

ROLE OF MATHEMATICS IN BUSINESS AND COMMERCE – A STUDY

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ABSTRACT

Mathematics is everywhere: weather forecasting, automatic teller machines, secure websites, electronic games, statistical data analysis, opinion polls and many more. Mathematics and Statistics hold pivotal position in almost every field like Industry, Commerce, Physics, Chemistry, Economics, Biology, Psychology, Astronomy and many more, so application of mathematics is quite extensive. It has devised many tools in the field of commerce and management. This paper attempts to overview some of the important areas of mathematics such as algebra, matrices, statistics, probability, linear algebra and operational research in business which helps in achieving the business objectives viz. maximising profits, minimising costs and ensuring optimal utilization of resources.

Key words: *Business and Commerce, Mathematics.*

I. INTRODUCTION

Mathematics and Statistics are crucial and used in almost every domain of human world such as Industry, Commerce, Physics, Chemistry, Economics, Biology, Psychology, Astronomy, Engineering, Medicine and many more, hence application of mathematics is quite extensive. Statistics is the area of mathematics we use to explore and try to explain the uncertain world in which we live. We all are familiar with the use of statistics in opinion polls and market research, but it is also central to the manufacture and testing of many products. Mathematics is one of the important subjects which increase one's ability to logical thinking, problem solving and reasoning. In today's era of globalization, mathematics is one of the primary elements and proved very useful in the field of business. Business organizations are using mathematics in the field of accounting (viz. financial accounting, cost accounting, corporate accounting, management accounting) inventory management, sales forecasting, marketing, financial analysis (Karatzas & Shreve, 1998) [1]. Without mathematics one feels helpless in every aspect of business and commerce.

II. APPLICATION OF MATHEMATICS IN BUSINESS AND COMMERCE

Mathematics is used in almost every field of daily life. Business involves the buying and selling of goods in order to earn profit, it uses mathematics to record, classify, summarize and analyse the business transactions. So mathematics is used by commercial enterprises to record and manage the business operations such as,

elementary arithmetic involving fractions, decimals, percentage, elementary algebra, statistics and probability. Now a days business management is using advanced mathematics such as calculus matrix algebra and liner programming. Practical applications include checking accounts, forecasting the sales, price discounts, mark-ups, mark-downs, payroll calculations, simple and compound interest, reducing wastage of resources (Veer & Shukla, 2009) [2]. Some applications of mathematics in business and commerce are listed below:

2.1 Algebra

Mathematical principles are needed to study accounting. It incorporates successful exploration of numerical, geometrical and logical relationships. Mathematics benefits accountant in comparison – mathematical formulas help business and commerce to compare income, cost, expenses and profits. The various formulas are derived using various percentage, ratios and equations. The various ratios are derived such as: inventory turnover ratios, profitability ratios, debtor turnover ratio, debt-equity ratio etc. Mathematics is helpful in deriving accounting equation. The basic idea in accounting is that total wealth of business is called Assets. There are two possible claims on assets(A) called liabilities(L) and capital(C). By using mathematical relation $A=L+C$, accountants use mathematics in order to arrive the total cost and taking decision regarding manufacturing or buying the product. The total cost formula for business is $T= a+bx$; where 'T' is total cost, 'a' is fixed cost, 'b' is cost per unit produced and 'x' is no. of units produced. Also profits are determined by subtracting total cost from total revenue and helps in analysing the financial health of business and prices are determined by adding some mark-up to cost. So accountant used addition and percentage to determine the prices of product

2.2 OPERATIONAL RESEARCH (OR)

OR is concerned with determining the maximum (profit, performance, yields) or minimum (loss, cost, risk) of some real world objectives. OR includes game theory, linear programming formulation techniques, PERT, CPM, transportation problems. Linear programming also called linear optimization is a method to achieve the best outcome (as maximum profit or lowest cost or ensuring best use of available resources) in a mathematical model whose requirements are represented by linear relationship. Some of industries that use LP model include transportation, energy, telecommunication and manufacturing. Linear function to be maximized by mathematical function.

2.3 STATISTICS AND PROBABILITY

Statistics is very indispensable for the businessman. It formulates various plans and policies and forecasts trends of future such as change in demand, market fluctuations using statistical techniques. On the other hand, future events are uncertain and to predict these uncertainties, probability is an effective tool to forecast sales, scenario, future returns and risk evaluation in the business world. Before introducing the product, team of market research analyse data relating to population, income of consumer, tastes, preferences, habits, pricing policy of competitors by using various statistical techniques. We can collect and analysis the data in the field of economy by using statistical methods. Probability theory serves as a useful tool for decision making, estimating number of defective units, sales expected and also in business policies. Through the use of statistical (regression) techniques Levine and Zervos (1998) [3] attempted to find the empirical relationship between various measures of stock market development, banking development, and long-run economic growth. They concluded that even after controlling for many factors associated with growth, stock market liquidity and banking development are both positively and robustly correlated with contemporaneous and future rates of economic growth, capital

accumulation, and productivity growth. The small business firms especially those in the fashion industry should learn and apply probability theory since their line of business was more prone to chance occurrences (Orga, &Ogbo, 2012) [4]. In their study in Nigeria they observed that the small business firms fail despite the programmes of government directed at their survival. The application of probability theory in small business was examined to find the implications and in restoring the gap between the rich and the poor through better and informed decisions. The findings indicated that probability theory has wide application in small business firms; probability shows specificity in business situations and is inevitable in this era of information overload caused by ICT. In nutshell, statistics and probability are very useful in taking various decisions relating to material, production, finance, personnel and marketing in an Industry.

2.4 CALCULUS

Calculus is another branch of mathematics made up of two fields- differential calculus and integral calculus. Differential calculus plays valuable role in management and business for decision making in production (e.g. supply of raw material, wage rates and taxes). In calculus, the case when 'y' is a function of 'x' or we can say one variable(y) is dependent on other variable(x) and the derivative of 'y' w.r.t. 'x' i.e. dy/dx measures the change of variable 'y' w.r.t. change in variable 'x'. Derivative enables a firm to make important production decisions. It is also called marginal function. Demand can be assumed as a function of price. This operator is also helpful in calculating minimum cost and maximum profit. Also total cost of production and marketing depends on no. of units in mathematical relations, which can be described as $c(x) = F + v(x)$, where $c(x)$ is cost function $v(x)$ is variable cost and F is fixed cost. Revenue function $R(x)$ can be represented as $R(x) = xp(x)$, where 'x' is no. of units and 'p' is rate per unit. Hence knowledge of derivative is essential for understanding the economic relations. Another integral operator is used to calculate the total revenue in case of marginal revenue is given. So calculus plays a vital role in taxes, profit and revenue calculations which are very important for any business.

2.5 MATRIX AND LINEAR ALGEBRA

Matrices play prominent role in developing a solution required for commercial organizations. It has knowledge to deal with unique needs of various sectors of Industry. It gives opportunities to finance and logistics management and customer relationship by providing them a variety of solutions. Also product price matrices are helpful to set bulk purchase discount. Determinants and Cramer rule are helpful in problem solving related to business and economy. It enables oneself in obtaining an optimal solution to maximize profit or minimize cost problems. Linear algebra serves a purpose of powerful tool for its application in business. As total cost, revenue, supply, demand and population are all related with a system of linear equations. Leontief (1987) [5] derived a production equation in input-output analysis and got Noble prize for his contribution. The model given by him was $X=CX+d$, where x is the production factor, c is consumption matrix and d is demand vector. If matrix $I-C$ is invertible then appropriate production for a given final demand can be computed directly via $X=(I-C)^{-1}d$.

This basic input- output analysis however is a very powerful tool (Miller & Blair, 2009) [6]. It can Predict what happens to an economy when final demand changes. By changing the consumption matrix this can represent what happens to an economy when the relative cost in terms of other goods (a change in one or more entries in internal demand) of producing one good can change both internal and final demand economy. Dyck & Sumaila (2010) [7], has applied the Leontief technological coefficients at total current impact of the fisheries sector at

current production and then estimate total output supported throughout the economy at the current level of production. They recognized that the non-linearity of fisheries production could cause problems when doing predictions at various levels of production.

III. CONCLUSION

Thus, it is evident that mathematical methods and tools become crucial part of the business organization. Application of mathematics becomes necessary from the beginning i.e. from buying or estimating the cost of product to the end sales and earning profits. Mathematical formulae help business to do financial analysis using ratios, percentages, equations. The objective of minimizing cost & maximizing profit is achieved through linear programming and calculus. The estimation of future returns & profitability is done through probability distributions. It also helps in sale forecasting & risk evaluation. Matrices play important role in variety of solutions for consumer relationships and logistics management. Statistics helps in collection, presentation and analysis of data to arrive at conclusions (Chiang & Storey, 2012) [8]. Statisticians have developed many tools for application and which can be utilized for business improvement. Statistical Thinking and Methods need to become part of the knowledge base of an organization (Abraham, B., 2007) [9]. In his study, he outlined several issues related to the implementation of statistical methods in business and industry. Well planned systems and training are necessary for implementation. Enhancement of university education is also necessary. In the light of above, we conclude that knowledge of mathematics should be made compulsory for students of Commerce and Management as it plays a key role in any business.

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