology and ABC success. They confirmed the importance of organizational factors (top management support and adequacy resources) during the ABC implementation stage. Liu and Pan (2007) carried out a study on Chinese manufacturing firms and revealed that top management support, hierarchical and communication structure and high proportion of dedicated professionals were the significant factors in determining ABC success implementation. Innes and Mitchell (2000) surveyed the level of ABC adoption among UK's largest companies and identified factors influencing on ABC success by using behavioral and organizational variables. They found that top management influenced ABC success significantly. Majid et al. (2008) described the process of ABC implementation in a Malaysian service company by using a case study approach; they categorized ABC implementation into initiation and adoption, design, implementation and use of information. They found that the factors determining ABC success were top management support, suitable ABC software, and finally, ensuring that all affected employees understand and participate in the ABC implementation stage. Khalid (2005) conducted study by using a questionnaire survey among the largest 100 firms in Saudi Arabia, ABC adoption was found to be positively related to diversity of products. Ruhanita et al. (2006) conducted a mail survey in Malaysia, and examined factors influencing on ABC success, especially at adoption stage. They found; cost distortion, decision usefulness, information technology and organizational factors as significant factors and showed that decision usefulness, top management support were linked with ABC for performance measuring and compensation, influenced as successful adoption of ABC. The ABC's positive impact on firm's performance were also noticed by other numerous studies including McGowan (1998) Anderson (1995), Innes et al. (1995), Anderson and Young (1999), Innes et al. (2000), Khalid (2003), Ruhanita et al. (2006), Sartorius et al. (2007), Colin et al. (2008), Majid et al. (2008), etc. Kaplan (1988) observed that many companies used single cost systems to meet three diverse needs, namely, inventory valuation and financial reporting, product /service/ customer costing and providing 'operational feedback to frontline employees' in the plant. However, he apprehended that, in a complex manufacturing environment with 'product and process diversities' and 'concern for excellence', the single cost system might not suffice for all the three needs (Chouhan, 2008 2009, 2010). Kaplan (1988) identified three purposes for cost systems, inventory valuation is one of them. He further reported the findings of the first of his excursions into the realm of management accounting practice and found that use of ABC for inventory reductions is one of the changes in accounting procedures, which is lag far behind changes in the real phenomena (Kaplan, 1985). Although the traditional cost accounting procedure of allocating overhead with a denominator volume is viewed as useful only for inventory valuation (Cooper & Kaplan, 1992). The process of ABC implementation is also important in this regard as irrespective of its superiority to traditional cost systems; it could fail due to poor implementation process (Pattison & Arendt, 1994; Ness & Cucuzza, 1995; Player & Keys, 1995). Firms mainly rely on cost information for inventory valuation/profit measurement rather than decision-making purposes may rely on less accurate cost information derived from simplistic costing systems (Kaplan & Cooper, 1998). The inventory valuation use has had the lowest adoption rate amongst ABC users (Adamu & Olotu, 2008). Dugdale and Jones (1997) follow-up survey to Innes and Mitchell (1995) and found that only three companies used ABC for stock valuation as against reporting of 14 companies, when strong definition of ABC was applied. Similarly Innes et al. (2000) found that use of ABC

in Stock Valuation decreased in importance from a rank of 6 to a rank of 8, and from statistically significant to not significant during 1994 to 1999 in UK's largest companies.

The above reviews revealed that ABC is used for inventory control and valuation but it has not justified that its use has increased the quality of information regarding inventory control. Hence, under this paper we have tried to analyse the areas where it can be successfully implemented in a company.

#### 4. Objectives

Since ABC can be used for the purpose of handling indirect cost of inventory, in the same context the objective of this paper are as under:

1. To explore the area of inventory control in which ABC principle can be applied as a strategic tool for cost control.
2. To develop an ABC model for inventory valuation in manufacturing.
3. To measure the applicability of the ABC in Indian companies for inventory valuation.

#### 5. Research method

##### 5.1. Sample Selection:

As per individual case study approachm a Company was selected from a manufacturing sector situated at Gujarat free trade zone <sup>1</sup>(Kandla) Gujarat, India. As it is having major cost element as material cost, it is using material as a basis for allocation of cost of its overheads.

##### 5.2. Data Collection:

This study is an analytical and exploratory type of research study. For the purpose of current case study the Primary data were collected through a response study. The study is based on the observations and schedule methods by using brief schedule and interviews with the Cost accountants/managers of the company. The company which was selected for this purpose (for convenience it is named as X Ltd.) is a 100% export oriented private company which uses computer for the cost accounting work. X Ltd exports its 400 various quality goods of two types to its concerned German company. For this purpose it has developed its own Software with the help of its concerned German company. It collects it's all costs according to cost department and cost center. The production process of the company is long process and at each stage a similar process is repeated. For building an ABC model the requirements of management were given more importance. Consequently, the various types of cost models were first discussed with the management to gain perceptions about their requirements of the nature of costs and the models potency to accomplish the cost objectives. The managers of the company and specially Managing director accredited the supremacy of ABC model and expressed their keenness to build ABC for improving decision making. The ABC model was then developed on the basis of responses gathered from all the three levels of management coupled with the activities organized in five phases. However, ABC is not a one stop journey and thus, offers scope for further perfection. The model developed here is based on the current level of job functions and corresponding activities performed in the organization. The model was then proposed for implementation and relevant feedback was sought.

##### 5.3. Process of ABC model building in the company

The research was organized in five phases (Chouhan, 2014) which are described as under.

*Phase I- Analysis of manufacturing process:* This phase broadly includes the identification of job functions followed by a comprehensive analysis of manufacturing process. The schematic view of manufacturing process is to be described for this purpose. Table 2 provides the list of stores material and their codes which is used further for preparation of ABC model.

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<sup>1</sup> This company has not given the permission for using its name.

*Phase II- Development of activity dictionary:* The detailed process of building ABC Model started with identification of activities of the firm. This step is the most typical stage and could not be finished without the detailed interview of the management. Selection of the related with indirect material is extremely important to renders scope to track the cost movement followed by requisite control.

*Phase III- Identification of cost elements:* This step chiefly includes the identification of cost elements under which the best relationship between the Activities and costs was identified and the scope of cost data related with material, objectives of their use, time factor and source of data were defined in a way that provided help for developing ABC model.

*Phase IV- Collection of cost on the basis of activities:* This phase includes identification of costs associated with each identified activity. Further, the cost pools were developed by aggregating the allied costs. Both the previous steps were clubbed under this stage. For this purpose 10 cost pools were identified in the selected company on the basis of activities related with material which is given in Table 2.

*Phase V- Classification of the cost drivers:* This phase includes the analyses of costs and the identification of appropriate cost drivers correspond to each identified activity. The cost drivers for cost pools related with material were identified by holding discussions with the managers and shop floor supervisors. The classification of cost drivers is also shown in Table 2

*Phase VI-Assignment of Cost-* The last step comprises of the assignment of costs by using suitable cost drivers to the identified cost objects. Further, the activity model and process flows were analyzed and revealed. Table 3 shows the inventory reporting sheet and Table 4 shows the cost assignment under traditional and ABC model.

The robustness of the ABC model developed was tested by applying various analytical techniques like Pareto analysis, Bunch Marking, Value Added Analysis, Comparative analysis, Cost-Benefit Analysis, Functional Economic Analysis, Structured Technique, etc.

After building the ABC Model the next important matter of concern is to implement and test the system. For switching over to ABC System it is also important to develop 'ABC Team' which include active participation of Top, Middle and low level Managers.

## 6. Process of ABC implementation in selected company

Out of all the companies which were ready to help one company was using job-cum-Batch costing method, one company was Raw Material Oriented Company and other companies were machine based manufacturing units. This company is keeping the Raw Materials in holding stores, which were given stores code as given in Table 1.

**Table 1**  
Stores Code

S. No.	Stores Code	Description
1.	1001	Raw Material Imported
2.	1002	Raw Material Indigenous
3.	1003	Raw Material Processed
4.	2001	Component Imported
5.	2002	Component Indigenous
6.	2003	Component Processed
7.	3001	General Material Imported
8.	3002	General Material Indigenous
9.	4001	Tools Imported
10.	4002	Tools Indigenous
11.	4003	Tools Manufactured
12.	6002	Civil Material
13.	7001	P-3000 Imported
14.	7002	P-3000 Indigenous
15.	7003	P-3000 Manufactured
16.	8001	Gas Analyser Imported
17.	8002	Gas Analyser Indigenous
18.	8003	Gas Analyser Manufactured

The Procurement Department which is central Receipt stores, prepares Receipt Voucher (RV) for indigenous material and Foreign Receipt Voucher (FRV) for imported material. For all the material received Bin Location Cord (BLC) is prepared and Quality Assurance Division (QAD) is responsible for Quality Assurance of all the material. For issuing Material, Material Withdrawal Voucher (MWW) is prepared and for Inter departmental stores Transfer Material Transfer Voucher (MTV) is used and the copy of such vouchers is sent to Cost Accounting Department. All the inventory input vouchers are fed to computer by computer center and the method used for issuing material is "Weighted Average Basis". The output for each Holding store is taken out on quarterly basis from the computer center for Material Accounting and Price ledger, Inventories at the end of the period, receipt Analysis and Issue Analysis. Later on Reconciled Inventory receipts is prepared. These documents are used for the Preparation of Inventory Reporting Sheet and for the ABC model. For ABC model records of the shop stock is used. The fact came out from this is that some materials cannot be conveniently cut and Issued separately so bulk Issues are made for standing work order termed as "shop stock", The indirect material handling is also not done properly but with the help of computer, we have tried to prepare a base for drafting ABC model from available details given by the company. The indirect expenses of material of company are not shown separately and its reporting process is also not specified. So the efforts were made for preparing a Good report with the help of ABC. First the Activities (indirect) are classified and then the cost driver which is measurement of consumption (Mukerjee, 1999), are calculated which is shown in Table 2.

**Table 2**  
Activities and Cost Drivers (ABC MODEL)

Activities	Cost Driver
1. Preparation and issuing enquiry Activities or purchasing activities.	1. No. of tender (Weight of Raw material purchased)
2. Negotiation with purchaser. (According to time devoted by managers)	2. No. of purchase order.
3. Stock entrance (Receiving Activities)	3. No. of time received or No of order lines handled.
4. Storage	4. Square meters of floor space
5. Issuing or dispatching activities.	5. No. of requisition
6. Transport activities (within factory and go down)	6. No. of time material were transferred.
7. Transportation (outside factory)	7. No. of packets delivered
8. Inspection and laboratory activities	8. No. of time inspection takes place.
9. Accounting activities.	9. Value of stock or No. of unit handled or No. of vouchers made.
10. Salary and wages of stores department.	10. No. of unit of material stored.

These cost drivers are suggestive drivers. If companies use the above inventory control ABC model, this model can provide better information for reporting inventory cost. According to above model a reporting chart is prepared which is shown in Table 3.

**Table 3**  
Inventory reporting Sheet for Indirect Inventory

Indirect Inventory costs:					
Activities	Activity code	Total Amount	Cost Driver	Total Activities	Cost per Activities
1. No of tender	9001	5434	No. of Tender	43	126.37
2. No of purchase order	9002	533	Purchase order	32	16.66
3. Receiving activities	9003	532	No. of time received	22	24.18
4. Storage	9004	63323	Space Area of Floor	769	82.34
5. Issuing or Dispatching	9005	61234	Requisition	332	184.44
6. Transport activities (Internal)	9006	312	No. of Time	223	1.40
7. Transport activities (Outside)	9007	2352	No. of Container Delivered	2342	1.00
8. Inspection and laboratory activities	9008	3234	No. of Time Inspected	443	7.30
9. Accounting activities	9009	2322	Value of Stock	547	4.24
10. Salary and Wages of Stores department	9010	552324	No. of Units stored	25435	21.72
Total Cost		691600	Total activities and per activity cost	30188	469.65

The allocation on basis of direct material in its 2 product under material based costing is in the ratio of 3:2, as it has produced 30,00,000 and 20,00,000 units of its two major products, respectively. The cost of indirect inventory is calculated under Traditional material based costing and under ABC costing is shown in Table 4.

**Table 4**  
Allocation of overheads on traditional and ABC Basis

Allocation of cost under Traditional Costing (Material Based)							
Allocation of cost in the ratio of 3:2						414960	276640
Cost Per unit Under traditional costing						0.13832	0.13832
Allocation of Cost under ABC							
Total Amount	Total Activities	Cost per Activities	Activities for product		Cost of product		
			A	B	A	B	
5434	43	126.37	18	25	2274.66	3159.25	
533	32	16.66	22	10	366.52	166.6	
532	22	24.18	8	14	193.44	338.52	
63323	769	82.34	532	237	43804.88	19514.58	
61234	332	184.44	180	152	33199.2	28034.88	
312	223	1.4	170	53	238	74.2	
2352	2342	1	1400	942	1400	942	
3234	443	7.3	308	135	2248.4	985.5	
2322	547	4.24	445	102	1886.8	432.48	
552324	25435	21.72	13467	11968	292503.24	259944.96	
					Total	378115.14	313592.97
Cost Per unit Under ABC						0.1260384	0.15679649

Table 4 revealed that there was a major difference in the cost of indirect inventory as the cost of Product A and B is the same in Traditional cost accounting method but it is different in ABC (approx. 0.1260 and 0.1568, respectively). This difference will not only decrease the efficiency of cost accounting in companies using traditional cost accounting but also significantly affect the profitability of the company.

## 7. Conclusion

The conventional system of inventory cost control encourages the management for allocation of inventory cost with the help of various valuations, issue methods and elimination of waste. It generates information for internal reporting purposes only and to determination of costs by responsibility areas. The developments in the field of improving cost and management accounting practices have revealed that the ABC logic remains a good way to improve management accounting systems to drive strategic decisions not only in the area of overheads but also in the area of other heads of cost accounting. This study extends an empirical research that has examined the application of ABC for inventory control. This company has specifically disclosed finished goods and all the other items of cost in their cost accounting records with the use of ABC, which is not the common practice of other companies working in the same industry. That is why ABC can become of the techniques used for the purpose of controlling indirect inventory cost and can also prove to be a medium to improve the operations decision-making. That's why an ABC model has been worked out with the information provided by this company and the managers of the company were also agreed that this model can be proven very helpful and appropriate in valuation and reporting for inventory. In this paper by taking sample of one industrial unit established in the free trade zone of Gujarat, with an objective of proving effectiveness of ABC for indirect inventory control, authors have tried to valuate and generate report which will be used by the managers to measure, control and evaluating closing inventory in the company.

## 8. Policy implication

The research has revealed that proper reporting system for inventory was not adopted by the companies yet and it is the duty of accounting professionals and academicians to bring out change in the standard



to make accounting practices and disclosers meaningful and while doing so prepare a good accounting and reporting procedure for management which may be the greatest revolution and perhaps an indication of need to change. ABC helps the managers understand the cost of inventory in well manner and eliminates waste. It provides a road map to remove complexity in valuating inventory of a manufacturing organization and also helps management understand an important source of complexity-the demands placed on the organization by a diverse range of products. When Product Volume Diversity, Product Diversity and Product complexity increase, the ABC can be used to categorize inventory and its costs based on the value contribution to total sales. Activity based product costing may not only be used as an alternative to the traditional inventory valuation methods, but it can also be used as a separate stand alone, microcomputer based system designed to obtain more accurate information for management decisions and extended as Activity based costs flow through the perpetual inventory accounts. Thus, ABC can be used as a separate management decision support system where activity based products cost are determined.

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