A Study of Application of Mathematics in Business, Commerce and Management

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ABSTRACT

There are several applications of mathematics, like electronic games, automated teller machines, safe websites, statistical data analysis, and opinion polls. The applications of mathematics are pretty broad as they are fundamental to practically every subject, including industry, commerce, physics, chemistry, economics, biology, psychology, astronomy and many more. It has created several tools for management and commerce. In order to support the achievement of the business objectives—maximizing profits, minimizing expenses, and guaranteeing optimal resource utilization—this paper aims to provide an overview of some of the key areas of mathematics such as algebra, matrices, statistics, probability, linear algebra, and operational research in business.

Key-Words: Business and Commerce, Mathematics

1. INTRODUCTION

Mathematics and statistics are important and employed in practically every aspect of human life, including industry, commerce, physics, chemistry, economics, biology, psychology, astronomy, engineering, medicine, and many others, hence its use is wide-ranging. Statistics is the branch of mathematics that we employ to investigate and understand the unpredictable environment in which we live. People all are aware with the use of statistics in opinion surveys and market research, but they are also essential in the production and testing of many items. Mathematics fosters logical thinking, problem-solving, and reasoning skills. Mathematics is one of the most important factors in today's globalized world and has shown to be quite helpful in the business sector. In the fields of accounting (financial, cost, corporate, and management accounting), inventory management, sales forecasting, marketing, and financial analysis, business organizations use mathematics. One feels helpless in every area of commerce and business without mathematics.

2. LITERATURE REVIEW

Klimova's (2019) study illustrates that mobile apps can be effective in the enhancement of student's performance in terms of their language learning by implementing smartphone app learning in a continuous assessment

Johnson et al. (2016) found out that learning programs that use web-based teaching offer students more adaptability to learn at their own pace and at convenient times, reduced travel time, and additional opportunities for reviewing course materials.

Grane (2016) demonstrates that multimedia content is not separate from the format, but that the interaction design of the applications for mobile devices determines the accessibility of content for users, especially for pre-schooled-aged children. The quality of mobile applications targeted at early childhood thus depends on two conditions: taking into consideration the developmental stage of the child when formulating content and activities and employing an interaction design that is appropriate to the child's cognitive and psychomotor development. This interaction design presents key difficulties in the search for simplicity due to the elevated presence of distractors and active elements on the screen that are often unnecessary. Although research demonstrates the potential of quality interactive resources for learning, the apps reviewed did not adapt to the needs of the target group. It was suggested that complements the heuristics analysis with observations of the interaction of children with the apps, define a direct implication, and establish a relationship with developers to improve interactive materials and adaptability.

Ling et al (2014) sought to understand whether the use of mobile applications had an impact on students' learning of the new statistical concept when learning through examples with the mobile app, students performed better on problems that required them to apply their knowledge, which corresponds to the third level of learning in Bloom's taxonomy.

3. MATERIAL AND METHOD

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. Some applications of mathematics in business and commerce are listed below:

3.1. 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

3.2. 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.

3.3. STATISTICS AND PROBABILITY

Statistics is very indispensable for the businessman. It formulates various plans and policies and forecasts trendsof 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 researchanalyse 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 there 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 businesswas 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.

3.4. 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 isalso 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 theeconomic 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.

3.4. 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 and 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. It is 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 isinvertible 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. 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. It 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.

4. 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. 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. 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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