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Activity Based Costing in Bangladesh: An Empirical Study of the Level of Sophistication

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ABATRACT

Cost and management accounting environment has been changed radically with the advent of advanced manufacturing technologies, fierce competition, shortening life cycle, strategic alliances and so many other parameters. Aptly, there is a paradigm shift of accountants' role and duties in a corporate set up than ever before. To address the need of management, the best tool developed so far in cost and management accounting arena is Activity Based Costing (ABC). ABC is a technique of charging product for the consumption of resources scientifically and thus attracts the researchers from multiple fields. How the firms in developing countries like Bangladesh are interfacing with this tool is a question of research. Thus, this study picks up the issue of surveying the application status of ABC in Bangladesh. At the same time, the research targets to study the level of sophistication achieved by Bangladeshi firms. The successful implementation of ABC requires sophistication in terms of skill, commitment, maturity and team-building. The studies on ABC and sophistication are abundant in literature that helps the researcher to develop the conceptual framework and research methodology. Both primary and secondary sources are explored to make the research findings worthy. A semi-structured questionnaire is administered to give the research a practical look. Multiple linier regression, stepwise regression and logistic regression is used to draw inferences. For judging qualitative issues, exploratory factor analysis is conducted with relevant methodologies of reliability and validity tests. The research concludes that cost driver, cost pool and cost pool_driver interrelationship explains the level of sophistication in a better way that supports the basic norms of ABC. It also supports the proposition that ABC system is a sophisticated system and traditional system is unsophisticated. The findings of the research add values to the current state of knowledge and will work as a future reference for researches that will be done in the related areas.

Key words: Activity based costing (ABC), sophistication, study, Bangladesh.

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1. Introduction

Cost and managerial accounting practices in Bangladesh are still in their infancy characterized by low number of expert professionals, state of unstructured competition, abundance of service industries, less demand from the market, low institutional capacity etc. But for sustainable economic development and strong economic structure, the practice of professionalism in cost and managerial accounting arena is of prime importance. As we have started to face global competition and the business environment is getting more complex, professionalism is demanded now-a-days in this area. What we need is to go along the path of sophistication, though it is a matter of debate, for our own sake. This research tries to shed light on the current level of sophistication, factors that affect the level of sophistication, identify the obstacles and find some feasible solution to attain more sophistication.

Most of the sophistication in cost and managerial accounting encompasses activity based costing, an alternative to the traditional way of accounting for overhead costs. Under ABC model costs have been analyzed in terms of activities (identifying activity centers), the cost pools (accumulating similar type of cost categories into one) have been formed, and finally costs are assigned to products and services (cost objects) based on the amount of resources consumed (activity drivers) in the process of manufacturing or providing a product or service. Thus, ABC demands some critical information for finalizing its process that requires sophisticated practices. Traditionally, the process of cost accumulation and allocation is very simple where costs have been allocated on the products or services by using a single activity driver in most of the cases. In such a situation, demand for information is minimal, sophistication is totally absent, and pricing is seriously distorted. But today, due to the changes in competition, globalization, tune of investment and complex manufacturing process, we need to reshape it and ABC is a right replacement to cope up with the changing situation. ABC implementation can help make employees understand the various costs involved, which will in turn enable them to analyze the cost, identify the value added and non-value added activities, implement the improvements and realize the benefits. This is a continuous improvement process in terms of analyzing the cost, to reduce or eliminate the non-value added activities and to achieve an overall efficiency. But, the implementation of ABC is not so easy. Furthermore, Robert Kaplan and Steven Anderson have suggested Time-Driven ABC. This is a new approach to sidestep the difficulties associated with large-scale ABC implementation (HBR, 2004). In this revised model, managers estimate the resource demands imposed by each transaction, product, or customer, rather than relying on time-consuming and costly employee surveys. Sophistication in cost and managerial accounting practices is required for these functions, namely; creating value for customers, maximizing wealth for owners, ensuring effective use of resources and confirming the existence of the entity on the face of bitter competition.

The adoption and application of ABC ensures sophistication in cost and managerial accounting practices. Most of the tools designed for strategic cost and managerial accounting decisions are highly concentrated within the circumference of ABC. Though the world has witnessed a significant development in the field of sophistication, in Bangladesh we are still in infancy in terms of using different tools in this field. Thus, the researcher is motivated to conduct a study to identify the level of sophistication achieved by Bangladeshi firms and the application status of ABC as well. To reach the goal of the research, a field survey is initiated through a semi-structured questionnaire containing both qualitative and quantitative aspects of the issue. Different inferential statistical tools like multiple linier regression, stepwise regression and logistic regression are applied to test the hypotheses assumed for test in the study. For analyzing the qualitative issues, factor analysis is used as a data reduction methodology and the concentration of parameters across different factors give some specific meaning.

The report is structured as follows: next section presents relevant literatures followed by research questions and research design. The following section deals with the analysis and findings in detail followed by the rationale of the study. Finally the paper ends with a concluding remark.

1.1 Rationale of the Study

The selection of such a topic has sufficient rationality. Accountants are the technical people as they have the nuts and bolts to do the troubleshooting function relating to financial matters. The sophistication is required to be an expert troubleshooter in the field. The study has an intention to make the accountant a troubleshooter with all necessary tools and techniques. In Bangladesh, our status and environment do not give us the permission to do so. Thus, the researcher finds the rationality to work in this area. Again, the literature of the current focus is not rich enough though there are a handful amount of studies done on ABC. Thus the basic foundation of the research comes from the published documents and the researcher gives a new dimension to the present research. Most of the ABC studies are conducted to find out the logic behind using and not-using ABC. But, no research addresses the issue of how the use of ABC may lead to the attainment of sophistication. It may seem to somebody that the study is simply a replication of studies done in economically advanced countries. The identification of ABC in attaining sophistication along with the qualitative factors considered in the study is made to make the study holistic in approach. It is believed that the study fills the gap in current state of knowledge and enlarges the scope of research in the area.

2. Literature Review

During the 1980s, Kaplan, in his review of The Evolution of Management Accounting (1984) and with Johnson in the Relevance Lost book, leveled strong criticism at the management accounting practices of the day. Virtually all of the (management accounting) practices employed by firms today and explicated in leading cost accounting textbooks had been developed by 1925 ... there has been little innovation in the design and implementation of cost accounting and management accounting control systems (Kaplan, 1984, p. 390). This statement reflects the concern of the author regarding the level of sophistication in cost and managerial accounting practices. However, a growing body of literature (Johnson, 1972; Hoskin & Macve, 1988; Tyson, 1990; Fleischman & Parker, 1990, 1991, 1997; Edwards & Newell, 1991; Fleischman et al., 1996; Carmona et al., 1997) provides evidence that sophisticated costing techniques were used in the early stages of, or even before, the Industrial Revolution. Fleischman and Parker found complex cost management techniques both in a cross sectional survey of 25 British industrial firms (1991) and in a single and comprehensive case study (1990). These authors hypothesize that the existence of several cost accounting techniques and uses are indicative of the development of mature cost management: cost control techniques (including responsibility cost management), accounting for overhead, costing for decision-making (including cost comparisons) and budgets, forecasts and standards.

Since the early 1980s a number of 'innovative' management accounting techniques have been developed across a range of industries. The most notable contributions are activity-based techniques which include activity-based costing, activity-based budgeting and activity-based management, strategic management accounting and the balanced scorecard. These new techniques have been designed to support modern technologies and new management processes, such as total quality management and just-in-time production systems, and the search for a competitive advantage to meet the challenge of global competition. It has been argued that these 'new' techniques have affected the whole process of management accounting (planning, controlling, decision-making, and communication) and have shifted its focus from a 'simple' or 'naive' role of cost determination and financial control, to a 'sophisticated' role of creating value through the use of resources.

Sophistication of a management accounting system refers to the capability of the system to provide a broad spectrum of information relevant for planning, controlling, and decision-making all with the aim of creating or enhancing value. Study of the level of sophistication has not received so much attention to the researchers. Drury and Tayles (1995) conducted a study of the state of management accounting practices and identified some factors that affected the level of sophistication. To measure the sophistication level of the UK food and drinks industry, CIMA (2006) used the four stages of management accounting evolution model introduced by IFAC (1998).

ABC is closely related with level of sophistication in cost and managerial accounting practices. Without a successful implementation of ABC, sophistication cannot be demanded. It may be said that ABC paves the way for sophistication and supplies all necessary resources for sophistication. And, there are a lot of studies conducted on ABC from different perspectives. ABC was clearly defined in 1987 by Robert S. Kaplan and W. Bruns in a chapter in their book Accounting and Management: A Field Study Perspective (Harvard Business School Press, 1987, ISBN 0-87584-186-4). Cooper and Kaplan described ABC as an approach to solve the problems of traditional cost management systems. ABC has received a great deal of attention as a cost management innovation. A review of leading journals for practicing management accountants, *Management Accounting* and the *Journal of Cost Management*, revealed that ABC accounted for 35 percent of the articles published over the period 1994-1996. Numerous proponents of ABC argue that its methods are necessary to trace overhead costs to cost objects, and thus properly account for batch and product-level costs (Cooper, 1990), manufacturing complexity (Jones, 1991), specialty product costs (Srinidhi, 1992) and diverse business environments (Cooper and Kaplan, 1988). Many also recommend using ABC to support process improvement (Turney, 1991) and to develop cost effective product designs (Cooper and Turney, 1989). Doglus and Marinus (2000) conducted a study to investigate the association of ABC with the improvement of financial performance. ABC has been promoted and adopted as a basis for making strategic decisions and for improving profit performance (Kaplan and Norton, 1992; Turney, 1992; Cooper and Kaplan, 1991b). In addition, as Kaplan (1990) predicted, ABC information is now also widely used to assess continuous improvement and to monitor process performance. Although ABC systems are most often associated with manufacturing companies, they can be applied in both manufacturing and service organizations (Rotch, 1990; Tanju and Helmi, 1991). The following table gives an overview of the application of ABC in different countries.

Authors	Country	Population	Response Rate	Period	Implementation Rate
NAA (1991)	United States	CMAs of 2500 firms	23%	Summer, 1991	11% had implemented ABC
Innes & Mitchell (1991)	United Kingdom	1990 survey of manufacturing and financial service firms	26%	September, 1990	6% began to implement ABC, 33% were considering, 52% had not considered, 9% has rejected
Ask & Ax (1992)	Sweden	Engineering Industry	67.3%	January-April, 1991	2% are applying ABC, 23% are considering
Bright et al. (1992)	United Kingdom	Manufacturers	12%	Latter half of 1990	32% are re-applying ABC
Nicholls (1992)	United Kingdom	179 companies that attended an ABC seminar in May 1990	34.6%	January, 1991	10% had implemented ABC, 18% were piloting ABC techniques
IMA (1993)	United States	CMAs of 1,500 firms	27%	Spring, 1993	36% has implemented ABC
Armitage & Nicholson (1993)	Canada	Financial Post list of 700 largest companies in Canada	50%	Summer, 1992	14% are applying ABC, 15% are considering
Drury &	United	Sample of 866	35%	1991	ABC introduced

Tayles (1994)	Kingdom	business units drawn from a population of 3,290 manufacturing firms			in 4% of the firms, 9% are planning the introduction, 37% are considering, 44% had not considered, 5% rejected
Innes & Mitchell (1995)	United Kingdom	Firms listed in TIME 1000	33.2%	Early 1994	21% currently use ABC, 29.6% are considering, 13.3% have assessed and rejected and 36.1% have not considered
Lukka & Granlund (1996)	Finland	Manufacturing firms	43.7%	November 1992 to January 1993	25% were considering, 5% were implementing
Bjornenak (1997)	Norway	Manufacturing organization	57%	1994	40% wanted to implement, were currently implementing or had already implemented ABC
Gosselin (1997)	Canada	Manufacturing strategic business units	39.5%	Oct. 1994 to Jan., 1995	30.4% are implementing ABC
Groot (1999)	Netherlands and USA	Food Industry	24% and 17%	1994-95	17% (USA) and 24% (Netherlands) are implementing ABC
Clarke et al. (1999)	Ireland	Manufacturing firms in the Business and Finance listing of Ireland	41%	Not mentioned	11.8% currently use ABC, 20.6% are considering, 12.7% have assessed and rejected, and 54.9% have not considered
Innes et al. (2000)	United Kingdom	Firms listed in TIME 1000	22.8%	1999	17.5% currently use ABC, 20.3% are considering, 15.3% have assessed and

					rejected, and 46.9% have not considered
Bescos et al. (2002)	Canada and French	Financial Post 500 in Canada and members of the Association of Financial Directors and Management Accountants	21.2% in Canada and 4.7% in France	Summer and Summer of 1999	23.1% of firms had adopted ABC in Canada and 23% in France. 9.3% were examining the possibility of adopting ABC in Canada and 22.9% in France
Cotton et al. (2003)	New Zealand	Corporate sector members of the Institute of Chartered Accountants of New Zealand (Organizations with more than 100 employees)		September 2001	20.3% currently use ABC, 11.1% are considering, 10.8% have assessed and rejected, and 57.8% have not considered.
Kianni & Sangeladji (2003)	USA	500 Fortune largest industrial corporations	21.6%	Fall, 1999	40% recently started implementing, 11.8% are having ABC well established
Pierce (2004) and Pierce & Brown (2004)	Ireland	Top 500 companies and top 50 financial services companies from the 2001 Business and finance listings of top Irish firms	23.2%	June, 2002	27.9% currently use ABC
Cohen et al. (2005)	Greece	Leading Greek companies in the manufacturing, retail and service sectors	31.1%	March to May 2003	40.9% of adopters, 31.9% of ABC deniers, 13.6% of supporters and 13.6% of ABC unawares

Gosselin (1997), and later Baird et al. (2004), examined ABC and ABM from a different perspective. Instead of considering ABC as a single innovation Gosselin (1997) considered that ABC was part of a much more complex management innovation that he called "activity management". Under this approach, AM was considered as "the effective and consistent organization of the enterprise's activities in order to use its resources in the best possible way to achieve its objectives" (Brimson, 1991). According to Gosselin (1997), AM can be divided into four levels of complexity: AA, ACA, pilot ABC and full ABC. AA is the initial level while full ABC is the final and the most complex one. Full ABC subsumes pilot ABC, ACA and AA. Pilot ABC requires the completion of the ACA and AA. AA is a prerequisite to performing an ACA.

AA consists of reviewing the activities and the procedures carried out to convert material, labor and other resources into outputs. Activities that do not contribute to the value of those outputs are identified in AA in order that they may be replaced, dismissed or removed. AA is quite similar to process analysis and business process re-engineering (Hammer & Champy, 1993; Harrington, 1991). These two approaches focus on the process itself while AA concentrates on the activities within each process.

AA does not include financial or accounting analyses. It is aimed at identifying areas of wasted effort, eliminating waste and improving cycle time, product quality and speed of response to customer demands. However, cost reduction is not necessarily the primary objective of AA. Reduction of cycle time, quality improvement, and zero inventories are also the objectives of such analysis. Just in time inventory management, cellular manufacturing, continuous flow processing, flexible manufacturing systems implementation and TQM are all initiatives under which AA may be performed. AA is the simplest version of AM. AA does not require cost analysis and does not necessarily lead to a new overhead allocation method. Most relevant to this approach, AA is also a pre-requisite to all three of the AM approaches examined here.

ACA is the next level in the AM hierarchy. It consists in analyzing the factors that affect the cost of an activity. ACA focuses on cost minimization by identifying the cost drivers and their associated activities and by tracing the interactions between cost drivers and activities (Aiyathurai et al., 1991). There are two different levels of cost drivers. Porter (1980) uses the concept of cost drivers as a designation for structural variables that explains the cost of an activity. Following Porter, Shank (1989) and Shank & Govindarajan (1989, 1993) classify cost drivers into two categories: structural and executional cost drivers. Structural cost drivers such as scale of investment and product diversity involve strategic choices made by the firm about its economic structure. Executional cost drivers are factors on which an organization depends to execute its activities successfully. Cooper (1988a) defines a cost driver as a measure of the manner in which products consume activities. Setup time, number of setups, material handling hours, ordering hours are examples of cost drivers under this definition. The strategic cost management and ABC perspectives on cost driver complement each other in a strategic cost management perspective. The first represents the structural or executional cost determinants whereas the second is the operationalization of those determinants. For example, product diversity is a structural cost driver (Shank, 1989), the number of setups or setup time represent some ways to measure the impact of product diversity on production costs.

In an AM system, ACA enables management to identify the costs of each activity and the factors that cause them to vary. Identifying the cost drivers of an activity may enable managers to better understand how they perform a task and may help them find new procedures, activities and processes to reduce costs. Therefore, ACA focuses on the costs of wasted efforts. It may be accomplished without implementing a product costing system that allocates overhead costs on the basis of these drivers. Nanni et al. (1992) suggested that many firms have not implemented ABC system because most of the benefits are found in the ACA. Organizations would prefer to take actions to reduce the effects of the drivers instead of using them to allocate indirect costs. As an extension beyond simple AA, ACA allows firms to prioritize the changes they want to make.

Gosselin (1997) divided the use of ABC into two levels: pilot ABC and full ABC. Pilot ABC is usually the first level in an ABC implementation process but may be an end in itself. It consists of designing and installing an ABC system for only one aspect of an organization such as a department or a product line. Most of the firms, if not all, that have implemented ABC have limited themselves to this level. The purpose of a pilot ABC system may depend on the organization in which it is implemented. Full ABC is the ultimate level in the implementation of an ABC system. It consists of a cost accounting system in which all products and services are valued on the basis of the output of the ABC system. ABC cost information is used for financial reporting as well as for managerial purposes such as make-or-buy decision, transfer pricing, performance measurement, and strategic cost management. Full ABC is still at the theoretical level. Most of the field studies and surveys, if not all, performed during the 1990s, showed that this level was never achieved. This state of affairs is even recognized by ABC proponents (Kaplan and Anderson, 2004).

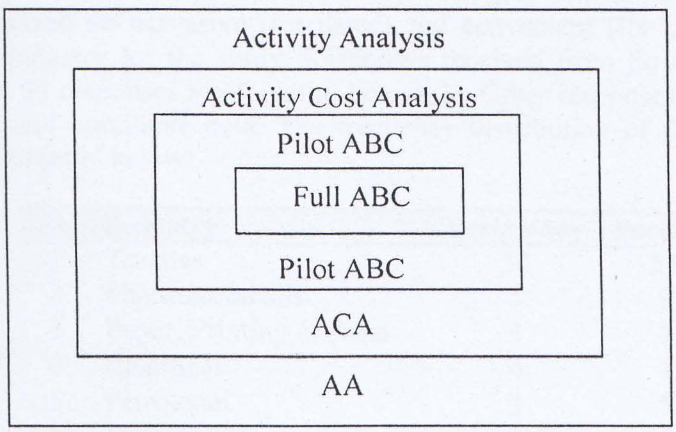


Figure 1: The four levels of Activity Management (AM)

Literature includes a lot of references to ABC that may lead to the misconception that ABC and sophistication is the same. This is not the case. The logic of having ABC literature is that it leads any system tuned for sophistication. As the literature of ABC is rich and it has a relationship with sophistication, the theoretical foundation of the research work comes from ABC literature.

5	Vice Presidents	1	1.82
6	Managing Directors	1	1.82
7	Chairman	1	1.82
	Total	55	100
	Educational Background		
1	Bachelor	-	-
2	Master	25	45.45
3	Professional	30	54.55
4	Others	-	-
	Total	55	100
	Experience in Years		
1	Less than 5 years	10	18.18
2	5-10 years	30	54.55
3	More than 5 years	15	27.27
	Total	55	100
	Age		
1	Less than 30 years	8	14.55
2	30 – 40 years	33	60.00
3	40 – 50 years	14	25.45
4	More than 50 years	-	-
	Total	55	100

4.2 Methodology

The research is based on both primary and secondary sources of information. Different published documents like texts, journals, speeches, web materials, periodicals, working papers etc. are used to develop the theoretical foundation of the research. Questionnaire, including both quantitative and qualitative factors, is used as a primary data collection method. Quantitative factors are used for drawing statistical inferences whereas qualitative factors are used to supplement the study. Different statistical tools like multiple linier regression, stepwise regression, and logistic regression along with data reduction technique like exploratory factor analysis for qualitative issues make the research methodology holistic.

4.3 Factors to be Used

Identifying the factors that have sufficient control over the sophistication process is important here. Thus, the study identifies the factors in defining sophistication level both individually and aggregately. The factors that have a considerable bearing on the sophistication level are initially identified as follows:

1. Number of Cost Pools
2. Number of Cost Drivers
3. Pools and Drivers Interrelationship
4. Existence of Independent Department
5. Existence of Professionals Working in the Departments
6. Size of the Organization in terms of Annual Turnover
7. Percentage of Overhead Cost as a Percentage of Cost of Goods Manufactured
8. Number of Years in Operation
9. State of Competition
10. Characterization of Production Process

4.3.1 Cost Pools

Cost Pool is of paramount importance for cost allocation. The cost categories that are similar in terms of resource consumption should be combined together to form a cost pool. Thus, hundreds of smaller cost categories may be brought together to have a single cost pool that reduces the second level cost allocation. But, it never means that we should have lower number of cost pools. Rather, such number depends on the rate of resource consumption by a product in an organizational set up. As the rate of resource consumption varies significantly, we need more cost pools to have the right cost drivers selected for subsequent cost allocation.

> ***Hypothesis 1(H1): The more the number of cost pools, the higher the level of sophistication.***

4.3.2 Cost Drivers

Number of cost drivers used for allocating overhead costs into cost object has a good bearing for defining the extent of sophistication. As the company uses more and more cost drivers, it is going to be more sophisticated in the sense that the indirect costs are going to be traced with the cost objects more accurately. Traditionally, companies tend to use a single cost driver for allocating overhead costs onto product demanding simplicity as a reason; say, labor hour for a labor intensive industry and machine hour for a capital intensive industry; resulting in a serious distortion in product pricing. Thus, the use of multiple cost drivers is a requirement for sophistication that requires more time, money, effort and last but not least, commitment.

> ***Hypothesis 2(H2): The more the number of cost drivers, the higher the level of sophistication.***

4.3.3 Pool and Driver Interrelationship

If the pool and driver interrelationship is very simple; i. e., single driver is used for single cost pool; less sophistication is required. But, if we need multiple drivers for a single cost pool due to the varied level of resource consumption by a specific product from a single cost pool, we need more sophisticated system to accommodate the situation.

> ***Hypothesis 3(H3): The more complex relationship exists between cost pool and cost driver, the higher the level of sophistication.***

4.3.4 Independent Department

Having independent department, responsible for cost and managerial accounting information, gives the testimony that the information is of greater importance for the management. When management demands more frequent information relating to cost and managerial accounting, they must provide for that in terms of installing a separate department dedicated to the specific function as mentioned.

Hypothesis 4 (H4): Existence of independent department dealing with cost and managerial accounting data ensures more sophistication.

4.3.5 Existence of Accounting Professionals

Accountants are the professionals who deal with the technical issues. Use of more sophisticated and technical scientific tools in the field of cost and managerial accounting gives it a separate identity. Thus, to handle the technicality it needs troubleshooters who are technically expert and fit for the work. Professionalism in the field of cost and managerial accounting practices ensures the maximum utilization of resources, creating value for monies and justifies the reason for being existed. Thus having accounting profession for guiding an organization is a must for having sophisticated cost and management accounting practices.

Hypothesis 5(H5): Existence of accounting professionals dealing with cost and managerial accounting data ensures more sophistication.

4.3.6 Size

Many researchers have argued that organizational size facilitates innovation (Aiken and Hage, 1971; Kimberly and Evanisko, 1981; Ettlie et al., 1984). Large organizations have more complex and diverse facilities that aid the adoption of a large number of innovations (Nord and Tucker, 1987). Previous empirical studies have noted a positive relationship between company size and adoption of innovations (Blau and Mckinley, 1979; Dewar and Dutton, 1986 and Damanpour, 1992). There is also evidence that size is an important factor influencing the adoption of more complex administration system (Moores and Chenhall, 1994).

Previous studies have also noted a positive relationship between company size and management accounting system sophistication. In particular, some studies of ABC adoption rates have shown that adoption is much higher in larger organizations (Innes et al., 2000 and Malmi, 1999). A possible reason for this is that larger organizations have relatively greater access to resources to experiment with the introduction of more sophisticated accounting systems. Several surveys have also indicated that an important factor limiting the implementation of more sophisticated management accounting system is the prohibitive cost (Innes and Mitchell, 1995 and Shields, 1995). As larger organizations have more resources to develop innovative systems it is also more likely that they will be able to implement more sophisticated costing systems. Above all, large organizations can afford all costs for skilled manpower, infrastructure and system that are required for sophisticated system to be in action. Now, size is a relative term. The quantification of size may be made in terms of square feet, manpower, capital invested, turnover etc. As I am talking about the sophistication of cost and managerial accounting system, I assume that in this case annual turnover will represent the size of organizations in a more accurate way.

Hypothesis 6(H6): The greater the size of an organization (in terms of tune of turnover), the higher the level of sophistication.

4.3.7 Percentage of Overhead Cost

Cost structure is very important for conceptualization of the significance of cost and managerial accounting system. Cost structure simply represents the respective share (weight) of different cost element that comprises the total cost of the cost object. Both simplistic and sophisticated costing systems accurately assign direct cost to cost objects. As a general rule increasing levels of sophistication in the design of cost systems should lead to more accurate assignment of indirect cost to cost objects. Johnson and Kaplan (1987) claim that over several decades there has been a dramatic change in cost structures resulting in a need for companies to modify their costing systems. Cooper (1988a) has also claimed that overhead costs, as a percentage of total costs, have increased over the years, particularly in recent years, causing unsophisticated systems based on direct labor hours to report increasingly distorted product costs. And now, this is undoubtedly true that many organizations, apart from Lean, JIT and TOC, have ensured mass production through automation that needs a lot of investments in fixed facilities resulting in increasing indirect costs in terms of overheads. As the share of indirect costs as a percentage of total costs increases, more sophisticated cost accounting system is required to reduce the distortion in product costs through wrong allocation of indirect costs.

Hypothesis 7(H7): The greater the proportion of indirect costs within an organization's cost structure, the higher the level of the sophistication.

4.3.8 Number of Years in Operation

Life cycle is a considerable factor for identifying the level of sophistication. As organizations are having more years in operation, it is going to be more matured that simultaneously creates a complex environment. In infancy period, organizations enjoy a lot of support from various parties, say, relaxed legal requirements, tax holiday, lesser competition etc. But, as it is going to be matured, all sort of incentives and flexibilities are withdrawn and it has to face a bitter competition. Then, it requires more information for running its day to day operation that necessitates the installation of a sophisticated system.

Hypothesis 8(8): The more the number of years in operation, the higher the level of sophistication.

4.3.9 State of Competition

Several studies have examined the relationship between the design and use of management accounting systems and the intensity of competition (Libby and Waterhouse, 1996; Simons, 1990). Bruns and Kaplan (1987) identify competition as the most important external factor for stimulating managers to consider redesigning their costing systems. Market may work as an important organ for organization's long term sustainability. If there are a lot of active players in a market in a specific segment, all of the players should compete for the goal. In a market where there is no competition as you are the only player, nobody will be motivated to spend for having sophisticated cost and managerial accounting system. Now, most of the organizations work in a competitive environment. Day by day the competition is increasing and we need an immediate switch from unsophisticated system to sophisticated one to ensure growth and even sustainability.

Hypothesis 9(H9): The greater the degree of competition, the higher the level of sophistication.

4.3.10 Production Process

Production process may be manual or automated. In a manual production process, overhead costs incurred due to actual labor hours worked. So, under manual production process overhead costs are allocated on the basis of direct labor hours that require less sophistication. But, if the production process is fully automated then a complex cost driver-object interrelationship exists that makes the cost allocation process difficult. And, in such a situation you have every possibility of charging your cost objects in a faulty way. Thus, the characterization of production process sets the level of sophistication.

Hypothesis 10(H10): The more the system is moving towards automation, the higher the level of Sophistication.

5. Findings and Analysis

This section deals with the analysis of major findings of the study, which are based on 53 cases as there were 2 non-responses.

5.1 Department dealing with Cost Management Issues

For a sophisticated cost management system in operation, it is customary to have an independent department dealing with related issues and specific persons to be held responsible. Thus, the questionnaire includes a question asking the respondents to know the existence of any departments to address the issue. The survey results that in 75% cases, companies have independent department dealing with the specific job.

Existence on Independent Department	Frequency	Percentage
Yes	40	75
No	13	25
Total	53	100

5.2 Professionals working for the Firm

Running sophisticated system necessitates experts in the respective field. Without expertise, innovative practices cannot be expected. Thus, the study searches for the firms' behavior in utilizing the experts' knowledge in respective fields. The outcome of the survey results in the following which is very much encouraging:

Use of Professionals' Expertise	Frequency	Percentage
Yes	45	85
No	8	15
Total	53	100

5.3 Status of ABC Implementation

Applying ABC to the fullest extent is a debated issue. Thus, the answer is not dichotomous rather situational. To address this issue, the questionnaire includes a question to know the status of the respondent firms in attaining the degree of implementing ABC. The results are arranged as below:

Status	Frequency	Percentage
a. Never Considered	11	21
b. Decided not to use ABC	00	00
c. Favorable to introduce ABC	07	13
d. Intentioned to introduce ABC	06	11
e. ABC implemented	24	45
f. No answer	05	09
Total	53	100

5.4 Cost Driver

A **Cost Driver** is any activity that causes a cost to be incurred. The Activity Based Costing (ABC) approach relates indirect cost to the activities that drive them to be incurred. In traditional costing the cost driver to allocate indirect cost to cost objects is volume of output. With the change in business structures, technology and thereby cost structures it is found that the volume of output is not the only cost driver. Some examples of indirect costs and their drivers are: maintenance costs are indirect costs and the possible driver of this cost may be the number of machine hours; or, handling raw-material cost is another indirect cost that may be driven by the number of orders received; or, inspection costs that are driven by the number of inspections or the hours of inspection or production runs. Generally, the cost driver for short term indirect variable costs may be the volume of output/ activity; but for long term indirect variable costs, the cost drivers will not be related to volume of output/ activity. John Shank and Vijay Govindarajan list cost drivers into two categories: Structural cost drivers that are derived from the business strategic choices about its underlying economic structure such as scale and scope of operations, complexity of products, use of technology, etc and Executional cost drivers that are derived from the execution of the business activities such as capacity utilization, plant layout, work-force involvement, etc. To carry out a value chain analysis, ABC is a necessary tool. To carry out ABC, it is necessary that cost drivers are established for different cost pools.

For each of the activity cost pools, a cost driver must be determined. There are basically three types of cost drivers:

1. **Volume:** The cost driver is based on units of work (e.g., number of orders.) The cost of the activity increases as more units are processed.
2. **Time:** The cost driver is based on the length of time taken to complete the activity. The cost of the activity increases based on the length of time required to complete the activity. It does not matter how many products are produced (e.g., when retooling machines, the cost driver is the length of time required to complete the retooling of machines).
3. **Charge:** The cost for the entire activity is charged directly to the cost object (e.g., all costs associated with the retooling of machines for a product is charged directly to the end-product).

In general, a charge-type cost driver is used very rarely. The most common drivers are volume and time. The driver used depends on the nature of the activity. The cost of the activity may increase based on the number of units handled or based on the length of time required to complete the activity. It could also be a combination of these two driver types. For example, the time required to test a product may vary based on the product under test and the number of units to be tested. The costs of testing increase as more products are tested. Moreover, the testing time will vary based on the complexity of the products (e.g., a complex software program takes longer to test than simple software program). Say it takes four hours to test a simple program and ten hours to test a complex program, and all other costs are the same with respect to testing the two types of programs. The cost of testing two simple programs (i.e., 2 programs × 4 hours/program = 8 hours) is less than the cost of testing one complex program (i.e., 1 program × 10hours/program = 10 hours). The survey results in a very important finding where firms use a wide variety of cost drivers which is evident in the following table:

SL	Cost Driver	Frequency	Percentage
1	Labor Hour	25	20
2	Physical Output	19	15
3	Material Cost	16	13
4	Direct Labor Cost	16	13

5	Machine Hour	15	12
6	Unit/Metric ton	4	3
7	Area Occupied	4	3
8	Order Size	3	2
9	Kilowatt	3	2
10	Sales Value	3	2
11	Machine Value	3	2
12	Consumption Unit (Liter/KW)	2	2
13	Horse Power	2	2
14	Number of Batch	1	1
15	Head Count	1	1
16	Gas Consumption	1	1
17	Engineering Time Effort	1	1
18	N50 Equivalent Production Unit	1	1
19	Ream	1	1
20	Cubic Feet	1	1
21	Steam Cost	1	1
22	Power Cost	1	1
23	Total Fatty Matter (TFM)	1	1
24	Bleach Quantity	1	1
25	Prime Cost	1	1
	Total	127	100

Twenty five types of cost driver are found in use and labor hour is used in most instances (about 20%). Another question deals with the number of cost drivers used by firms which results in the following:

SL	Quantity of Cost Drivers	Frequency	Percentage
1	Single Cost Driver	20	38
2	Double Cost Driver	4	8
3	3 Cost Driver	18	34
4	4 Cost Driver	5	9
5	5 Cost Driver	3	6
6	6 Cost Driver	1	2
7	7 Cost Driver	1	2
8	11 Cost Driver	1	2
	Total	53	100

5.5 Cost Pool

Cost pools are often used in a two-stage accumulation process in ABC. For example, Cooper and Kaplan view costing in ABC as a two-stage procedure. In the first stage, cost of support resources are assigned to the appropriate resources, creating cost pools. In the second stage, the cost pools are allocated to products or services. The allocation of cost is determined by each product or service's resource consumption.

Not all proponents of ABC follow the cost pool procedure, however. Turney and Stratton designate the different stages by different types of cost drivers. They describe resource drivers as the mechanisms to assign the cost of resources to activities (the first stage) and activity drivers as the mechanism to assign the cost of activities to products or services. Whatever the technical manipulation (cost pools or resource and activity drivers), the underlying principles of ABC must always be remembered: Product consumes activities and activities consume resources. Thus identification of right cost pools, accumulation of costs in right cost pool, identification of right driver for the pools are some critical steps. The survey question, relating to the number of cost pools, results in the following frequency distribution.

SL	Quantity of Cost Pools	Frequency	Percentage
1	Single Cost Pool	19	35
2	Double Cost Pool	11	21
3	3 Cost Pool	17	32
4	4 Cost Pool	2	04
5	5 Cost Pool	1	02
6	6 Cost Pool	1	02
7	7 Cost Pool	1	02
8	8 Cost Pool	1	02
	Total	53	100

5.6 Cost Structure

The use of sophisticated cost management system comes from a cost structure dominated by manufacturing overhead that is indirect to production process. If most of the production cost becomes direct, the accuracy of product costing is automatically ensured due to the right tracing of costs with cost object. But the problem becomes a considerable issue if there exists a significant portion of manufacturing overhead. The survey results in the following cost structure where manufacturing overhead is significant and require sophisticated system to trace the same with cost object.

SL	Elements of Costs	Percentage
1	Direct Material	55
2	Direct Labor	23
3	Manufacturing Overhead	22
	Total	100%

5.7 Accuracy and Cost Driver

The beauty of ABC is that it ensures accuracy in product costing if the things are done in line with the theory. Let us look at different methods of cost assignment. Costs are assigned to a cost object by direct tracing, cause-and-effect cost assignment or cost allocation. Direct tracing requires that, by physical observations, a cost can *easily* and *accurately* be related to a cost object. This method is less expensive than assignment or allocation and the result is usually more accurate.

Cause-and-effect cost assignment should be used when costs either cannot be directly traced or it is not cost-effective to do so. This method assigns costs to the cost object based on the long-run cause of the cost. For example, costs may be assigned to a material handling cost pool based on the number of moves for each part during the year. The total material handling cost, the total number of moves and the total number of parts are forecast and the appropriate cost is assigned to the cost pool. Since the cause of the cost is determined by cause-and-effect assignment, the costs assigned to a cost object are usually more accurate than if the cost had been allocated. Moreover, identifying the cost driver will assist management in managing the costs. The cost allocation method should be used if the cost can neither be traced nor assigned an cost object. The cost allocation method is similar to cause-and-effect assignment, except that the allocation base is not the cause. In most cases, the allocation base is usually some quantity that is already being tracked, such as sales or direct labor. Since the allocation is not based on a causal relationship, the cost allocation method will usually yield a cost that is less accurate than the two methods described above. In fact, the accuracy of an allocation can usually not be determined.

It is possible that the cost assigned to a cost object is correct. This will occur when there is a high positive correlation between the cost and the allocation base. Even if the costs assigned are accurate, this method provides little help to managers wishing to control costs.

Type of Assignment	Average Accuracy	Cost of Assigning	Usefulness for Control
Direct tracing	High	Low	Low*
Cause-and-effect	High	High	High
Cost allocation	Moderate	Moderate	Low

Exhibit: Comparison of Three Methods of Assignment

Sometimes it is argued that as the number of drivers used in cost allocation increase, the level of accuracy also increases. However, some professionals are happy with the accuracy having only few drivers. To look at the interaction between accuracy and the number of cost drivers used, the study runs a cross*tab between level of accuracy and number of cost driver with the following results:

Level of Accuracy	Number of Driver								Total
	1	2	3	4	5	6	7	11	
Neither Inaccurate Nor Accurate	0	1	0	0	0	0	0	0	1
Somewhat Accurate	10	2	7	1	2	1	0	0	23
Accurate	9	1	8	3	1	0	0	0	22
Very Accurate	1	0	3	1	0	0	1	1	7
Total	20	4	18	5	3	1	1	1	53

5.8 Quantification of Variables

In line with different hypotheses taken in the study for test, the study mainly focuses on the level of sophistication achieved by firms and the factors that affect such level of sophistication. 'Level of sophistication' is a categorical variable having three categories, namely, 'highly sophisticated', 'moderately sophisticated', and 'unsophisticated'. The rule of such categorization is made in line with earlier studies (Drury & Tayles, 1995) with some modification. It has been established in the literature by the time that the cost system sophistication largely depends on the number of cost pools and drivers a firm use for allocating overhead costs over cost objects to make the tracing accurate. A cross tab between number of cost pools and drivers used by the firms under the study results in the following situation:

Table: Cross tabulation between cost pool and cost driver

		Cost Driver								Total
		1	2	3	4	5	6	7	11	
Cost Pool	1	17	1	1	0	0	0	0	0	19
	2	0	2	7	1	1	0	0	0	11
	3	1	0	10	3	1	1	1	0	17
	4	1	0	0	1	0	0	0	0	2
	5	0	0	0	0	0	0	0	1	1
	6	0	0	0	0	1	0	0	0	1
	7	0	1	0	0	0	0	0	0	1
	8	1	0	0	0	0	0	0	0	1
Total		20	4	18	5	3	1	1	1	53

	Unsophisticated		Moderately Sophisticated		Highly Sophisticated

From the status achieved by the sampled firms participated in the survey, the categorization rule is roughly set as –

Number of CD	Number of CP	Category	Category Name	Category Value
Less than 3	Less than 3	1	Unsophisticated	1
Others	Others	2	Moderately Sophisticated	2
More than 3	More than 2	3	Highly Sophisticated	3

Other variables considered in the study are quantified as –

Explanatory Variables	Measurements
Number of Cost Pools	Ratio
Number of Cost Drivers	Ratio
Pools and Drivers Interrelationship	Categorical; one to one = 1, one to many = 2, many to many = 3
Existence of Independent Department	Dummy; yes = 1, no = 0
Existence of Professionals Working in the Departments	Dummy; yes = 1, no = 0
Size of the Organization in terms of Annual Turnover	Ratio
Percentage of Overhead Cost as a Percentage of Cost of Goods Manufactured	Ratio
Number of Years in Operation	Ratio
State of Competition	Scale
Characterization of Production Process	Categorical; Manual = 1, Hybrid = 2, Automated = 3

With this definition of different variables considered in the study, level of competition is considered as a dependent variable while other variables are considered as independent variables. Initially a multiple regression analysis is done to identify the measures explaining the level of sophistication better. Later on, to give a better insight into the analysis and to confirm the results of the earlier analysis, a stepwise regression is conducted. And finally

Logistic regression is done to introduce the odds ratio and how it can be used to improve the firms' status on the attainment of level of sophistication.

[illegible] Multiple Linear Regression (MLR)

Multiple linear regression is a method of analysis for assessing the strength of the relationship between each of a set of explanatory variables (sometimes known as independent variables, although this is not recommended since the variables are often correlated), and a single response (or dependent) variable. In this study, the level of sophistication is assumed to be explained by some other variables and multiple regression is used aptly as an important statistical technique to conclude the explanatory power of different variables in explaining the level of sophistication. Applying multiple regression analysis to a set of data results in what are known as regression coefficients, one for each explanatory variable. These coefficients give the estimated change in the response variable associated with a unit change in the corresponding explanatory variable, conditional on the other explanatory variables remaining constant. As per the table given below, only four explanatory variables become significant. The standardized beta coefficient of number of cost pools is computed as .394 (p<.001), number of cost drivers .506 (p<.001), pool driver interrelationship .298 (p<.010) and years in operation -.268 (p<.005). Three of the four variables show positive relationship and another shows negative relationship. As years in operation results in a negative coefficient, it will not be a right predictor of level of sophistication though it becomes statistically significant. Thus, we may conclude that the three variables out of ten have the explanatory power. For a one unit change in number of cost drivers, level of sophistication will be changed by 0.506; similarly, for a one unit change in number of cost pool, level of sophistication will be changed by 0.394 and for a one unit change in pool driver interrelationship, level of sophistication will be changed by 0.298.

Years of Operation	-1.988E-02	.006	-.268	-3.225	.003	.096	-.464	-.203	.571	1.753
Level of Competition	-6.453E-02	.067	-.074	-.964	.341	.226	-.155	-.061	.668	1.498
Production Process	-.150	.074	-.163	-2.017	.051	.010	-.311	-.127	.605	1.653
(Constant)	1.241	.327		3.802	.001					
Number of Cost Pools	.176	.043	.394	4.095	.000	.635	.553	.257	.427	2.342
Number of Cost Drivers	.195	.033	.506	5.974	.000	.778	.696	.375	.550	1.819
Pool Driver Interrelationship	.245	.084	.298	2.908	.006	.754	.427	.183	.374	2.672
Independent Department	.142	.125	.088	1.135	.263	.330	.181	.071	.654	1.530
Existence of Professionals	9.270E-03	.153	.007	.060	.952	.068	.010	.004	.327	3.062
Annual Turnover	2.014E-15	.000	.000	.003	.998	.047	.000	.000	.842	1.188
Percentage of Overheads	-9.096E-03	.007	-.122	-1.348	.186	.030	-.214	-.085	.484	2.068

The above table also reports correlation under zero-order, part and partial categories. Zero-order correlation is the Pearson correlation between each predictor and the outcome variable. It also produces the partial correlation between each predictor and the outcome, controlling all other predictors of the model. Finally, it produces the part correlation between each predictor and the outcome. This correlation represents the relationship between each predictor and the part of the outcome that is not explained by other predictors in the model. As such, it measures the unique relationship between a predictor and the outcome.

The variance in the dependent variable explained by each explanatory variable is expected to be independent. As multicollinearity is essentially a sample phenomenon, the significant distinction is not between the existence and nonexistence of multicollinearity, but between its various degrees (Gujarati, 2003). So, evidence regarding the extent of multicollinearity in our regression is required.

Multicollinearity is a high degree of correlation among several independent variables when a regression model incorporates a large number of independent variables. It is because some of them may measure the same concepts or phenomena. Existence of multicollinearity is not only a violation of OLS assumption but also it violates the assumption that X matrix is full ranked, making OLS impossible. When a model is not full ranked, that is, the inverse of X cannot be defined, there can be an indefinite number of least squares solutions. However, there is no clear-cut criterion for evaluating multicollinearity of linear regression models. Correlation coefficients of independent variable may be checked. But, high correlation coefficients do not necessarily imply multicollinearity.

In multiple regression models, collinearity can be related to the existence of linear dependencies among the columns of the X matrix. For each regressor x_j, the tolerance (Tol) can be computed as $Tol_j = 1 - R_j^2$, where R_j^2 is the coefficient of determination obtained in each of the k auxiliary regressions of the form:

$$x_{ji} = \delta_0 + \delta_1 x_{1i} + \cdots + \delta_{j-1} x_{j-1i} + \delta_{j+1} x_{j+1i} + \cdots + \delta_k x_{ki} + v_i$$

Thus, Tol_j shows the proportion of variance x_j that is not accounted for by the remaining $k-1$ regressors and can be used as an index of the degree of collinearity associated to x_j. Another index of collinearity of x_j, called variance inflation factor (VIF) can be obtained as a measure of the increment of the sampling variance of the estimated regression coefficient of x_j (β_j) due to collinearity. It shows how multicollinearity has increased the instability of the coefficient estimates (Freund and Littell, 2000). Putting differently, it tells us how 'inflated' the variance of the coefficient is, compared to what it would be if the variable were uncorrelated with any other variable in the model (Allison, 1999). VIF_j can be computed as the jth diagonal value of the inverse of the R correlation matrix among the regressors or alternatively as $1/Tol_j$.

However, there is no formal criterion for determining the bottom line of the tolerance value or VIF. Some argue that a Tol_j less than 0.1 or VIF_j greater than 10 roughly indicates significant multicollinearity. Others insist that magnitude of model's R^2 be considered determining significance of multicollinearity. Klein and Nakamura (1962) suggests alternative criterion that R_j^2 exceeds R^2 of the regression model. In this vein, if VIF_j is greater than $1/(1-R^2)$ or a Tol_j is less than $(1-R^2)$, multicollinearity can be considered as statistically significant. As the last column of the table above indicates both Tol_j and VIF_j is within the range causing no multicollinearity that may be of concern.

Overall measures of collinearity which take all regressors into account simultaneously have also been suggested. The most often used overall collinearity diagnostic is the condition number (Belsley et al., 1980; Belsley, 1982). The condition number of a matrix is the square root of the ratio of the largest to the smallest eigen-values. A large condition number of the X'X augmented moment matrix, reflects the existence of one or more linear dependencies among the columns of X (Belsley et al., 1980).

When there is no collinearity at all, the eigenvalues, condition indices and condition number will all equal one. As collinearity increases, eigenvalues will be both greater and smaller than 1 (eigenvalues close to zero indicate a multicollinearity problem), and the condition indices and condition number will increase. An informal rule of thumb is that if the condition number is 15, multicollinearity is a concern; if it is greater than 30 multicollinearity is a serious concern. The Table below incorporates collinearity diagnostics data that again produces no data of serious concern.

Statistics	Tol_j	VIF_j	Eigenvalue	Condition Index	Proportion of Variation
Critical Value	Less than $(1-R^2)$, roughly less than 0.1	Greater than $1/(1-R^2)$ roughly greater than 10	Less than .01	Greater than 50 (or 30)	Greater than 0.8 (or 0.7)
Method	R_j^2 from a regression $X_j = X_{others}$		Principal Component Analysis on the X'X matrix		

The fit of a multiple regression model can be judged in various ways, for example, by the calculation of the multiple correlation coefficients or by the examination of residuals. The table below includes some statistics to specify the fit of the model. A measure of the fit of the model is provided by the multiple correlation coefficient, R, defined as the correlation between the observed values of the response variable and the values predicted by the model. The value of R^2 gives the proportion of the variability of the response variable accounted for by the explanatory variables.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.922[a]	.850	.811	.30341	1.726
a. Predictors: (Constant), Production Process, Pool Driver Interrelationship, Years of Operation, Annual Turnover, Level of Competition, Independent Department, Percentage of Overheads, Number of Cost Drivers, Number of Cost Pools, Existence of Professionals					
b. Dependent Variable: Levels of Sophistication					

The above table includes the multiple correlation coefficient, R, its square, R^2, and an adjusted version of this coefficient as summary measures of model fit. The multiple correlation coefficient R = 0.922 indicates that there is a strong correlation between the observed level of sophistication and those predicted by the regression model. In terms of variability in observed level of sophistication accounted for by our fitted model, this amounts to a proportion of R^2 = 0.850, or 85.0%. Since by definition R^2 will increase when further terms are added to the model even if these do not explain variability in the population, the *adjusted* R^2 is an attempt at improved estimation of R^2 in the population. The index is adjusted down to compensate for chance increases in R^2, with bigger adjustments for larger sets of explanatory variables. Use of this adjusted measure leads to a revised estimate that [illegible]% of the variability in level of sophistication in the population can be explained by the explanatory variables. The table also provides an estimate of the standard deviation of the error term (under "Std. Error of the Estimate"). Here we estimate the mean absolute deviation as .303, which is small considering that the level of sophistication range from 1 to 3.

Durbin-Watson test is important to check whether there exists any serial autocorrelation. In multiple regression analysis, it has been assumed that the error term is independent with a mean value of zero but in practice, it may happen that the errors are not independent instead *auto-correlated.* Such error autocorrelation, or "serial correlation", has many undesirable but correctable consequences (e.g., the least-squares estimates are sub-optimal, standard confidence intervals for β are incorrect; the error term is forecast able). Thus, it is highly desirable to try to detect error autocorrelations. The **Durbin-Watson Test** for serial correlation assumes that the ε_i are stationary and normally distributed with mean zero. It tests the null hypothesis H_0 that the errors are uncorrelated against the alternative hypothesis H_1. Since d is approximately equal to $2(1-r)$, where r is the sample autocorrelation of the residuals, $d = 2$ indicates no autocorrelation. The value of d always lies between 0 and 4. If the Durbin–Watson statistic is substantially less than 2, there is evidence of positive serial correlation. As a conservative rule of thumb, Field (2009) suggests that values less than 1.0 and greater than 3.0 are definitely cause for concern. Small values of d indicate successive error terms are, on average, close in value to one another, or positively correlated. If $d > 2$, successive error terms are, on average, much different in value to one another, i.e., negatively correlated. In regressions, this can imply an underestimation of the level of statistical significance. In this analysis, the vale of d is calculated as 1.726 which is not lower than 1 or substantially less than 2. Thus, it may be concluded the autocorrelation that may exist in the analysis is not alarming. Even the residual statistics also shows that the mean of residual is zero.

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.7118	3.5728	1.8163	.64305	49
Residual	-.65498	.56593	.00000	.26996	49
Std. Predicted Value	-1.718	2.731	.000	1.000	49
Std. Residual	-2.159	1.865	.000	.890	49

a. Dependent Variable: Levels of Sophistication

The variation in the response variable can be partitioned into a part due to regression on the explanatory variables and a residual term. The latter divided by its degrees of freedom (the residual mean square) gives an estimate of σ^2, and the ratio of the regression mean square to

The residual mean square provides an F-test of the hypothesis that each of $\beta_0, \beta_1, \beta_2 \cdots\cdots, \beta_n$ takes the value zero.

	Sum of Squares	df	Mean Square	F	Sig.
Regression	19.849	10	1.985	21.561	.000
Residual	3.498	38	.092		
Total	23.347	48			

The ANOVA table as shown above also provides an F-test for the null hypothesis that none of the explanatory variables is related to level of sophistication, or in other words, that R^2 is zero. Here we can clearly reject this null hypothesis (F (10, 38) = 21.561, $p < 0.001$), and so conclude that at least one of the explanatory variables is related to the level of sophistication.

5.10 Step Wise Regression

Stepwise regression removes and adds variables to the regression model for the purpose of identifying a useful subset of the predictors. Stepwise first finds the explanatory variable with the highest correlation (R^2) to start with. It then tries each of the remaining explanatory variables until it finds the two with the highest R^2. Then it tries all of them again until it finds the three variables with the highest R^2, and so on. The overall R^2 gets larger as more variables are added.

	Levels of Sophistication			
	Step 1	Step 2	Step 3	Step 4
Constant – t	1.014	.487	.451	.622
Number of Cost Drivers				
$\beta_{i,j}^{CD}$	.778	.510	.475	.494
t-stat	8.486^{***}	5.455^{***}	5.496^{***}	6.058^{***}
Pool Driver Interrelationship				
$\beta_{i,j}^{PD}$		.453	.333	.277
t-stat		4.840^{***}	3.545^{**}	3.059^{**}
Number of Cost Pools				
$\beta_{i,j}^{CP}$			.260	.378
t-stat			3.137^{**}	4.205^{***}
Years of Operation				
$\beta_{i,j}^{YO}$				-.200
t-stat				-2.630^{*}
Change in R - Square	.605	.133	.047	.029
Adjusted R - Square	.597	.727	.771	.798
F Value	72.014^{***}	64.898^{***}	54.859^{***}	48.282^{***}

$^{***}p<0.001$, $^{**}p<0.005$, $^{*}p<0.015$

Cost driver is the variable which explains the level of sophistication better than any other variables considered in the study. Inclusion of pool_driver relationship as another variable in the model, the model improves with a change in R^2 amounting to 0.133. It means the model explains 13.3% more of outcome variable due to the inclusion of second variable. In step 3, The model considers cost pools as another variable that again improves the model with a R^2 change of 0.047. The model further improves considering years of operation as another variable though coefficient is negative and not significant. The stepwise regression stops as considering other variables will not improve the model. Thus, we may conclude that both multiple linear regression and stepwise regression produces similar results with some better insight.

5.11 Logistic Regression

Logistic regression is used to predict a categorical (usually dichotomous) variable from a set of predictor variables. With a categorical dependent variable, discriminant function analysis is usually employed if all of the predictors are continuous and nicely distributed; logit analysis is usually employed if all of the predictors are categorical; and logistic regression is often chosen if the predictor variables are a mix of continuous and categorical variables and/or if they are not nicely distributed (logistic regression makes no assumptions about the distributions of the predictor variables). For a logistic regression, the predicted dependent variable is a function of the probability that a particular subject will be in one of the categories.

In logistic regression, the dependant variable is required to be dichotomous. Thus, the dependent variable is coded as 1 for the category 'highly sophisticated' and 0 for other two categories, namely, 'moderately sophisticated' and 'unsophisticated'. The case processing summary below states that there are 49 cases used in the analysis with no missing cases.

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	49	100.0
	Missing Cases	0	.0
	Total	49	100.0
Unselected Cases		0	.0
Total		49	100.0

a. If weight is in effect, see classification table for the total number of cases.

The following table shows the coding of dependant variable as assumed in the study. The analysis kept the original values for the dichotomous variable level of sophistication. If the variable was coded as, for example, 3 and 4, these would have been re-coded to 0 and 1. In this case, 0 means unsophisticated and 1 means sophisticated.

Dependent Variable Encoding

Original Value	Internal Value
0	0
1	1

The data entry method is chosen as Enter and thus the SPSS starts by inserting only a constant in the model in Block 0. Other variables are not considered. The Block 0 output is for a model that includes only the intercept. Given the base rates of the two decision options (41/49 = 84% decided unsophisticated, 16% decided sophisticated), and no other information, the best strategy is to predict, for every case, that the firms are having unsophisticated system. Using that strategy, you would be correct 84% of the time.

Block 0: Beginning Block

Classification Table[a,b]					
	Observed		Predicted		
			Levels of Sophistication		Percentage Correct
			0	1	
Step 0	Levels of Sophistication	0	41	0	100.0
		1	8	0	.0
	Overall Percentage				83.7

a. Constant is included in the model.

b. The cut value is .500

Under Variables in the Equation, the intercept-only model is ln(odds) = -1.634. If we exponentiate both sides of this expression we find that our predicted odds [Exp(B)] = .195. That is, the predicted odds of sophisticated system .195. Since 8 of our subjects have sophisticated system and 41 have unsophisticated system, our observed odds are 8/41 = .195. The Wald chi-square tests the null hypothesis that the constant equals 0. This hypothesis is rejected because the p-value (listed in the column called "Sig.") is smaller than the critical p-value of .05 (or .01). Hence, we conclude that the constant is not 0. The df is the degrees of freedom for the Wald chi-square test. There is only one degree of freedom because there is only one predictor in the model, namely the constant.

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1.634	.387	17.875	1	.000	.195

Variables not in the Equation					
			Score	df	Sig.
Step 0	Variables	pool	6.829	1	.009
		driver	21.809	1	.000
		pool_driver	6.840	1	.009
	Overall Statistics		22.698	3	.000

On Step 1 in Block 1 below, SPSS enters all the variables in the model. The coefficients here give us a measure of how well the model fits. We must look mostly at the Model coefficient. It is analogous to the multivariate F test for linear regression. The null hypothesis states that information about the independent variables does not allow us to make better prediction of the dependent variable. Therefore we would want that this chi-squared value is significant (as in this example).

Omnibus Tests of Model Coefficients gives us a Chi-Square of 32.996 on 3 df, significant beyond .001. This is a test of the null hypothesis that adding the variables to the model has not significantly increased our ability to predict the decisions made by our subjects.

The following table shows the chi-square statistic and its significance level. In this example, the statistics for the Step, Model and Block are the same because we have not used stepwise logistic regression or blocking. The value given in the Sig. column is the probability of obtaining the chi-square statistic given that the null hypothesis is true. In other words, this is the probability of obtaining this chi-square statistic (32.996) if there is in fact no effect of the independent variables, taken together, on the dependent variable. This is, of course, the p-value, which is compared to a critical value, perhaps .05 or .01 to determine if the overall model is statistically significant. In this case, the model is statistically significant because the p-value is less than the critical value. These values (step, block and model Chi-Squares) test whether or not all of the variables entered in the equation (for model), all of the variables entered into current block (for block), or the current increase in the model fit (for step) have a significant impact. As the values for each chi-square is significant, it indicates that the variables added to the model significantly impact the dependant variable.

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	32.996	3	.000
	Block	32.996	3	.000
	Model	32.996	3	.000

Under Model Summary we see that the -2 Log Likelihood statistic is 10.619. This statistic measures how poorly the model predicts the decisions - the smaller the statistic the better the model, a perfect model has a -2 Log Likelihood value of zero. The Cox & Snell R^2 can be interpreted like R^2 in a multiple regression, but cannot reach a maximum value of 1. The Nagelkerke R^2 can reach a maximum of 1. The log-likelihood ratio statistic was used for selecting parameters in the logistic regression model. The SPSS statistical package presents not the log-likelihood itself but the log-likelihood multiplied by –2 (SPSS Inc. 1998). Output from SPSS denotes log-likelihood multiplied by -2 as "-2 Log Likelihood". By multiplying the log-likelihood by -2 it approximates a chi-square distribution (Menard, 1995). Larger values of -2 log likelihood indicate worse prediction of the dependent variable.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	10.619[a]	.490	.831

a. Estimation terminated at iteration number 9 because parameter estimates changed by less than .001.

The Hosmer-Lemeshow tests the null hypothesis that there is a linear relationship between the predictor variables and the log odds of the criterion variable. Cases are arranged in order by their predicted probability on the criterion variable. These ordered cases are then divided into six groups (lowest decile [prob < .1] to highest decile [prob > .9]). Each of these groups is then divided into two groups on the basis of actual score on the criterion variable. This results in a 2 x 6 contingency table. Expected frequencies are computed based on the assumption that there is a linear relationship between the weighted combination of the predictor variables and the log odds of the criterion variable. For the outcome = no (decision = unsophisticated) column, the expected frequencies will run from high (for the lowest decile) to low (for the highest decile). For the outcome = yes column the frequencies will run from low to high. A chi-square statistic is computed comparing the observed frequencies with those expected under the linear model. An insignificant chi-square indicates that the data fit the model well.

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	2.635	4	.621

Contingency Table for Hosmer and Lemeshow Test

		Levels of Sophistication = .00		Levels of Sophistication = 1.00		Total
		Observed	Expected	Observed	Expected	
Step 1	1	14	14.000	0	.000	14
	2	5	5.000	0	.000	5
	3	8	7.967	0	.033	8
	4	10	9.817	0	.183	10
	5	3	3.923	3	2.077	6
	6	1	.293	5	5.707	6

Classification Table[a]

	Observed		Predicted: Levels of Sophistication 0	Predicted: Levels of Sophistication 1	Percentage Correct
Step 1	Levels of Sophistication	0	40	1	97.6
		1	0	8	100.0
	Overall Percentage				98.0

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	95.0% C.I.for EXP(B) Upper
Step 1[a]	pool	1.647	.935	3.099	1	.000	5.190	.830	32.470
	driver	3.834	1.720	4.968	1	.026	46.270	1.588	1.348E3
	pool_driver	.262	2.004	.017	1	.013	1.299	.026	66.063
	Constant	-20.952	9.708	4.658	1	.031	.000		

a. Variable(s) entered on step 1: pool, driver, pool_driver.

The last table produced by SPSS is the one containing the variable coefficients. The formula should read as follows.

$$Logit\,(p) = \ln(\frac{p}{1-p}) = -20.952 + 1.647(pool) + 3.834(driver) + .262(pool\_driver)$$

To find out the probability of being sophisticated system by a firm having 3 cost pool, 3 cost driver and many to many (3) pool_driver relationship, let us substitute the equation first and find the exp to obtain the odds.

$$Logit\,(p) = -20.952 + 1.647(3) + 3.834(3) + .262(3) = -3.723$$

$$\exp^{-3.723} = 0.02416$$

Let us transform it to obtain the probability as $\frac{\exp^{-3.723}}{1+\exp^{-3.723}} = 0.02359$

5.11.1 Odds Ratio (OR)

The ratio of two odds is called odd ratio, where odds are computed from two respondents. For example, let us consider the steps as used above to calculate the odds for a firm having 6 cost drivers, keeping other information intact.
Logit formulation of the model will be –

$$Logit\,(p) = -20.952 + 1.647(3) + 3.834(6) + .262(3) = 7.779$$

$$\exp^{7.779} = 2389.884$$

Let us transform it to obtain the probability as $\frac{\exp^{7.779}}{1+\exp^{7.779}} = 0.999582$

Thus the OR will be Odd_1/Odd_2, i.e. 0.999582/0.02359 = 42.37. It means the firm with three cost pools, six cost drivers and many to many pool-driver relationship enjoys 42.37 times higher probability of attaining sophistication as compared with the firm with three cost pools, three cost drivers and many to many pool-driver relationship

These estimates tell us the relationship between the independent variables and the dependent variable, where the dependent variable is on the logit scale. These estimates tell the amount of increase (or decrease, if the sign of the coefficient is negative) in the predicted log odds of level of sophistication = 1 that would be predicted by a 1 unit increase (or decrease) in the predictor, holding all other predictors constant. For the independent variables which are not significant, the coefficients are not significantly different from 0, which should be taken into account when interpreting the coefficients. (See the columns labeled Wald and Sig. regarding testing whether the coefficients are statistically significant). Because these coefficients are in log-odds units, they are often difficult to interpret, so they are often converted into odds ratios. It can be done by hand by exponentiating the coefficient, or by looking at the right-most column in the Variables in the Equation table labeled "Exp(B)". For every one-unit increase in pool, we expect a 1.647 increase in the log-odds of **level of sophistication,** holding all other independent variables constant. For every one-unit increase in driver, we expect a 3.834 increase in the log-odds of **level of sophistication**, holding all other independent variables constant. And for every one-unit increase in pool_driver, we expect a .262 increase in the log-odds of **level of sophistication. -20.952** is the expected value of the log-odds of **level of sophistication** when all of the predictor variables equal zero. In most cases, this is not interesting. Also, sometimes zero is not a realistic value for a variable to take.

The S.E. is the standard errors associated with the coefficients. The standard error is used for testing whether the parameter is significantly different from 0 by dividing the parameter estimate by the standard error you obtain a t-value. The standard errors can also be used to form a confidence interval for the parameter. The Wald and Sig. columns provide the Wald chi-square value and 2-tailed p-value used in testing the null hypothesis that the coefficient (parameter) is 0. In case of using a 2-tailed test, we should compare each p-value to our preselected value of alpha. Coefficients having p-values less than alpha are statistically significant. For example, if you chose alpha to be 0.05, coefficients having a p-value of 0.05 or less would be statistically significant (i.e., you can reject the null hypothesis and say that the coefficient is significantly different from 0). If you use a 1-tailed test (i.e., you predict that the parameter will go in a particular direction), then you can divide the p-value by 2 before comparing it to your preselected alpha level.

1. For the variable **pool**, the p-value is .000, so the null hypothesis that the coefficient equals 0 would be rejected.
2. For the variable **driver**, the p-value is .026, so the null hypothesis that the coefficient equals 0 would be rejected.
3. For the variable **pool_driver**, the p-value is .013, so the null hypothesis that the coefficient equals 0 would be rejected.

5.12 Reasons for Implementing ABC

The firms who are assessing or implementing ABC must have some reasoning behind that. The researcher also has got the interest to figure out the rationality of using ABC considering all limitations. Thus the questionnaire includes a question asking the respondents to circle the values from 1 to 5 in support of their decision of implementing ABC where 1 represents 'Not Important' and 5 represents 'Extremely Important'. The question has thirteen different parameters with the following results:

1	More accurate cost calculation	4.27
2	Improved cost control/management	4.09
3	Ensuring product/customer profitability	3.86
4	Improved budgeting, performance measurement	3.86
5	Increasing competitiveness	3.73
6	Supporting other management innovations (TQM and JIT)	3.35
7	Providing behavioral incentives by creating cost consciousness among employees	3.53
8	Improving product quality via better product and process design	3.44
9	Responding to an increase in overheads	3.40
10	Responding to increased pressure from regulators	3.19
11	Better use of resources	3.60
12	Evaluating and justifying investments in new technologies	4.02
13	Improved insight into cost causation	3.67

To give some better insight into the analysis, an exploratory factor analysis is done. Four factors have been extracted explaining 74% of the variation as shown in the table below.

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.409	41.608	41.608	5.409	41.608	41.608	3.790	29.152	29.152
2	1.730	13.307	54.915	1.730	13.307	54.915	2.604	20.034	49.186
3	1.316	10.122	65.037	1.316	10.122	65.037	1.794	13.802	62.988
4	1.185	9.116	74.153	1.185	9.116	74.153	1.451	11.165	74.153
5	.708	5.449	79.602						
6	.666	5.123	84.725						
7	.453	3.483	88.208						
8	.409	3.142	91.351						
9	.347	2.668	94.019						
10	.285	2.191	96.210						
11	.202	1.555	97.765						
12	.172	1.321	99.086						
13	.119	.914	100.000						

All of the factors having more than 1.0 eigenvalue have been retained while others have been rejected. The component matrix table shows the distribution of different parameters across four factors. Alpha value is more than the reference value that ensures reliability.

	Component			
	1	2	3	4
Cronbach's Alpha	0.856			
Accuracy			.803	
Costmgt	.536			
Profitability	.566			
perfmeasure	.686			
competitiveness	.724			
innovation	.522			
costconscious	.701			
Quality	.794			
overheads	.826			
preregulators		.663		
useresources	.826			
investechnology				.677
costcausation	.833			
All loadings in excess of 0.400 are shown (n=53).				

The Kaiser-Meyer-Olkin measure of sampling adequacy is adequate (0.77) and the Bartlett test of Sphericity is highly significant $\chi 2$ (p = 0.000).
Significant at $p < 0.001$

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.770
Bartlett's Test of Sphericity	Approx. Chi-Square	271.027
	df	78

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.770
	Approx. Chi-Square	271.027
	df	78
	Sig.	.000

The split-half reliability statistics also support reliability of the scale. For both of the half, the alpha value is more than the reference value. Guttman split-half coefficient is also significant. Thus the sale has passed multiple measures of reliability. And the factor analysis itself ensures construct validity.

Reliability Statistics			
Cronbach's Alpha	Part 1	Value	.720
		N of Items	7[a]
	Part 2	Value	.775
		N of Items	6[b]
	Total N of Items		13
Correlation Between Forms			.752
Spearman-Brown Coefficient	Equal Length		.858
	Unequal Length		.859
Guttman Split-Half Coefficient			.853
a. The items are: Accuracy, Costmgt, Profitability, perfmeasure, competitiveness, innovation, costconscious.			
b. The items are: costconscious, quality, overheads, preregulators, useresources, investechnology, costcausation.			

5.13 Problems faced during ABC Implementation

The research had another target to know the problems faced by the firms who have assessed or implemented ABC. It is an important finding for the firms who are planning to implement ABC in future. The question includes twelve different parameters to address this issue with the following results.

SL	Parameters	Mean	SD
1	Identifying the major activities performed in the factory	3.86	1.025800
2	Identifying what drive the activities identified above	4.00	0.962720
3	Determining the cost of the activities identified above	3.60	0.857094
4	Difficulties in selling the concept to senior management	3.12	1.365112
5	Difficulties in selling the concept to department managers	3.36	1.055102
6	Difficulties in allocating costs to activities	3.81	1.311080
7	Lack of adequate resources	3.57	1.271505
8	Difficulties associated with gathering the data required	3.98	1.157965
9	Difficulties associated with information systems	3.57	0.940754
10	Inadequate IS support to implement the system	3.24	1.122052
11	Increased workload of accounting personnel	3.62	1.324302

12	Accountants' reluctance to change traditional methods	3.67	1.028062

The respondents were asked to choose the respective value against each parameter designed in a Likert 5 point scale where 1 represents 'Strongly Disagree' and 5 represents 'Strongly Agree'. The major problem was with the identification of right driver.

An exploratory factor analysis extracts three factors having eigenvalue more than 1.0 explaining 71% of total variance as shown in the table below:

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.340	44.500	44.500	5.340	44.500	44.500	3.679	30.661	30.661
2	1.841	15.341	59.840	1.841	15.341	59.840	2.566	21.386	52.047
3	1.447	12.055	71.895	1.447	12.055	71.895	2.382	19.848	71.895
4	.821	6.840	78.735						
5	.783	6.528	85.263						
6	.571	4.759	90.021						
7	.328	2.732	92.753						
8	.314	2.616	95.369						
9	.193	1.609	96.978						
10	.148	1.231	98.208						
11	.140	1.166	99.375						
12	.075	.625	100.000						

Extraction Method: Principal Component Analysis.

The Kaiser-Meyer-Olkin measure of sampling adequacy is adequate (0.72) and the Bartlett test of Sphericity is highly significant $\chi 2$ (p = 0.000).
Significant at $p < 0.001$

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.723
Bartlett's Test of Sphericity	Approx. Chi-Square	315.922
	df	66
	Sig.	.000

The split-half reliability statistics also support reliability of the scale. For both of the half, the alpha value is more than the reference value. Guttman split-half coefficient is also significant. Thus the sale has passed multiple measures of reliability. And the factor analysis itself ensures construct validity.

	Summary 1st Half	Summary 2nd Half
No. of Items	6	6
Mean:	21.57143	21.80952
Sum:	906.0000	916.0000
Std. Dv.	4.103199	4.988954
Variance	16.83624	24.88966
Alpha	.6899834	.8062903
ITEMS 1:	activities	drivers
2:	costs	conceptsell
3:	conseldmanager	costallo
4:	res	datagather
5:	is	isimple
6:	workload	reluctance

Correlation between first and second half: .930029597

Correlation corrected for attenuation: --

Split half reliability: .963746461

Guttman split-half reliability: .954271576

The component matrix showing the distribution of different factors in three different categories are shown below. For factor loading, cut off value is considered as 0.4 as a common rule of thumb.

Component Matrix[a]			
	Component		
Cronbach's Alpha	.881		
	Factor 1	Factor 2	Factor 3
activities			.575
drivers	.740		
costs	.647		
conceptsell	.730		
conseldmanager	.649		
costallo	.775		
res	.676		
datagather	.780		
is		.784	
isimple		.598	
workload	.818		
reluctance	.639		
Extraction Method: Principal Component Analysis.			
a. 3 components extracted.			

5.14 Benefits from Adopting ABC

Another question deals with the benefits received by the firms who have adopted ABC. This section generates important message to those who have not implemented ABC yet. The question again has fourteen parameters and the respondents are asked to choose the suitable value in a Likert 5 point scale where 1 represents 'Strongly Disagree' and 5 represents 'Strongly Agree'. The survey results in the following:

1	More accurate cost information for costing	4.37
2	More accurate cost information for pricing	4.19
3	Improved cost control and management	4.16
4	Better insights into cost causation and behavior	4.05
5	Better performance measures	4.12
6	More accurate profitability analysis	4.23
7	Better allocation of overhead	4.07
8	Reduction of waste and rework	3.60
9	Better understanding on cost reduction possibilities	3.56
10	Improvement in customer services	3.67
11	New product design	3.60
12	Restructuring or reengineering business operations	3.65
13	Better stock valuation	3.74
14	Other (please specify)	3.92

An exploratory factor analysis extracts four factors having eigenvalue more than 1.0 explaining 75% of total variance as shown in the table below:

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.447	41.903	41.903	5.447	41.903	41.903	3.126	24.050	24.050
2	2.129	16.379	58.282	2.129	16.379	58.282	2.656	20.433	44.482
3	1.166	8.970	67.252	1.166	8.970	67.252	2.078	15.986	60.468
4	1.025	7.882	75.133	1.025	7.882	75.133	1.906	14.665	75.133
5	.780	6.000	81.134						
6	.535	4.114	85.248						
7	.495	3.811	89.058						
8	.418	3.212	92.270						
9	.287	2.207	94.477						
10	.237	1.826	96.303						
11	.219	1.687	97.991						
12	.160	1.233	99.224						
13	.101	.776	100.000						

Extraction Method: Principal Component Analysis.

The Kaiser-Meyer-Olkin measure of sampling adequacy is adequate (0.74) and the Bartlett test of Sphericity is highly significant $\chi2$ (p = 0.000).
Significant at $p < 0.001$

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.744

Bartlett's Test of Sphericity	Approx. Chi-Square	300.156
	df	78
	Sig.	.000

The split-half reliability statistics also support reliability of the scale. For both of the half, the alpha value is more than the reference value. Guttman split-half coefficient is also significant. Thus the sale has passed multiple measures of reliability. And the factor analysis itself ensures construct validity.

Reliability Statistics			
Cronbach's Alpha	Part 1	Value	.785
		N of Items	7[a]
	Part 2	Value	.856
		N of Items	6[b]
	Total N of Items		13
Correlation Between Forms			.621
Spearman-Brown Coefficient	Equal Length		.766
	Unequal Length		.767
Guttman Split-Half Coefficient			.756
a. The items are: accuracy, accupric, costmgt, costcau, perfmea, profana, overallo.			
b. The items are: overallo, wastrew, costreduc, impcust, newprodes, restuc, stocvalu.			

The component matrix showing the distribution of different factors in three different categories is shown below. For factor loading, cut off value is considered as 0.4 as a common rule of thumb.

Rotated Component Matrix[a]				
	Component			
Cronbach's Alpha			.879	
	Factor 1	Factor 2	Factor 3	Factor 4
accuracy		.717		
accupric		.685		
costmgt				.811
costcau	.686			
perfmea				.830
profana		.728		
overallo		.864		
wastrew	.837			
costreduc	.862			
impcust	.639		.500	

newprodes	.422		.795	
restuc	.562		.601	
stocvalu		.470	.720	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 8 iterations.				

The component matrix as shown above does not confirm the convergent and discriminate validity as a single parameter comes under more than one factor as the rule of factor loading is considered as 0.40.

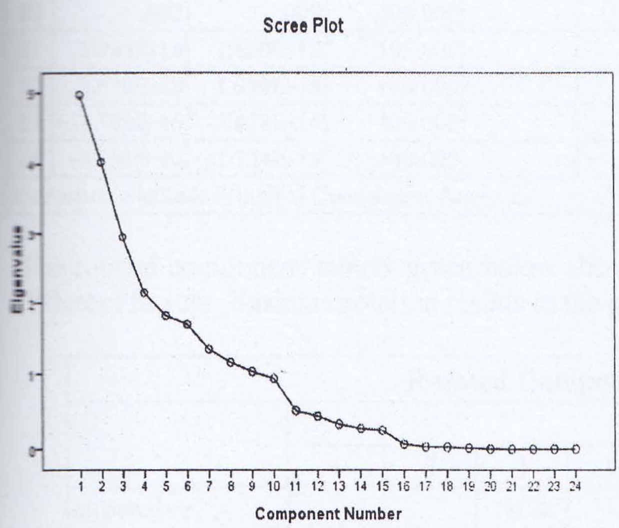
5.15 Reasons for not adopting ABC

A good number of companies (around 30) do not adopt ABC yet. Thus the researcher had the intention to know the reasoning from the practitioners behind the rationality of not using ABC. The questionnaire includes a question targeting to know the reasons for not adopting ABC with 24 individual parameters grouped under 5 categories. These groupings were made from theoretical underpinning and logical cognizance. The survey comes out with the following results:

1. Technical	
Too expensive including cost of IT	3.09
Does not add value	3.79
Too detailed, time-consuming	3.05
Lack of skills, high staff turnover (ABC skills)	2.84
Difficulty with data	3.36
Difficulty configuring ABC with other systems, IT	3.00
Difficulty identifying suitable cost drivers	3.70
Difficulty defining cost pools, cost drivers	3.59
Lack of adequate systems, IT	3.00
Most of the costs are fixed	3.66
2. Satisfaction with other systems	
Satisfaction with current system	3.49
ABC not suited to business sector	4.00
3. Misconceptions about ABC	
ABC only suited to manufacturing	3.18
Inadequate marketing of ABC	3.61
Negative publicity about ABC	3.46
Takes time to assess, be accepted	3.09
Over expectation by clients	3.43
4. Top Management	
Top management decision/ policy not to implement	4.02
Lack of top management support/employee resistance	3.35
Other priorities (TQM, JIT)	2.85
5. Others	
Firm is doing so well they do not focus on cost	3.36
Firm still focuses on financial accounting	2.93
Competitors are not using ABC	2.82
Consultants are not available	2.68

The respondents were asked to circle the respective numbers against each parameter measured in a Likert 5 point scale with 1 representing 'strongly disagree' and 5 representing 'strongly agree'. Thus the respondents were free to use their judgments in choosing the parameters contributing to the reluctance of using ABC. The parameter mostly contribute towards non-adoption of ABC as the decision of management not to implement ABC. And the lowest score attained by unavailability of consultants. It is a very important finding that we have skilled manpower or the companies have their own personnel who can implement the ABC without the help of any outside consultants.

This section deals with qualitative factors quantified in a ratio scale. The accuracy of the outcome depends on how consistent the respondents were while choosing values for different parameters. Thus, reliability test is warranted before generalizing the outcome. The Cronbach's Alpha is computed as .707 which is more than the reference value indicating that the outcome is reliable. Using the principal components method, a factor analysis of these survey items revealed nine distinct factors with eigenvalues greater than 1.0, which accounted for 88 percent of the total variance in the data. The accompanied Scree Plot gives a visual display of number of components having eigenvalues greater than 1.0. Thus, only nine components are retained rejecting others.



The factor solutions for the defined constructs support the construct validity of the survey instrument. Convergent validity is demonstrated by each factor having multiple-question loadings in excess of 0.5. In addition, discriminant validity is supported, with no elements having loadings in excess of 0.45 on more than one factor. Cronbach's alpha is used as the coefficient of reliability for testing the internal consistency of the constructs validated by the factor analysis. The alpha coefficients for all of the constructs are in excess of 0.7, considered acceptable for exploratory research (Nunnally, 1994).

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.971	20.713	20.713	4.971	20.713	20.713	3.218	13.409	13.409
2	4.026	16.776	37.489	4.026	16.776	37.489	2.889	12.036	25.445
3	2.944	12.268	49.758	2.944	12.268	49.758	2.565	10.688	36.133
4	2.144	8.934	58.692	2.144	8.934	58.692	2.472	10.300	46.433
5	1.819	7.579	66.271	1.819	7.579	66.271	2.200	9.166	55.599
6	1.698	7.075	73.345	1.698	7.075	73.345	2.185	9.103	64.702
7	1.345	5.605	78.950	1.345	5.605	78.950	2.123	8.844	73.546

8	1.157	4.821	83.771	1.157	4.821	83.771	2.010	8.376	81.922
9	1.030	4.290	88.061	1.030	4.290	88.061	1.473	6.139	88.061
10	.938	3.910	91.971						
11	.509	2.120	94.090						
12	.434	1.807	95.898						
13	.330	1.375	97.273						
14	.271	1.129	98.402						
15	.249	1.037	99.439						
16	.064	.268	99.707						
17	.029	.121	99.828						
18	.026	.106	99.935						
19	.013	.056	99.991						
20	.002	.009	100.000						
21	3.984E-16	1.660E-15	100.000						
22	2.638E-16	1.099E-15	100.000						
23	-1.780E-16	-7.418E-16	100.000						
24	-4.161E-16	-1.734E-15	100.000						

Extraction Method: Principal Component Analysis.

The rotated component matrix given below shows the distribution of the parameters in nine different factors. Varimax rotation results in the grouping after 17 iterations.

Rotated Component Matrix[a]

	Component								
	1	2	3	4	5	6	7	8	9
expensive			.804						
nonvalue	.594								
timeconsume				.479					
staffturnover			.857						
datadifficulty		.669							
configabc				.411					
idendriver	.899								
definingpool	.879								
lacksystems	.496								
fixedcost							.856		
satisfaction				.934					
unsuitable							.774		
manufacturing				.494					
inadequatemark		.835							
negpublicity		.896							
Assess						.863			
overexpectation									.794
mgtsupport								.816	

resistance								.795	
Other				.697					
Nofocus					.723				
Focus									.520
Nonuse					.906				
consultants						.841			
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.									
a. Rotation converged in 17 iterations.									

As per the factor loading, the nine components with the respective parameters are presented below:

Factor 1 – Complexity	
1	Does not add value
2	Difficulty identifying suitable cost drivers
3	Difficulty defining cost pools, cost drivers
4	Lack of adequate systems, IT
Factor 2 – Infamy	
1	Difficulty with data
2	Inadequate marketing of ABC
3	Negative publicity about ABC
Factor 3 – Costly	
1	Too expensive including cost of IT
2	Lack of skills, high staff turnover (ABC skills)
Factor 4 – Optional	
1	Too detailed, time-consuming
2	Difficulty configuring ABC with other systems, IT
3	Satisfaction with current system
4	ABC only suited to manufacturing
5	Other priorities (TQM, JIT)
Factor 5 – Rationality	
1	Firm is doing so well they do not focus on cost
2	Competitors are not using ABC
Factor 6 - Protracted	
1	Takes time to assess, be accepted
2	Consultants are not available
Factor 7 – Misconstruction	
1	Most of the costs are fixed
2	ABC not suited to business sector
Factor 8 – Disinclination	
1	Top management decision/ policy not to implement
2	Lack of top management support/employee resistance
Factor 9 - Untimely	
1	Over expectation by clients
2	Firm still focuses on financial accounting

The above table disaggregates the parameters and brings them into new alignment in line with the factor analysis. It gives the readers a better insight regarding the reason for not using ABC in a country like Bangladesh.
The above mentioned scale was analyzed using the six measures of reliability discussed by Guttman (1945). Of the six, he argued that the one with the highest rating establishes the lower bound of the true reliability of the scale (henceforth, Guttman's Lower Bound or GLB) Cronbach's Alpha (Cronbach, 1970), one of Guttman's six measures, was highlighted in the analysis as is fairly standard in most discussions of reliability. The accepted level of reliability depends on the purpose of the research projects. For example, Nunnally argued that in early stages of research, reliability of 0.50 to 0.60 would suffice and that "for basic research it can be argued that increasing reliabilities beyond 0.80 is often wasteful" (1967, p. 226). Thus, for this study, the target level of minimum reliability was set in the 0.70 to 0.80 range.

Factor analysis is used as an assessment of construct validity. Fornell (1983) has argued that, in traditional factor analysis, the results are "indeterminate" because factor loadings can be rotated in numerous ways. Thus, data analysis where possible ought to be grounded in strong **a priori** notions. This fits the approach in this research where the constructs of interest are based on a substantial body of prior research (Rogers, 1983; Tornatzky and Klein, 1982) and have been explicated prior to any item development. This also follows several prescriptions that items be developed to fit the constructs conceptual meaning as a method of ensuring construct validity (Bohrnstedt, 1983; Campbell and Fiske, 1959; Kerlinger, 1978).

Principal Component Analysis was conducted with VARIMAX rotation. The results indicate that a nine-factor solution was the most likely as nine factors have eigenvalues greater than 1.0, while the scree plot also showed a break after the ninth factor. The nine factors accounted for approximately 88% of the variance in the data set. This was verified by confirmatory factor analysis on this data (Gerbing and Hunter, 1988). Next, the rotated factor matrix was examined for items which either did not load strongly on any factor (<0.40), or were too complex (which loaded highly or relatively equally on more than one factor).

6. Summary

In line with the statistical analysis in the earlier sections, it can be concluded only three (cost pool, cost driver and pool-driver interrelationship) of the ten factors are statistically significant and have explanatory power on level of sophistication. Another factor (years in operation) becomes statistically significant but is negatively correlated, and thus, it has no explanatory power. The following table gives a general conclusion regarding all hypotheses assumed in the study for testing.

Hypothesis	Expected Sign	Supported	Not Supported
Hypothesis 1(H1): The more the number of cost pools, the higher the level of sophistication.	+	X	
Hypothesis 2(H2): The more the number of cost drivers, the higher the level of sophistication.	+	X	
Hypothesis 3(H3): The more complex relationship exists between cost pool and cost driver, the higher the level of sophistication.	+	X	
Hypothesis 4 (H4): Existence of independent department dealing with cost and managerial accounting data ensures more sophistication.	+		X
Hypothesis 5(H5): Existence of accounting professionals dealing with cost and managerial accounting data ensures more sophistication.	+		X
Hypothesis 6(H6): The greater the size of an organization (in terms of tune of turnover), the higher the level of sophistication.	+		X
Hypothesis 7(H7): The greater the proportion of indirect costs within an organization's cost structure, the higher the level of the sophistication.	+		X
Hypothesis 8(8): The more the number of years in operation, the higher the level of sophistication.	+		X*
Hypothesis 9(H9): The greater the degree of competition, the higher the level of sophistication.	+		X
Hypothesis 10(H10): The more the system is moving towards automation, the higher the level of Sophistication.	+		X

Table: Summary of Hypotheses and Findings [*This relationship was significant, but negative]

7. Conclusion

This study assumes that the assignment of indirect costs is based on the activity-based costing (ABC) concept since the purpose of activity-based costing is to fairly allocate the indirect costs over product. And most of the sophistication in cost and managerial accounting is targeted to the accurate tracing of indirect costs to cost objects (product or services). This will reduce the possibility of distortion in pricing. In such a situation, customers will be satisfied by spending money for the right value and the organizations will ensure long term sustainability. ABC systems are designed to be complementary with the technological changes in the factories due to enhanced global competition (Lewis, 1993). Thus, ABC is successful in doing that. As companies are moving to incorporate more and more cost drivers with structured cost analysis, they are switching to ABC system from traditional one that is not possible without instilling sophisticated system in operation/practice. The research work is, thus, targeted to find out the current level of sophistication we have with the identification of factors affecting such sophistication. And the survey concludes that the level of sophistication is explained by cost drivers, cost pools and pool-driver interrelationship. Thus, it supports the proposition that ABC system is sophisticated and traditional system is not. As the firms start using more and more cost drivers, the system is moving towards attaining more sophistication.

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