CHAPTER II

DEVELOPMENT OF COST ACCOUNTING

2.1 INTRODUCTION

Cost accounting has a history since long time, when the bookkeepers, accountants, and managers developed and used records of their revenues and expenditures on items consumed within their manufacturing organization. These records involved the products manufactured or services provided by the manufacturing companies. However, several centuries before the Industrial Revolution, the use of double entry bookkeeping was made in connection with manufacturing firms.

According to Garner 1954, many industrial bookkeeping practices are older than the industrial revolution. So cost accounting was raised after 1800. In fact industrial bookkeeping started since fourteenth century when, as a result of the rapid growth of commerce in Italian, English, Flemish, and German, industrial enterprises began to be established by various individuals and partnerships to engage in the manufacture of woolen and silk cloth, books, coins, and other items in common use at that time.

Cost accounting is probably as old as financial accounting. Its origin dates back to the first forms of social life. The Greece traders of antiquity, the Chinese, the Egyptians, and the Phoenicians, and the Arabs had accounting in the service of the royal court, some of whom specialized in the determination of cost. In Egypt, 3.000

years before Christ, these accountants had to present to the Pharaohs each year
detailed report on the net cost of the harvest, so that just taxes on wheat could be
levied (Garner 1954).^2

Accounting evolution in similar other fields has been in response to economic
and social needs. As business and social scenario have become more complex over
the years, accounting has developed new concepts and techniques to meet the
increased needs of financial information. The industrial revolution has brought many
social and economic changes such as change of production methods from handmade
to mechanization, which provided for a large market. This system depended on
machinery and thus there was a rising need to determine the cost of voluminous
machine-made products as compared with the cost of handmade products. However,
the concept of cost accounting was the answer to the requirements of financial
accounting information for the purposes of planning, inventory valuation and
controlling of cost for volumes of product made by the machine.

Cost theories were one of the main developments of the industrial
environment. The expansion of the manufacturing system during the hundred years,
the huge improvement in manufacturing method and techniques, and the keener
competition brought about the widening of markets. All these necessitated the
manufacturer to appreciate more fully the necessity of adequate information as to his
cost of production. Cost accounting as a managerial instrument was the most
significant method of obtaining desired results. However, allocation of overhead, one
of the problems associated with product costing, has received more attention than any
other problem connected with cost accounting.

^2 Garner, S.P. (1954),ibid
This chapter contains seven main sections. The First Section defines the cost accounting and its objectives. Second Section summarizes the development of cost accounting through the nineteenth and twentieth centuries. The impact of scientific management and the two world wars are included in this section. The Third Section will discuss the modern manufacturing environment that relates to the advanced technology in the manufacturing and production field. The Fourth Section focuses on the changes in the business environment such as competition and globalization. The Fifth Section attempts to describe the main areas of cost accounting system which are influenced by the new environmental changes both in manufacturing and business as mentioned in the two previous sections. Finally, a review of traditional cost accounting and its current problems which were reflected to these changes are discussed.

2.2 COST ACCOUNTING

BOX NO: 2.1

COST: HISTORICAL PERSPECTIVES

- Limitations of Financial accounting
- Information to management and internal users
- Financial and non-financial information about cost
- Cost information required for product pricing and inventory valuation.

Cost accounting as a branch of accounting has been designed to measure the economic resources consumed in producing goods or providing services. Cost accounting has been developed because of limitations of financial accounting which caters to the requirement of external users (shareholders, tax authority and banking
etc.), while the cost accounting is designed for internal users such as management, owners and employees etc. Cost accounting provides an organization with information about the cost of products being produced and sold as well as for the goods consumed within of the manufacturing firms.

Cost accounting has been defined by several authors as classification, recording and appropriate allocation of expenditure for determination of cost of products or services and the presentation of suitably arranged data for control and guidance of management. Cost accounting provides information for management and financial accounting. Cost accounting is a measure and reports both financial and non-financial information relating to the cost of acquiring or utilizing resources in an organization.

Cost accounting is defined as “a technique or method for determining the cost of a project, process, or things.....this cost is determined by direct measurement, arbitrary assignment, or systematic and rational allocation”.

According to James Martin, cost accounting is linked to tax accounting, financial accounting, and managerial accounting because it is an important component of each discipline. This definition of cost accounting aims at determining the cost of product, service, an activity, a project, or some other cost objects. These costs are needed for several purposes. For example, tax and financial accounting depend on cost accounting information in order to determine product pricing and inventory valuation, as well as, preparation of external reports.

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3 Horngren, Charle T., et al. (11th Ed) (2005), Cost Accounting: A Managerial Emphasis
4 Jesse, T. B., et al. (2nd Ed) (1994), Cost Accounting: traditional and Innovations
Cost accounting is concerned with internal users especially the management, owners and employees who use the cost information for various purposes such as determination of the cost of product, improving the performance measures, efficiency and to determine the selling price. Cost accounting information is the major factor for inventory valuation, planning process, control, and decision making such as make or buy decisions, replacing equipment, introduction of new products or discontinuance of unprofitable products or service etc. Jawahar Lal(2007) determined three important objectives for cost accounting: (1) to determine product costs; (2) to facilitate planning and control of regular business activities; and (3) to supply information for short and long-run decisions.

However, the success of cost accounting system is dependent on the environmental factors of managerial and production activities. These factors have developed and have undergone changes such as the competition environment, consumer market place, globalization, and advances in manufacturing technologies etc. Thus, cost accounting is used in all types of business, government, educational, health institutions, and in profit and non-profit organizations.

\[\text{Jawahar Lal (3rd Ed) (2007), Cost Accounting}\]
2.3 DEVELOPMENT OF COST ACCOUNTING

BOX NO: 2.2

Development of cost accounting

- Rudimentary accounting to determine profitability.
- New developments in cost accounting with industrial revolution.

From the beginning of commercial activity, merchants have attempted to determine the profitability of their activities. Rudimentary accounting principles arose to facilitate this attempt at profit measurement. Luca Pacioli, a Venetian of the thirteenth century is regarded as the father of accounting. Pacioli is noted for the development of debits and credits. However, he is also credited with the origins of cost accounting. While not focusing on the manufacturing cost aspect, Pacioli did develop a concern for cash budgeting and variance accounting.

The theories of cost accounting and its practices date back to the fourteenth century when the small industrial companies started to produce products, such as books, woolens, coins, and wine. The industrial Revolution brought new developments in cost accounting systems, but these were incomplete system. However, before that time, most of the manufacturing firms simply modified their accounts (direct material, direct labor, and overhead costs). Usually no sharp distinction was made between the shop burden (overhead) and the commercial (selling and administrative) expenses of the firm. At the end of the nineteenth century cost accountants began to study the overhead element of cost. In this regard, the

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7 Cunagin, C. and Stancil, J. L. (2002), COST ACCOUNTING: A HISTORY OF INNOVATION.
debate between absorption and variable costing began. There was a wide diversity of opinions as to whether overhead assigned to a product should be all-inclusive or very limited (Cunagin and Stancil). However, the Industrial Revolution was major reason for development of cost accounting, but progress in technology was much rapid than progress in cost accounting.

Development of Cost Accounting in the 19th Century

**BOX NO: 2.3**

**COST ACCOUNTING IN THE 19TH CENTURY**

- Development of Job and process costing systems.
- Development of cost accounting in mechanized textile mills.
- Control of prime cost the main strategic focus to achieve profitability.
- No focus on overhead cost as it was insignificant portion of total cost.
- Introduction of principles of scientific management.
- Development of budgetary control and standard costing system.

Payen in the early nineteenth century (1817) (quoted in Garner 1954), explained two accounting methods for two different industries that what are today called job costing and process costing systems. The first industry is engaged in production of vehicles, while the second industry was a glue factory. According to this author there has to be a journal and ledger in monetary terms and a journal and ledger for kind, the money journal was summarized into cash received and paid, so the costs were carried from one section to the next. This kind of journal was really a summary of the cost of each type of labor used in manufacturing. The journals were

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5 Cunagin, C. and Stancil, J. L. (2002), ibid

posted to a separate ledger accounts. Payen, also, considered the payment for manufacturing items. It should be noted that the account contained assets, expenses, cost, and sales all mixed together. Of course, if the author had deducted from the balance of the account (1) the asset element; (2) the balance of raw materials on hand, and; (3) the remaining stock at cost, he could be arriving at gross profit figure for the period. However, Payen, presented a considerably more intricate illustration dealing with the allocation of cost between two principal productions, all element of cost were divided, including material, labor, and factory overhead.

The mechanized integrated textile mills that appeared after 1812 are according to Chandler the first business organizations to develop cost accounting system. They used cost accounting to ascertain the direct labor and overhead costs of converting raw cotton into finished yarn and fabrics. The accounts were mainly considered with labor cost. For decision making and control, comparison of wages paid to the workers with the output produced was done to get a rational basis to evaluate internal conversion cost and to compare these with external market prices.

Babbage (1835) (quoted in Garner 1954 and Kranowski 1977) described ‘full products cost’ calculation, illustrating how a proposed system would calculate the cost of making a pound of pins. Babbage determined the cost of every process then aggregated them, to calculate the first ‘absorption cost’ of a manufactured product. His method included the cost of wear and tear on machinery, an early example of recognizing the cost of depreciation. Babbage’s ideas, so familiar in today’s cost systems were not adopted in practice. It can be surmised that there was no demand for this information, possibly because the largest item of cost continued to be the prime cost of labor and material and these were explicitly emphasized in

10 Panda, N. M. (1999), Activity-Based Costing for Indian Industries.
11 Babbage, C. (1835), On the Economy of Machinery and Manufactures, New York
existing systems, with smaller cost items receiving less attention. Since the production technology had not changed from its labor intensive mode, overheads were relatively a smaller component of total cost, and presented correspondingly smaller control opportunities. The control of prime costs remained the strategic focus for management to achieve profitability.

Johnson (1972),^12 Johnson and Kaplan (1987) ^13 described the cost accounting in Lyman Mills a New England Textile Mill during the middle of 19th century that enabled the managers to monitor the efficiency of the mill's conversion of raw material into variety of finished goods. The system was based on the company's double entry book of accounts and provided information about cost of finished goods, productivity of worker, and impact of change in plant layout, as well as, this system lead to control of receipts and used raw material, Kaplan (1998a).^14

According to Garner (1954)^15 in 1860 all costs were charged to two accounts, manufacturing and expense, where they disappeared forever in a meaningless total. The manufacturing accounting contained all factory costs (material, labor and overhead), the expense account carried office and selling expense, salaries, and miscellaneous indirect cost outside the factory. The expense account was closed out to manufacturing at the end of year, and the balance of the manufacturing accounts

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15 Garner, S.P. (1954), ibid
constituted the company profit. However, the expense account was gradually divided into significant and useful subdivisions of administration and selling expenses.

Chandler (1977)\textsuperscript{16} (quoted in Kaplan 1998) provides evidence of how U.S. railroads, in the 1860s and 1870, developed cost accounting procedures to help management in planning and control. Railroad handled a greater volume and dollar volume of transaction than had any previous business and, as the economic motivation for forming centralized firms to carry out the multiple processes for these basic activities.

According to kranowski (1977)\textsuperscript{17}, Metcalfe \textsuperscript{18} around 1885 has made one of the earliest recorded attempts to control overhead costs. He suggested a charge or "burden" to each job based on the time it spent in production. Further he concurred that overhead costs should be allocated to jobs, but argued that administrative and other non-factory overhead should be excluded from the cost of product because they were not part of the manufacturing process. The division between product and non-product cost survives to this day in calculation of Gross Profit and Net Profit.

Also at the same period, Metcalfe, Henry in 1885\textsuperscript{19} gave rather thorough explanation, complete about what he called the "shop order" method. This was essentially the job order technique. He recommended the use of other forms entitled (1) analysis of service performed on components of shop order number; (2) analysis


\textsuperscript{18} Metcalfe, Henry (3rd Ed) (1885), The Cost of Manufactures, 1st, John Wiley and Sons, 1907: New York.

\textsuperscript{19} Metcalfe, Henry (3rd Ed) (1885),ibid
of material expended on components of shop order number; (3) consolidated analysis of cost of shop order number. It is unclear exactly what the driving force was for these proposed allocations and attempts to develop a 'full cost' of production, because manufacturers in 1880's did not implement these suggestions. They continued using market price to value their inventory, treated factory overhead costs as period costs, and focused their control efforts on prime costs (Kaplan1984) (Quoted by Drenna, L and Ning Y)\textsuperscript{21}. According to Kaplan there was little demand for full costing system because the size of factory overhead cost was still small compared with prime costs, and did not incorporate the latest cost system about full allocation of overhead to calculate product cost.

The success of manufacturers was largely determined by the efficiency of labor as the labor was the most significant conversion cost element. Cost systems continued to focus on the control of labor and prime costs, and did not give attention for allocation of overheads cost to calculate product cost because overhead cost was insignificant element. In the financial accounting records, the market price was considered to be an adequate guide for inventory valuation, and pricing also relied on market price because the market at that time was stable, further reinforcing the lack of demand for full product cost information (Quoted by Drenna, L and Ning Y).\textsuperscript{22}


\textsuperscript{21} Drennan, L and Ning, Y. (undated), The Evolution of Cost Systems, Contingency Proposition about Accounting Change.

\textsuperscript{22} Drennan, L and Ning, Y. (undated), ibid
English Chartered Accountant, Andrade (1899)\(^{23}\) (quoted in Garner 1954) presented a new viewpoint in allocating burden charges to achieve fair and equitable basis. His suggestion was to analyze different overhead items according to their relation to cost. For example, the superintending charge should be apportioned according to the direct labor time worked on a particular job or contract, while salaries of storekeepers, and freight and cartage, were to be allocated according to the amount of materials used. Any additional overhead items might be allocated in a similar analysis as to their true nature. This technique, although, perhaps more accurate than a general averaging process, would require considerably more attention on the part of the cost clerks.

Alexander Hamilton Church\(^{24}\) was one of the most influential persons during the nineteenth century advocating for the adoption of absorption costing method. Alexander developed the machine-hour method of allocating and applying fixed cost such as power, land, and building costs. However, allocation of overhead costs on the basis of machinery hours has not received much attention in cost accounting practice until recent years. This method received the attention when the manufacturing companies installed automation systems, as well as, the composition of product costs changed. In the early and middle part of nineteenth century cost accounting had several developments but these could not serve the managers needs of information in complex manufacturing processes where firms use computers and machine made products. The need for information about the efficiency of the workers engaged in complex tasks inspired a systematic analysis of factory productivity known as

\(^{23}\) Andrade, E., (1899), Manufacturing Cost Accounts, Their Use and Treatment, the Accountant, February.

\(^{24}\) Church, A. Hamilton, (1901), The Proper Distribution of Establishment Charges, The Engineering Magazine, XXI and XXII
'scientific management'. With the end of nineteenth century managers needs were "to gather precise and accurate information about the efficiency of workers engaged in specialized tasks" (Johnson and Kaplan 1987).25

The last decades of the nineteenth century, and the first decades of the twentieth, watched the emergence of a new managerial philosophy. Managers started to look for new ways to co-ordinate and control production activities. Before that the control from top managers over operational procedures was very limited because actual production was typically directed by skilled workers who followed traditional c and raft customs. New technologies were almost beyond executive control; however, growing cost of labor and the need for better quality and productivity forced managers to change their production systems.

Frederick W. Taylor26 is acknowledged as the 'father' of scientific management, because of his famous work entitled "Principles of Scientific Management", published in 1911. His studies concentrated on the efficient use of time in the workplace. A piece rate system was introduced by Taylor to encourage the worker to achieve their work within the standard time. Taylor suggested two piece rate, one in case of a worker who performs his work within the standard time and the second in case a worker perform his work in less than the standard time is paid a higher piece rate, and vice versa. This research focused on "the best way to use labor and material resources" (Johnson and Kaplan 1987)27. The names associated with developments in the scientific management approach include Frederick Taylor, Harrington Emerson, A. Hamilton Church, Frank Bunker Gilbreth, and Henry Towne.


This approach included not only the development of work standard but also a new form of organization, supplementing the traditional operation or line function with staff function designed "not to accomplish work, but to set up standards and ideas, so that the line may work more efficiently". The "scientific management" also advocates starting the practice of measuring and allocating overhead cost to products, as well as, the human factors at the work place.

The scientific management movement in American industry provided a major impetus to the further development of cost accounting practices (Chandler 1977). The major players in this movement were engineers who, by detailed job analysis and time and motion studies, determined scientific "standards" for the amount of labor and material required for producing the given units of output. The standards were used to provide a basis for paying workers on a piece-work basis, and to determine bonuses for workers who were highly productive. The concept of scientific management "developed a host of new cost measurement techniques both to analyze task productivity and profits of products" (Johnson 1972).

It can be said that, the new cost accounting system designed by experts of scientific management like Taylor and Emerson primarily helped in assessing and controlling the financial and physical efficiency of processes and tasks in the firms which featured the complex machine making. Engineers and management experts in the manufacturing firms played vital role to develop a new goal for cost accounting to evaluate the overall profitability of their organizations. In fact, time and motion studies, the development of labor standards, the calculation of variances, and the

28 Chandler, A. A. (1977), ibid

29 Johnson, H.T. (1972), ibid
analysis of result were actually the contribution of engineers like Taylor and not accountants. Nevertheless, the benefits of these new systems have clear application to cost accounting for purposes of both decision making and control.

Fleischman, 2000, Fleischman and Marquette, 2003, Boyns, T and Edwards, 1997 confirmed the relationship between the development of scientific management and the development of standard costing and budgetary control and the rise of scientific management in connection with the growth of the large business corporation. Further advancement in cost and management accounting were associated with the scientific management involvement. The scientific management engineers concentrated on improving the efficiency of the production process by simplifying and standardizing the operations. Thus scientific managers were refining their techniques for determining standard. Articles advocating the use of standards for cost control were published (Longmuir 1902, Whitmore 1908).

From Longmuir's approach, variances between standard costs and actual performance costs were derived. Harrington and Emerson became the first individual to create analysis equation for the purpose of cost variance. However, Emerson


33 Longmuir, Percy (1902), Recording and Interpreting Foundry Costs, The Engineering Magazine, September

34 Whitmore, John (1908), Shoe Factory Cost Accounts, The Journal of Accountancy, VIO
stressed the importance of variances due to controllable conditions and those caused by conditions beyond management’s control (Johnson and Kaplan 1987).  

Development Cost Accounting in the 20th Century

BOX NO: 2.4

Cost Accounting in the 20th Century

- Development of cost accounting in America.
- Importance of allocation of costs emerged.
- Different basis for allocation of cost developed.
- Three groups of expenses- Shop expenses, Administrative expenses and selling expenses.

The twentieth century witnessed much of history in cost accounting in the western world, especially in America. America became the dominant world force, politically and economically during this century and when America led, other countries followed. In relation to cost accounting, British shared with America in the area of development of cost accounting and implementing new techniques such as standard costing and budgetary control. Japan also played an important role in this area in the second half of this century. Furthermore at the beginning of the twentieth century, there was an expansion in machinery manufacturing and cost accounting systems. The allocation of burden items continued to receive more and more attention as the years passed, but the authorities who treated the subject duplicated each other's efforts and theories to a large degree. Standard costing was born at the beginning of this century based on the ideas of Fredrick Taylor, the pioneer of scientific management. As mentioned above Taylor’s theory was to improve productivity of labor. He wanted to find a way to reduce products cost then increase profits, and on the other hand, to make pay possible for workers.

35 Johnson, H. T. and Kaplan R. S. (1987), ibid
In a series of articles which he wrote in 1901, A Hamilton Church\textsuperscript{36} treated this topic in a more comprehensive manner than other authorities prior to that time (Garner 1954).\textsuperscript{37} Church wrote and worked for the most part in the USA. Although he was primarily concerned at that time with the allocation and distribution of “establishment charges”, it was of course necessary for him to define what he meant by the term “cost of production”. According to Church, “cost of production” comprised of prime cost (material and wages) plus “shop charges” (depreciation, power, floor burden, insurance etc.) plus the general “establishment charges”. A. Hamilton Church also introduced the burden control accounts as a technique involving the establishment of a “shop-charges account”- the debits to this account included the items which made up the machine rate (Garner 1954)\textsuperscript{38}. The same account was created with the so-called machine earning, which together with the supplementary rate closed the account. In those early articles Church did not give entries and accounts, so the specific accounting which he recommended is not known. From what he wrote later (1909)\textsuperscript{39} one can ascertain that he would have set up accounts for the factory expenses, which in turn were closed to the profit and loss account at the end of the fiscal period.

According to Garner (1954)\textsuperscript{40} David Cowan introduced critically seven methods of allocation of costs. These were: (1) a percentage on prime cost of the work; (2) a percentage of the values of direct labor, only entering into prime cost; (3)

\textsuperscript{36} Church, A. Hamilton, (1901),ibid
\textsuperscript{37} Garner, S.P. (1954),ibid
\textsuperscript{38} Garner, S.P. (1954),ibid
\textsuperscript{40} Garner, S.P. (1954),ibid
a percentage computed on the value of direct labor, and second percentage computed on the value of materials; (4) averaging the rates paid for direct labor all over the shop, this average rate being increased sufficiently to cover the overhead; (5) a constant charge, at per hour, on the quantities of direct labor, in addition to the rates actually paid to the workers for such labor; (6) an average charge of so much per man per day; (7) an arbitrary charge depending on the circumstances of each case. It was his opinion that the labor quantities method would prove most satisfactory. The general burden items should be distributed to the producing departments on some equitable basis, and then the whole of the overhead charges allocated to product turned out on the basis of the hours spent by direct workers on each contract or job.

Manufacturing burden was divided into two categories: the first one is factory expenses such as coal, power, lighting, indirect wages, and taxes, and the second is establishment expenses, such as patterns, timekeepers, store room expenses and drawing office expenses, both of these groups were closed to a manufacturing account at the end of the fiscal period, while the selling and general expenses were closed to a trading account with that statement the distinction was complete.

At the same time in the first decade of 20th century, the most common practice for allocating factory overhead cost to products was based on the direct labor hour content per unit of product (Church 1908). For example, if a unit of product consumed two per cent of total direct labor hours, it would bear two per cent of factory overhead costs. This practice did not incur significant incremental costs because many manufacturers had already labor measurement systems in their pursuit of labor efficiency, so any additional system costs of basing allocations on labor were

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This costing system includes direct cost (i.e., wages and materials) indirect or overhead charges, and an allocation of general and selling expense to each product (Johnson 1972). It can be said that, a practical outcome of using a labor-based allocation rate was that factory overheads tended to be controlled only indirectly via observing labor, and inherently different products could carry the same factory overhead because their direct labor consumption intensities were the same. In relying on direct labor as the foundation of allocations, the cost system continued to imply the apparent reality that the labor controls had an important role in the successful business.

Knoeppel, C.E. (1919) a prominent American industrial management consultant divided, the “expenses” into three groups. The first was called “shop expenses” and included repairs, power, heat, light, stock room expenses, and general expenses of labor and material. The second group comprised supervision and recording expenses and was called “administration expenses” while the third group included selling expenses only. Each of these groups was to be distinguished on reports and in ledger accounts (Garner 1954).

Also in 1917, A. Hamilton Church, who had first given his views in 1901, summarized more completely his preferred method of handling the burden items. The charges were first to be debited to individual accounts, just as he had previously recommended, but periodically, through the means of a burden journal, they were to

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43 Johnson, H.T. (1972), ibid

43.1 Knoeppel, C. E., (1919), Graphic Production Control, Industrial Management, LVII

44 Garner, S.P. (1954), ibid
be transferred to departmental burden accounts, as debits in total. From the
departmental burden accounts, which were not control accounts, the amounts applied
to goods in process were to be transferred this time through a manufacturing journal,
to departmental manufacturing accounts, one for each department. Church thus used
a rather round about device for securing the desired control over burden without
actually using true control accounts at all (Garner 1954).

BOX NO. 2.5

Cost Accounting during the First and Second World Wars

- Increasing Government controls increased manufacturers concern about cost.
- Increasing popularity of cost accounting.
- Development of different methods of inventory valuation.
- Increasing popularity of standard cost system for pricing.
- Sophisticated cost accounting theories and practices adopted in mass production
  industries.
- Cost information used to assess operating efficiencies and to motivate worker
  performance.
- Advent of second world war provided impetus for increased adoption of sophisticated
  cost accounting systems

The First World War period revealed that the development of cost accounts
systems in UK industry was very uneven (Loft 1986). The war, however, provided

45 Garner, S.P. (1954), *ibid*

Accounting in the U.K., 1914-1925, Accounting, Organizations and Society, Vol. 11, No.
1:137-169.
a significant boost; the emphasis of government controlling during the war on cost-plus contract, increased manufacturers concern with costs. There was a more widespread discussion on cost accounting; and clerks and accountants working in industry became more visible (Loft 1990). This led to many existing businesses becoming controlled establishment. In other words, these businesses remained under private ownership but were subjective to direct government control of production. Despite the problems, cost accounting apparently became a better known and more widely practiced technique during the war period (Loft 1990). Loft has also argued that the First World War relationship between ammunitions suppliers and the British government resulted in significant advancement in cost accounting practices in Great Britain. Montgomery in 1979, (Quoted by Fleischman and Marquette 2003), argued that scientific management appeal increased in the US during First World War. Perhaps the Second World War experience would be similar. The First World War clearly had a major impact on UK industry in a view that is uncontestable large sections of it coming under some form of direct or indirect government control.

Cost accounting authorities began in 1920 to look into the problem of pricing the material of the product with more carefulness. The work of Jordan and Harris in America (quoted in Garner 1954) mentioned as illustrative of the more complete analysis of the topic. These authorities proceeded to the consideration of the following techniques of pricing requisition: (1) The method which used the original prices of the

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48 Loft, A. (1990), ibid


50 Fleischam, R. K., and Marquette, R. p. (2003), ibid

51 Garner, S.P. (1954), ibid
oldest stock on hand; (2) the method which used the market prices at time of consumption, adopted in the pine lumber industry and the iron and steel industry; (3) The method which used the average cost, both current averages and end-of-month averages; (4) The method which used the original cost of the highest priced material, considered the most conservative method. This list of methods was practically complete except for the normal or base stock method, which a few companies had adopted during the period and the last-in-first-out method which also was beginning to be adopted by a few lines of business.

In 1920 there were interesting practices of standard costing that came to the forefront, not only for materials, but also for other elements of cost. In summary, therefore, it may be stated that by 1925 the techniques and theories involved in handling and controlling the raw materials of a factory had become fairly well-known (Garner 1954)\(^{52}\). Many firms operated a standard costing system and standard costs for material issues; it was a acceptable pricing method for decision making. This means that a standard cost system may be an acceptable method for stores pricing for meeting both the internal and external requirements. Iron and steel industry manufacturers had begun to introduce the techniques generally from the late 1920. Boyns and Wale (1996)\(^{53}\) have shown that the firm in the coal industry became large and their organizational structures more complex, their management information systems based on ground cost information likewise became more detailed. This significantly affected all industrial sectors during the First World War.

\(^{52}\) Garner, S.P. (1954),ibid

Clark (1923), quoted by Garner (1954) provides an extensive discussion on the nature of overhead costs and their use in managerial decisions. Driven by a concern with the regulation of railroads and public utilities and with the broader societal implications of cost measurement (including price discrimination, cut-throat competition, and labor compensation), Clark examined in depth the nature of overhead costs. Many cost concepts that are widely used today, such as escapable or avoidable overhead, sunk costs, incremental or differential costs, and the relevant time period for determining whether a cost is fixed or variable, can be found in Clark's book. An entire chapter is devoted to a discussion of "different costs for different purposes", a concept illustrated by considering the changing definition of cost in nine different decisions to be made about a plant and its output.

Sophisticated cost accounting theories and practices had been developed in 1924. Many of these innovations were being used to improve the efficiencies of enterprises actively engaged in the mass production of standard products with relatively high direct labor content. Unlike the situation today, the cost accounting, capital accounting, were designed for and operated separately, with the cost accounting system typically designed for and operated by the manufacturing departments. Cost information was used to assess operating efficiencies and to motivate worker performance.

However, at that time many manufacturing firms had installed proper costing systems. Most large companies had costing department though there was a lot of ground to be made up in the area of medium size firm, and that they were generally controlled by a professional accountant.

Clark, J. M. (1923), The Economics of Overhead Costs, University of Chicago press, Chicago.
The Second World War was similar to First World War. It affected the cost accounting. For example, in US it was viewed as a double edged sword, it’s most positive effect was engendering awareness particularly among companies that served as military contractors and thus had to make full representation to contracting agencies for reimbursement. On the negative side, the dislocation of war especially shortage in the factors of production and capacity constraints (Fleischman and Marquette 2003)^{55}, all techniques that had developed from Taylor’s principles were suspended during the Second World War.

Chandler 1977^{56}; Tyson, 1990^{57}, 1993^{58}, 2000^{59}, claimed that despite the lack of evidence thus far, there are reasons to expect that the advent of Second World War might have provided impetus for the increased adoption of sophisticated cost accounting. Before Civil War, the user of sophisticated cost accounting control method was the Springfield armory.

^{55} Fleischam, R. K., and Marquette, R. p. (2003), ibid 
^{56} Chandler, A. A. (1977), ibid 
^{59} Tyson, T.N. (2000), Accounting History and the Emperor’s New Clothes: A Response to Knowing More as Knowing Less?, Accounting Historians Journal, Vol. 27, No. 1: 159-171
## Development at the End of Twentieth Century

### BOX NO: 2.6

### Development at the end of twentieth century

- Significant changes in both economic and technological environment.
- Global competition and increasing emphasis on quality and reliability.
- Increasing proportion of non-production cost in total cost.
- Higher percentage of fixed cost with increase in automation.
- Traditional allocation of overheads proving deficient for improving global competitiveness.
- Emergence of Activity Based Costing as a method to improve cost and management accounting.

Significant changes in both the economic and technological environments in the US manufacturing, the competitive environment for US manufacturers altered significantly during the 1980s, when inflation came under control, and US Dollar strengthened against the Japanese Yen and many others currencies. The economic shift made foreign products less expensive to US consumers, and US produced goods more expensive to foreign purchases. All these impacted on US manufacturers in the US market and non US markets, Johnson and Kaplan (1987)\(^6\).

Product development has recently received a lot of attention, product and process technologies are evolving rapidly and competition is becoming more global. Customers are placing increasing emphasis on quality and reliability but at the same time they are looking for good value. Global competition has forced companies to

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\(^6\) Johnson, H. T. and Kaplan R. S. (1987), ibid
adopt new manufacturing technology and philosophies or risk loss of market share. With regard to performance measurement, another important function of cost and management was discovered. The contemporary practice had already become obsolete and did not suit the new environment of uncertainly (Brimson, J 1991). In the 1980s, production of large number of new products, as well as, customized products created a complexity and volume diversity, calling in turn for widening of technical requirement such as engineering design, scheduling, setup, and inspection etc., (Kaplan 1989). So cost of non-production costs also increased, reflecting increased complexity in areas of product development, marketing and administration. Typically, production costs at that time came to represent only about 40 per cent of a product's selling price (Kaplan 1992).

In today's business environment manufacturing companies which are facing fierce competition in domestic and global markets are keen to implement strategic management tools, in order to increase their competitiveness. The impact of automation on direct labor was significant, because automation led to a higher percentage of fixed cost which rose dramatically and far exceeded direct labor cost in many industries.

Assigning cost to production has been a way of doing business since time immemorial. The principle cost elements are material, labor, and overhead. Labor and material have been allocated directly, overhead cost are then allocated to units of

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production based on a predetermined burden rate which was correlated to labor cost. This system worked, but in 1970s it became clear that the figures were not reflecting actual cost. Companies up to this point were able to hide these problems because they could increase the price that allowed them to maintain profit margin. But cost systems were not able to keep pace with the increasing complexity of operations and multiple products as well as in repetitive manufacturing and automation. Another important shift that had occurred over the decades of this century is that the labor cost began to become a smaller and smaller percentage of total cost.

As stated earlier, however, overhead and other indirect cost were allocated to products based on labor cost or hours when it was a much more significant factor. Unfortunately the old cost systems still operated under the assumption of late 19th and early 20th century when it made sense to allocate overhead cost based on labor. However, for fifty years practitioners and academicians in accounting have debated whether variable (direct) costing or absorption (full) costing will lead to better decisions in a competitive environment. In the past decade and a half practitioners/consultants have also argued that the use of ABC will lead to better decisions than traditional absorption costing. Thus, it is noted here that in 1980s, the criticisms of traditional cost and management accounting were seriously realized in view of increased competition and the radical shift in the production environment.

In the late 1980's activity based costing gained the attention of academic researchers, consultants, and managers as a means of overcoming the disadvantages of traditional cost allocation methods. Cost accounting had traditionally allocated overhead to products or services using only one volume sensitive drive, typically direct labor for organizations with high overhead and a mix of products or services
using cost direct may distort cost estimates. (Cooper 1989a)\textsuperscript{64} Traditional methods of allocating overhead were therefore, believed to be deficient in terms of improving global competitiveness. (Johnson 1990)\textsuperscript{65}. ABC has been increasingly adopted in many industrial and service firms as a method to improve cost and management accounting in complex production systems. The change is obviously noticeable through many surveys which were made with regard to the adoption of ABC, which is covered in detail in the next chapter on ABC.

2.4 MODERN MANUFACTURING ENVIRONMENT AND ITS INFLUENCE ON COST

In advanced manufacturing environment, technology plays a dominant role of integrating various functional areas throughout an organization. Technology was a major player in the global environment and organizations needed to establish internal policies and strategies to avoid the threat of technological obsolescence (Morden 1996)\textsuperscript{66}. However, it can be said that, technology is the driver of change and the backbone of a global business solution.

The second half of the 20\textsuperscript{th} century witnessed major changes in manufacturing environment such as advanced manufacturing strategies and technologies (i.e., CAM, CAD, FMS, CIM, JIT, CI, and TQM). All these focused on the elimination of non-value added costs, reduction of product cost, quality improvement, and making the


\textsuperscript{66} Morden, T. (1996), Principles of Management, McGrow, Hill. UK.
manufacturing firms competitive in the market. In short the following technologies are identified and explained:

**Computer-Aided Manufacture (CAM)**

It involves the use of computers directly to control production equipment and indirectly to support manufacturing operations. Direct CAM applications like a computer attached directly to production equipment in order to monitor and control the actual production process. Indirect CAM applications include materials requirement planning, quality control and inventory control systems. Jesse, *et al.* (1994)^67^, CAM refers to using computers to control production processes through the use of Numerically Controlled Machine (NC), robots, and automated assembly systems. These systems lead to reduction in the quantity and cost of labor, production of high quality of goods and afford management the ability to respond quickly to change in market demands.

**Computer-Aided Design (CAD)**

CAD provides interactive graphics that assist in the development of product and service design. It also connects to a database allowing designs to be recalled and developed easily. CAD reduces the time of developing design and improve manufacture effectively and efficiently. Boothroyd and Dewhurst (1987)^68^ said that the philosophy of designing of manufacture is to promote the simplification of product design thereby reducing the total manufacturing cost. CAD system contributes to Quality processes by making it possible for companies to issue fewer and fewer engineering change orders after production is in process. An engineering

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^67^ Jesse, T. B., et al. (2nd Ed) (1994), ibid

change order affects the way in which a product is manufactured by modifying the
design, parts, process, or even quality of the product (Jesse, *et al.* 1994).

**Flexible Manufacturing Systems (FMS)**

It is a group of machines with programmable controllers linked by automated
materials handling system and integrated by information systems that enable a variety
of parts with similar processing requirement to be manufactured. This system aims to
use computer to produce a variety of output quickly. With FMS the manufacturing
firms are able to change readily and rapidly from one production run to another and to
produce limited quantities of variety of items. In addition there can be a flexible
change during production process. The trend in business today is for customers to
order smaller quantities in order to meet JIT requirements of continuous improvement
programs. Customers also want these lower quantities at the same unit price. This can
create a problem for a company which is not flexible enough to produce smaller lot
sizes (Peter L. Grieco 1996).  

**Computer-Integrated Manufacture (CIM)**

It aims to integrate information for manufacturing and external activities, such
as order entry and accounting to enable the transformation of a product idea into a
delivered product in the minimum of cost.

**Just In Time (JIT)**

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69 Peter L. Grieco (1996), Total Cost Management: Activity-Based Costing, S. Abdul Majeed &
Co., Malaysia.
JIT production systems are concerned with eliminating waste in the total manufacturing cycle. Bhimani and Bromwich (1991)\textsuperscript{70} JIT affects every aspect of the manufacturing process including nature and volume of raw material, work in progress and finished goods. In addition, product quality and product design are affected by JIT approach. According to Horngren \textit{et al.} (2005)\textsuperscript{71}, JIT’s affect on cost system through reduced material handling, warehousing and inspection. It leads to reduce inventories cost as well as overhead costs. JIT systems also facilitate direct tracing of some costs usually classified as indirect. For example the use of manufacturing cells makes it cost effective to trace material handling and machine operating costs to specific products or product families made in these cells. Thus the benefits of JIT approach depend on the appropriate costing system as well as ability to manage costs. For example, the high inventory leads to high cost finally, inventory insurance will be high but the JIT approach leads to decrease of cost. Because JIT philosophy is to reduce storage space, handling and equipment, and inventory risk.

\textbf{Continue Improvement (CI)}

According to Horngren, \textit{et al.} (2005)\textsuperscript{72}, CI means continuous increase in quality, efficiency and effectiveness in all areas of life including personal, family, social, and work. To compete many companies are concentrating on improving different aspects of their own operations. Different industries will focus on improvement in different operational factors. The continuous improvement targets often are set by benchmarking or measuring the quality of products, services and

\textsuperscript{70} Bhimani, Al. and Bromwich M. (1991), Accounting For Just-in-Time Manufacturing Systems, CMA, Feb, 65,1; ABI/INFORM Global.


\textsuperscript{72} Horngren,Charle T., et al. (11th Ed) (2005),ibid
activities of the company against the best levels of performance found in competing companies (Horngren 2005). According to (Jesse, T. et al. 1994) the continuous improvement concept recognizes the value of eliminating non-value added activities to reduce lead time and making products (performing services) with zero processes.

Thus, continuous improvement is essential for survival in the global marketplace. TQM leads to continuous improvement in the quality of product and processes in order to meet the needs and expectation of customers. Moreover, it is a total system approach to lower real costs, and support waste elimination activities. The costing systems should provide useful signals for continuous improvement of manufacturing processes. Activity analysis leads to an ABM business model form which enables management to make decisions to improve the objectives of organization. These improvements can take the form of incremental process improvement using TQM, JIT or re-engineering.

Total Quality Management (TQM)

TQM is a management strategy in today's organization in all businesses where all functions work together to make the products with high quality. TQM originally was to control operation process and focus on meeting customer definition of quality and defect free- processes. TQM program aims to provide effective links across the value chain. There are various elements of TQM such as (1) customer focus; (2) continuous improvement; (3) people orientation; (4) quantitative methods.

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73 Horngren, Charle T., et al. (11th Ed) (2005), ibid

74 Jesse, T. B., et al. (2nd Ed) (1994), ibid
However, the automotive industry has been one of the fastest growing industries in the world. This growth is expected to continue during current century. Cost and management accounting must be aware of the influence of new technologies and change in production management on the usefulness of various accounting techniques.

In addition, the Environmental and technological developments have affected the type and the structure of data which flow into today's cost accounting systems. Rapid changes in today's field of business require successful and suitable cost accounting system to provide comprehensive and accurate cost information. The manufacturing firm's manager differentiate themselves by their ability to make proper decisions based on cost accounting information such as product costing information, financial and non-financial information. In the face of all these changes, traditional cost accounting information became irrelevant and even dangerous for managerial purposes. So it is essential to reexamine and develop it to keep pace with all new environmental requirements.
2.5 CHANGES IN BUSINESS ENVIRONMENT AND ITS IMPACT ON COST

The change in the business and economic environment lead to increase in competition created pressure on the companies for more product variety with less cost, short-life cycle in order to satisfy customers and survive in marketplace.

During 1970's and 1980's the American companies experienced a major deterioration of its share of manufactured goods in the world markets. "With the WTO's elimination of quota, one means by which the domestic industry has computed inexpensive, competitive product will be lost and the door to foreign products and US market penetration opened". US market also started providing gainful opportunities to Japanese and European companies. Companies operating in most of the major industries covering television, textile, computer, machine tools, and automobiles had to address the above issues through their renewed policies to provide quality goods and services at a competitive price that too satisfying the diverse needs of the customers (Panda 1999). In this situation American consumers started purchasing products that was made by foreign companies more than those made by American companies. The US manufacturing industries were severely threatened by this trend. The US manufacturing companies believed that the low prices achieved by the foreign companies were due to their low labor costs, which enabled them to provide the products at lower price. But that was only one of the product cost reducing factors and with times, US manufacturing companies started to recognize the new techniques that were applied in Japan such as JIT, TQM, FMS, CIM. All these resulted in a revolution in US manufacturing companies. However, global

75 Panda, N. M. (1999), ibid
The competition forced many companies not only in the US but around the world to make sweeping changes in technology and organization of their production processes. At the same time, many companies began to realize that TCA was generating inaccurate costing information. This system was beginning to show its deficiencies in analyzing manufacturing cost by distorting the true costs, providing imprecise information, and leading to poor decision making. So, with increasing competition in the global marketplace, companies required information about products, services, customers, and processes. Such information required by manufacturing companies could not be obtained from their traditional cost accounting systems.

Additionally, increasing competition, both globally and locally, made it clear that businesses should know accurately and understand the resource, processes, products, and service costs within their organization to reassess their operation and to ensure survival and growth. The management faced big challenges to regain their competitive advantage. To tackle competition, the companies should have accurate cost information and production cost, as well as the increase in competition requires more accurate product costing (Kaplan and Cooper 1998). The relation between competition and product costing accuracy can defer, depending on the definition of competition and also market or industry characteristics. So some product costing systems may change more rapidly or successfully than others when competition changes. To stay in a market place it is necessary for companies to bring the price of their products at lower cost to compete in a global market as well as in local market.

Gunasekaran et al. (1990) suggested that today's manufacturing companies in the

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face of global competition, have no choice but to implement cost system such as ABC to calculate accurate product costs. ABC helps the companies in this regard, because it focuses more on financial and non-financial measures, as well as, non-value-added activities. In fact Cooper (1989a)\textsuperscript{78} recognized that all of the ABC's described were introduced by firms that faced forceful competitive pressure. Cooper (1990a)\textsuperscript{79} stated that all managers identified forceful competition as the major reason that forced companies to adopted ABC systems. This was the issue when full-line products faced more focused competition from a compressed product line; because limited product offering distorted product costing in the traditional unit-based system.

Globalization is one of the impacts on the today's businesses. More and more markets are opening to firms from around the world. The firms can compete with each other not only at the local, regional, or domestic levels but also at the global level. WTO has been issued several agreements in order to promote free trade between the countries around the world. Kapoor (2005)\textsuperscript{80} determined five of these agreements which are: (1) Anti-dumping agreement; (2) subsidies and countervailing measure; (3) safeguard agreement; (4) role of origin and (5) custom valuation agreement.

According to Kapoor all these agreements involved maintenance of cost records on regular basis by the industry. These records should consider all cost information of the product cost for the domestic or export sales. The detailed cost


\textsuperscript{79} Cooper, R. (1990a), Cost Classification in Unit-Based and Activity-Based Manufacturing Cost Systems, Journal of Cost Management (Fall), pp. 4-14.

information of the product is essential to the investigating authorities as well as for assessing the correct custom value of imported raw material or finished goods.

Additionally, reduction of trading restraints and reduction of custom tariff encouraged the large companies to expand beyond their domestic market. The developed countries got the biggest opportunity from this situation, because the companies in these countries have the advantage of competitive factors such as variety of production, product quality, international brands and competitive prices. Also, modern managerial and accounting systems and advanced technology is available in these countries. Developing countries started facing sharp competition both in the domestic and international markets. In such situations the manufacturing companies of the developing countries must adopt and implement new management systems and accounting such as ABC.

As mentioned above, the main changes in business and manufacturing environment, the latter quarter of the last century witnessed explosion in new production strategies involving all areas of manufacturing companies, which were causing rapid changes in production process and creating product innovation such as shorter-product life cycles, demand for high quality and customer delivery service/on-time delivery.

Production lines are more complex (Turney 1992a), more specialized products for different markets, customers, and product variety increased according to demand and desire of customers. Product complexity and diversity of production also lead to increase of overhead and distortion of cost of product. The conventional

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methodology of allocation of the cost of overhead activities related to product variety and complexity on a volume-related basis distortion product cost (Brimson, J 1991)\textsuperscript{82}. Thus, all these changes have been affected the main areas of cost management and accounting as the following.

2.6 **THE IMPACT OF ENVIRONMENTAL CHANGES ON COST**

**Impact on Cost Structure**

Cost structure is a general term used to describe changes in costs as a reaction to economic stimuli. The big change in cost structure today has been much higher share of total cost represented by capacity-related costs. This change has occurred because of the shift toward greater automation, which requires more production engineering, scheduling, and machine setup activities; the emphasis on better customer service; and increase in support activities required by a proliferation of multiple products (Atkinson, et al.\textsuperscript{83}). Miller and Vollmann 1985,\textsuperscript{84} underline the changes in the cost structures and environment of manufacturing firm. They showed that output volume did not drive overhead costs in the new manufacturing environment. They also demonstrated that overhead drivers were associated with organization's transactions such as logistics (material movement), balancing (purchasing, material planning and human resources requirement), quality

\textsuperscript{82} Brimson, J. A. (1991), ibid

\textsuperscript{83} Atkinson, A. A., et al. (3rd Ed) (2003), Management Accounting, Prentice Hall of India, New Delhi.

(engineering and quality control) and change (engineering change order). They referred to these transactions as the hidden factors.

Cost structures have changed as a consequence. Direct labor costs have declined and have been replaced by increasing cost of overhead costs (burden) in all areas of business. Due to a changing cost structure, many firms have become dissatisfied with current cost accounting practices. It is important because it provides necessary information for profit maximizing decisions. However, cost structure information is used for operational decisions for example whether to produce a product, or which product to produce among limited options. Direct labor and overhead costs are two important cost elements, so they are briefly discussed below.

**Direct Labor Cost (DLC)**

In the new manufacturing and highly automated environment direct labor cost has become very less than before, on the other hand the manufacturing overhead cost has become very high more than before. In short, labor cost now is the least dominant driving force than it was during the development period of cost accounting. Instead, indirect cost has replaced labor as the dominant portion of costs for some products (Kelly 1991). In this situation the use of labor hours/cost as major basis for allocation of overhead costs in such cases, as conventional accounting does, may be misleading.

Traditionally, these problems were addressed by allocating indirect cost arbitrarily, which fails to establish a close match of costs and output. For example, most manufacturing firms have customarily used labor as the basis for indirect cost allocation to products. However, in the manufacturing industries, labor gradually

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became less significant as a portion of total cost and the continued practice of using labor as the basis of allocation contributed to a misleading image of a company's cost structure (O'Guin 1991, Hicks 1992). In the electronics industry, for instance, direct labor cost is often less than fifty per cent of the total manufacturing cost (Atkinson, et. al. 2003).

**Overhead Cost**

Due to the implementation of automated manufacturing, overhead cost has significantly increased mainly because of increase of burden elements such as equipment depreciation, supervision, and setup cost etc. Flexible Manufacturing Systems (FMS) are the models for the advanced application. Machines within a desired range of capability and designed for changeover are integrated for efficiency and controlled by computers for maximum responsiveness (Roth and Sims (1991). Automation led to a high percentage of fixed cost because of its capital intensity (James, R. M). Obviously, this affected the labor force because the manufacturing firms depended on machines more than human resources. Finally, the highly skilled laborers have become a valuable resource. Under such circumstances, the use of volume measure to allocate indirect cost (overhead) became increasingly inaccurate in

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88 Atkinson, A. A., et al. (3rd Ed) (2003), ibid


computing product costs, because they were designed for manufacturing environment with high direct labor cost.

**Impact on Costing Theory/Valuation Methods**

Absorption costing and variable costing are two major costing theories or methods which are used for valuation of products costs and inventory valuation. And both use the same basic data but their structure and processing of data are different. Both methods may be used in job order or process costing along with actual, normal, or standard costs (Raibom *et. al.* 1993). On the other hand, the net income statement under the two methods differ because fixed cost charged to expenses in variable costing is a period cost while, in the absorption costing fixed cost is considered as product cost. Both absorption and variable costing treated organization's selling and administration cost as period costs. However, these methods have advocators, as well as, objectors, which can be summarized as:

**Absorption Costing**

Absorption costing was one of the innovations of the beginning of 20th century. It treats the cost of all manufacturing activities (direct material, direct labor, variable overhead, and fixed overhead cost) as product costs. Under this method, the costs incurred by the manufacturing organizations are considered as period costs and are expensed in a manner that properly matches them with revenue. Absorption costing indicates that inventory values include fixed factory overhead (Horngren, *et al* 1996). The advocators of this method emphasized that, both variable manufacturing

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cost and fixed manufacturing cost are necessary to produce goods. So, the price of activity unit should not be less than activity unit cost, to avoid losses. This method provides information for the purpose of external financial statements. It is acceptable as a generally accepted inventory valuation method for external reporting purposes. From the point of view of objectors, this method assumes that full manufacturing capacity of the product is used to produce the products during the year, but in fact full capacity is unattainable in the real world. In other words, it is impossible and should be avoided. Unused capacity cost should not flow through to cost objectives (Cokins 2002). Other objection is that this method doesn’t help management team to do proper planning, controlling, and managerial policy (Basialy, M 2002).

According to Horngren, et al (1996), many firms continue to use absorption costing or full costing method because it is simple. Until the last decade or two this method which used variable costing for internal reporting, was expensive. Also this method is required by General Accepted Accounting Principle (GAAP) for external financial reports. However, as Cooper and Kaplan (1988a) found most senior managers are convinced that their full cost systems were inadequate for making product-related decision. Managers must consider the focus on costs and target profit in pricing decision.

Variable Costing

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94 Basialy, Makrem (3rd Ed) (2002), Cost Accounting: Authenticity and Contemporary, Strategic Insight, Part one, Modish Library, Cairo

95 Horngren, Charle T., et al. (10th Ed) (1996), ibid

Variable costing method presented in US in the last century and manufacturing companies started using it since 1960s. Under this method only the variable costs were included in production cost (direct material, direct labor, and variable overhead costs) as direct costs. Fixed overhead costs were treated as period expenses by charging against revenue during the period they are incurred (Raiborn et.al.1993;97 Homgren et. al. 199698). In the new manufacturing environment, the variable costing tended to decrease such as labor cost and on the other hand fixed manufacturing cost began to increase day-by-day. In other words, most of the product costs are fixed cost such as depreciation.

Advocators of this method assumed that, variable costing is the utility capacity costs. They believed that, variable costing is more helpful in assisting managers in performing activities relating to planning, controlling, and decision making. It provides information for management purposes. From the point of view of objectors, variable costing is not an acceptable method for inventory valuation or preparing external reports or tax purposes. Also this method may mislead managers to under price products in the advanced manufacturing environment. However, the change in cost structure affects this method. With diversity of production, the method is not useful for management to achieve their internal purposes. Finally, because of the demerits in both absorption and variable costing, managers felt that the traditional costing systems couldn’t provide accurate information about cost of their products. So, they required a new approach such as ABC, which could provide links between each manufacturing cost with the activity that created the cost.

Impact on Evaluation of Inventory

97 Raiborn, C. A., et al. (1993), ibid
98 Homgren, Charle T., et al. (10th Ed) (1996),ibid
In the past, inventories have acted as a buffer to disconnect manufacturing from the market. In other words the companies were storing a hug of goods because they believe that, (1) production in big volume led to low cost; (2) to face the competitive markets and to meet unexpected or emergency needs in the markets. Today with advanced production environment and competition environment, the companies have new ideas, new strategies such as low volume product, short product runs, and short product life cycles. JIT and TQM philosophies affected the inventory which finally leads to reduce the inventories and inventories cost. Today competitive effectiveness calls for just the opposite when the market needs it, responsiveness is provided with reduced inventory. Also there are cost implications in information system, such as Material Requirement Planning (MRP) and the support of more skilled workers in JIT system.

From the preceding discussion, all these changes lead to reduce the inventories. The decrease of inventory volume, finally, should be reducing cost of products. With TCA system usually underestimates, ignores, or overrates cost for inventory. Different products require different activities. The manufacturing firms can’t consider every product as having the same fixed costs because one allocation base can’t analyze correctly all manufacturing activities and processes. For example some products need special attention in design and engineering and some products require quality and technical support.

2.7 TRADITIONAL COST ACCOUNTING

Traditional cost accounting systems were innovated in the middle ages and designed, developed during the last two centuries when most companies manufacture a narrow range of products and direct labor, direct material were dominant factory costs. Overhead costs were small. Traditional cost accounting system was one of the
most important systems used to analyze the costs of production in manufacturing firms. This system is used in most of nations in the world, marketplaces during the past centuries and until the eighties decade of the 20th century were very small and characteristics by the small number of products with high volume, and long product life cycles. The processes of production were simple, and raw material was cheaper. Under that situation, direct labor was a major cost for manufacturing products. Direct labor and direct material costs were traced directly to products object, but the overhead costs were assigned to product objects on the basis of a labor cost, material cost or both. In other words, traditional cost accounting attributes cost to individual products by a single variable, usually the number of direct labor or machine hours or cost of material consumed (Cooper 1988a, Cooper and Kaplan 1988b, Horngren et al. 1997).

In the late quarter of the 20th century, the market dramatically changed from small market to a global market. The demand for products and behavior of customers changed as well as the raw material became scarce and price rapidly increased. The manufacturing firms started using new technologies in order to utilize material effectively to improve the quality and provide the quantity of products demand. The increase in product demand was because of the globalization and the increasing population world. Consequently, these affect added more complexities to product. For example, as variety is added to a product, the production process became more

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complex. This complexity requires the consumption of more organizational resources and special attention. Each resource has different activities and each activity has different cost patterns. Under these circumstances manufacturing companies faced more difficulties with TCA system regarding analysis of costs and measures of the activities. Moreover, the precise cost of each activity and product is needed, especially in overhead and product-mix costs. Kaplan (1984\textsuperscript{102} 1986\textsuperscript{103}) and Miller and Vollmann (1985)\textsuperscript{104} allocation of overhead based on volume drivers may not be appropriate in the new manufacturing environment.

As mentioned above, technological advances have dramatically affected both the competitive and the operating environment of many business concerns. With new manufacturing technology labor cost is becoming mostly fixed resulting in a decreasing importance of variable labor costs. A changing cost structure also implies a need to redefine or reexamine the relevant of fixed and variable cost categorization consider the reliance that customary accounting conventions place on the separation of fixed and variable costs for the implementation of many accounting practices. This major change in emphasis requires that managers learn new ways to think about and measure both product costs and product profitability. It is clear that the change in cost structure was because of technological innovations.

In the new business environment objectives of cost accounting should be change to keep with modern management requirements, for example, accurate product costing, pricing and cost estimation, activities performance management, profitability


\textsuperscript{104} Miller, J. G and Vollmann, T. E. (1985),ibid
measurement, cost reduction management, management of automation, reporting, and profitability of customers as well as integrate costing systems with inventory and manufacturing control systems.

Conventional cost accounting systems classify cost information by production and service departments not by activities. The traditional cost classification consists of grouping costs under an account most easily identified with the check disbursed (McGroarty and Horngren 1993). Additional changes arising from advances in automation including an increase in information workers and a decrease in direct labor workers. The application of TCA system in these situations that allocate overhead cost to direct labor hours will be at best irrelevant and, more likely (Kaplan 1984).  

2.8 PROBLEMS OF TRADITIONAL COST ACCOUNTING

Distortion of product cost


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described how traditional cost accounting systems may distort product cost because incomplete cost information about product costs, then take a wrong decision regarding of pricing, profitability of product. Seed (1984) describes changes needed in cost accounting in order to provide more accurate products cost information in advanced manufacturing environment.

The new business environment, the automation, and use of new technologies have been influenced the cost structure. As mentioned above, the labor cost has been decreased in spite of overhead has been increased in this case the product cost became distorted because the allocation of overhead costs was on the basis of direct cost/ hour or direct material which became less percentage of total product cost while indirect cost represent the majority cost. The majority of these indirect cost elements are not proportional to the volume of unit’s products or sold (Cooper and Kaplan 1992a). Kaplan (1988) discussed that, cost systems were designed primarily to satisfy the financial accounting requirement for inventory valuation and as a result, and this systems are not appropriate for performance measurement, operation control or

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product costing purposes. He states that a good product cost system should produce product cost estimates that incorporate expenses inaccurate in relation to that product across the origination's entire value chain. He sides that standard product cost usually consumed by product. This is because allocation of overhead was on the basis of direct labor hours, and as result can cause distortion to product costs. As overheads need not to be causally related to the demands of individual products to satisfy financial accounting requirement, many companies continue to use direct labor as the basis for allocating overheads even though it may account for less than ten per cent of total manufacturing cost. Cooper (1995)¹¹⁷ also argue that the distortion of product cost, because the inappropriate bases of allocation of overhead, can lead managers to chose a losing competitive strategy by over pricing products that are to complex unprofitable lines.

**Misallocation of indirect cost**

As mentioned above the use of direct labor, cost/hours as a basis for allocation of overhead to the product object, lead to distort of product cost. That means the allocation of indirect cost using volume-based measurement relating to direct labor hours, direct or machine hours lead to distort of product cost. This system worked well in the past since direct labor costs were a large percentage of total cost, as well as, overhead was only small fraction of the total cost. Presently, with the increased automation direct labor costs are small some times less than ten per cent of the total cost. As department using robots may have no direct labor but quite high overhead. In some high-technology firms the figures is less than five per cent Grady (1988)¹¹⁸.


However, in the manufacturing firms labor gradually became less significant as portion cost, and the continued practice of using labor as the basis of allocation contributed to a misleading image of a firm's cost structures (Hicks 1992).\(^{119}\)

Overhead allocation became the main problem of traditional cost accounting. Kaplan (1984, 1986, and 1988), discussed that the traditional overhead allocation has lost its relative and became useless with the new changes in the manufacturing environment. However, there was doubt about the results of cost accounting system since 1923, where Economist John M. Clark identified possible problems and warned that arbitrary allocation of cost, to units lead to "fictitious notions" of cost Clark (1923).\(^{123}\)

The TCA approach and management control practices are unlikely to provide positive indicators for managing contemporary firms manufacturing operations (Kaplan 1983).\(^{124}\) Cooper (1987) states that several changes in the manufacturing systems have occurred in the increased use of machine hour and materials cost unfortunately do little to overcome the most serious problem in existing cost system designs. However, the concealing of the source of overhead costs will be confused the organization management.

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\(^{120}\) Kaplan, R.S (1984), ibid

\(^{121}\) Kaplan, R.S(1986),ibid

\(^{122}\) Kaplan, R.S (1988),ibid

\(^{123}\) Clark, J. M. (1923), The Economics of Overhead Costs, University of Chicago press, Chicago.


In the current era, companies produce a wide range of products and direct labor represents only a small percentage of total cost. The increase of overhead cost against decrease of labor cost due to increasingly automation production and increase of information technology application. In addition, TCA introduce false information when overhead expenses are high and profit margins are small (Johnson and Kaplan 1987, Cooper 1990a, Cooper and Kaplan 1991, Cokins 2002). In traditional approach there is lack of cause and effect relationship between the cost allocation bases and indirect cost pools due to one or few cost pools for each department or entire plant having little homogeneity are used. However, inaccurate cost information that is provided by traditional costing methods may lead to wrong decisions.

2.9 COST SYSTEMS IN PORT

Many studies have been conducted on cost systems in manufacturing sector. Cost system in service sector is gaining importance in recent times only. More specifically, the empirical estimation of port cost functions started in the seventies with a study carried out by Wanhill (1974) aimed at designing a model which allowed determination of the optimal number of berth minimizing total cost for port use. These costs resulted from the addition of two different components: the cost of

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127 Cooper, R. (1990a), Cost Classification in Unit-Based and Activity-Based Manufacturing Cost Systems, Journal of Cost Management (Fall), pp. 4-14.


providing infrastructure (berth) and the cost of the ship’s stay in the port. According to *Wanhill (1974)*, future investments and planning should be made taking into account the fact that port services cannot be stored and, that, therefore, there is a trade-off between port capacity cost and the cost of ships’ stay in the port (service time plus waiting time) that is determinant and should be considered when planning.

The manual on port planning prepared by the UNCTAD Secretary in 1978 for developing countries follows the same line of work as *Wanhill (1974)* study. It relies on Monte-Carlo simulation techniques to calculate the costs of different types of terminals according to terminal features and ships’ stay in the port. It points out that port planners should bear in mind that a planning policy exclusively aimed at reducing operators’ port costs to the least (i.e., without considering ship’s waiting time) will generally result in a suboptimal service level. This, in turn, might result in the imposition of charges for port congestion which will not be economically acceptable. At the same time, the manual shows the difficulty to measure the return on port terminal operations on the basis of the data generally available in the ports’ yearbooks and yet this it is essential to make estimations of the production and cost function in order to analyze productivity growth, economies of scale and technical change. The branch of the literature concerned with the optimal planning of ports or port terminals which started with the two papers mentioned above, continued with the papers by *Janson and Sheneerson (1982)*, *Sheneerson (1981)*, *1983*, *Janson*.

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131 *Wanhill, S.R.C. (1974)*, ibid


(1984), and Fernández et al. (1999). All these papers consider that the optimal use of a berth results from minimizing the addition of operators’ port costs and the cost of ships’ stay in the port. This explains why all these papers adopt a queuing model as the basic form of port service production function, at the same time that they assume ships’ arrival is at random and follows a Poisson distribution function while service time follows an exponential distribution. Two criticisms have been leveled against these models which add users and operators’ costs. On the one hand, the vessel’s time is introduced as a productive factor in the port cost function, even though –following Hooper (1985) it is more convenient to consider it a product component representing service quality. On the other hand, when the productive process to be modeled includes more than two inputs or outputs, as in the case of ports, the selected functional form should not impose their separability a priori (Burgess, 1974), but it should be empirically contrasted. Furthermore, costs analysis should enable to carry out evaluations of ports’ return and productivity by calculating different indicators, such as in the studies by De Monie (1989), Dowd and Lechines (1990) and Conforti (1992). Additionally, it would allow

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comparisons of the productive efficiency among various firms and throughout the time for a single firm.

Following this line of study, a new branch of research which differs from the typical papers considering that firms are minimizing costs and, therefore, allows the analysis of situations in which this assumption is breached. Thus, it admits the possibility that firms may be inefficient.

2.10 SUMMARY

This chapter has discussed the part one of the literature review relevant to the development of cost accounting system during the past two centuries up to new innovation called ABC. Some limited research has been carried out in the cost systems relevant to Ports. The new environment changes in the business and manufacturing areas discussed in this chapter included its influences on the cost and management accounting. These changes were the promotion factors which led to evolution and development of ABC. However, Activity Based Costing (ABC) as the part two of literature review of this study is discussed in the following chapter.