

IMPORTANCE OF QUANTITATIVE TECHNIQUES IN MANAGERIAL DECISIONS

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Abstract

The term 'Quantitative techniques' refers to the methods used to quantify the variables in any discipline. It means the application of subjects like mathematics and statistics, econometrics and operations research to understand and solve problems.. It is a study of the application of differential calculus, integral calculus and matrix algebra, measures of central tendencies, measures of averages, correlation and regression etc. It also includes the application of the techniques of management science such as Linear programming, Game theory, CPM and PERT analyses to business problems. The relevance and usefulness of Quantitative Techniques in seven functional areas of Management are discussed in this paper.

Introduction:

Truly, the importance of Quantitative proficiency cannot be over emphasized to Management Professionals! This body of knowledge involving quantitative approaches has been given various names like- Business Mathematics, Business Statistics, Operations Research, Decision Science and Management Science. All are concerned with rational approaches to decision making based on the scientific method.

For example, consider the following simple mathematical problem:

A) "A Mayor of a town wants to improve the bus services between 2 destinations falling within his district. The destinations are 1 hour journey apart and he wants the bus services in such a way that a traveler need not wait for more than 20 minutes time, at either side. So, how many buses are totally required ? For convenience sake assume that the buses will be operational for 24 hours continuously and also ignore lunch breaks, tea breaks etc"

B) 10 black colour cards (both sides black) and 20 green colour cards (both sides green) are available in a box. Assuming you close your eyes and pick up the cards one by one, how many cards you should pick up, before you have 2 cards of the same colour ?

(Answers are given at the end)

While a trained person will solve this puzzle within a few minutes, a person who is not equipped with Quantitative inputs, will indeed struggle for a long time.

Two developments that occurred during the post-world war II period, led to the growth and use of quantitative methods in nonmilitary applications.

- One, the most significant development was the discovery of Linear programming by G.Danzig in 1947.
- Secondly, the computer technology explosion.

It has been widely accepted that a manager should, to a certain extent be familiar with techniques to deal with numbers in order to make right decision at the right time. Students of management are advised to have a working knowledge of mathematics and statistics applied to business problems for a successful career as a manager of multinational companies. Decisions can be called scientific only when they are backed by facts expressed numerically. In modern times, the managers are exposed to different software such as SPSS, EXCEL, SAS, SAP, EViews so that the decision making process becomes not only scientific but also reliable.

Computers simplify the monotony of doing calculations.

Management science (MS) is an interdisciplinary branch of applied mathematics devoted to optimal decision planning with strong links with economics, business, engineering and other sciences. It uses various scientific research-based principles, strategies and analytical methods including mathematical modelling, statistics and numerical algorithms to improve an organisation's ability to enact rational and meaningful management decisions by arriving at optimal or near optimal solutions to complex decision problems.

In short, management sciences help businesses to achieve their goals using the scientific methods of operational research. Management science is concerned with developing and applying models and concepts that may prove useful in helping to elucidate management issues and solve managerial problems, as well as designing and developing new and better models of organisational excellence. The application of these models within the corporate sector became known as management science. The problem solving process involves the following seven steps:

1. Identify and define the problem
2. Determine the set of alternative solutions
3. Determine the criteria to evaluate the alternatives
4. Evaluate the alternatives

5. Choose an alternative
6. Implement the selected alternative
7. Evaluate the results.

Let us analyse the importance of quantitative methods in seven functional areas of management.

1. Marketing

Quantitative marketing is about data, facts, information and knowledge. We define quantitative marketing as the utilization of facts and knowledge to understand better the behavior of consumers across the marketing enterprise to maximize marketing investment.

2. Business Analytics

Business Analytics is a specialized domain that has been growing at an annual rate of about 30 per cent. Companies incur significant expenditure on business intelligence. Besides the job being challenging, diversified and refreshing, the pay packet is quite attractive. Analytics include complex statistical analysis, computational modeling and data mining. The domain encompasses enterprise decision management, predictive science, strategy science, fraud analytics, credit risk analysis, marketing analytics, and so on. With the growing popularity of Business Intelligence tools, the business significance of analytics is gaining greater acceptance in industry

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3. Marketing Engineering

Marketing engineering is computer assisted marketing analysis and planning. Marketing managers must make ongoing decisions about product features, prices, distribution options and sales compensation plans. When making these decisions, managers choose from among alternative courses of action in a complex and uncertain world. Marketing engineering provides managers with new concepts, methods and technologies to make decisions in increasingly data-intensive marketing environments.

4. Data Mining

Knowledge of advanced data mining techniques enables marketers to gather and organize data and address key business questions, to learn how to leverage the growing volume of customer data captured in the marketing process. Multiple regression analysis, logistic regression analysis, decision trees, factor analysis, cluster analysis, risk modeling, neural networks, Web log analysis, and market basket analysis are used to organize, analyse and summarise the data and make relevant inferences about the behaviour of different segments of customers.

5. Production

5.1 Facility location

Plant expansion and new facility construction are among the most far reaching decisions an organisation faces. Breakeven analysis can be done for the selection of best location by comparing alternative locations on an economic basis. Factor rating is a means of assigning quantitative values to all the factors related to each decision and deriving a composite score that can be used for comparison. Further linear programming can be applied to find out the transportation costs for raw materials and finished goods so that they can decide the location of a plant.

5.2 Product design

It is the structuring of components/parts or activities so that as a unit they can provide a specified value. Computer Aided Design(CAD), Computer Aided Manufacturing(CAM), Group technology (GT), and Computer Integrated Manufacturing system (CIM) are designed to integrate product design and manufacturing activities with both the suppliers of materials and components as well as the customers of the firm's products.

5.3 Process planning

It consists of designing and implementing a work system to produce the desired goods or services

in the required quantities at the appropriate time and within acceptable costs. Monte Carlo Simulation can be done using software such SIMSCRIPT,GPSS, DYNAMO,SLAM,SIMAN etc. Assembly and flow-process chart can also be used

5.4 Project management

A project is a unique set of activities that must be completed to achieve a specific objective within a limited time period by utilizing appropriate resources. The network models Critical –path method and program evaluation and review technique used for project scheduling

6. Human Resource

6.1 Performance Appraisal

Qualitative approaches like interviews and questionnaires are not always suitable. For example, if your aim is to compare jobs for pay purposes, you may need to say that, in effect, Job A is twice as challenging as Job B and so is worth twice the pay. To do this, we must be able to assign quantitative values to each job. The position analysis questionnaire and the US Department of Labor approach are popular quantitative methods.

6.2 Position Analysis questionnaire (PAQ):

A questionnaire used to collect quantifiable data concerning the duties and responsibilities of various jobs. It is a very structured job analysis questionnaire. The PAQ contains 194 items, each of which (such as written materials) represents a basic element that may or may not play an important role in the job. The job analyst decides if each item plays a role and if so to what extent. For example, written materials received a rating of 4, indicating that written materials (like books, reports, and office notes) play a considerable role in this job. The analyst can do this online.

The advantage of the PAQ is that it provides a quantitative score or profile of any job in terms of how that job rates on five basic activities: (1) having decision making / communication / social responsibilities, (2) performing skilled activities, (3) being physically active, (4) operating vehicles / equipment, and (5) processing information. The PAQ's real strength is thus in classifying jobs. In other words, it lets you assign a quantitative score to each job based on its decision making, skilled activity, physical activity, vehicle/equipment operation, and information processing characteristics. You can therefore use the PAQ results to quantitatively compare jobs and then assign appropriate pay levels for each job.

US Department of Labor (DOL) Job analysis procedure:

A standardized method by which different jobs can be quantitatively rated, classified, and compared based on data people and things scored. The US Department (DOL) job analysis procedure also provides a standardized method by which to quantitatively rate, classify and compare different jobs.

7. Finance

Financial markets and others generate vast amounts of data on asset returns, their volatility, and other financial variables in long and high-frequency time series. The ability to analyse market behaviour requires knowledge of the properties of time series and appropriate estimation methods. Since the early 1980s techniques for analysing time series which exhibit auto-regression have yielded important studies of financial markets, increasing our knowledge of financial variables' volatility. It examines techniques for the valuation of different classes of securities, analyses criteria for guiding investment decisions, considers the measurement of asset risk and return and discusses statistical techniques of forecasting.

E - Views software is provided for regression analysis and diagnostic procedures. It improves the confidence and skill in the use of the mathematical and statistical methods used in the analysis of financial instruments and financial markets, including the

calculation of financial market yields and probability, correlation and prices, frequency distributions, risk and regression analysis.

Answers to the puzzle:

- A) A simple problem of Logistics: Total requirement- 6 buses. 3 buses to be positioned on each side, in the beginning.
- B) A simple problem of Probability :2 or 3 cards

About the author:

Prof. P. Murugesan has 40 years of experience in teaching Quantitative subjects, Research Methodology, Production Management & allied Subjects

Quotable Quotes

- The best exercise is to bend down in order to lift somebody.
- Happiness is like electricity; it is available everywhere, you have to know just where to plug in.
- Worries are like babes; the longer you nurse them , the bigger they become.
- When you talk, you already know the contents; when you hear there could be something new.
- Nothing big has ever been achieved, without being passionate about it.
- Fear & greed are generally credited to be the ultimate motivators of mankind. But the desire to excel, achieve & serve others are as strong.
- No one has damaged his eyes by looking at the brighter side of life
- Old age is a question of mind over matter; if you don't mind, it doesn't matter