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A case study of application of operations research and quantitative techniques in real life situations

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Abstract
The Operations Research techniques are not simple but involve higher mathematics. The tendency today is to combine several of these techniques and form more sophisticated and advanced programming models. The subject of operation research was born during Second World War in U.K., and was used for military strategy. During World War II, a group of scientists, having representatives from mathematics, statistics, physical and social sciences were entrusted to the study of various military operations. This team was very successful and greatly contributed to the meticulous handling of entire operation and related problems of the operation. After the World War II, it was started applying in the fields of industry, trade, agriculture, planning and various other fields of economy. The present study accounts the applications of Operations Research to prove the multidisciplinary of O.R.

Keywords: operations, applications, multi-disciplinary

Introduction
Scientific methods have been man's outstanding asset to pursue an ample number of activities. It is analysed that whenever some national crisis, emerges due to the impact of political, social, economic or cultural factors the talents from all walks of life amalgamate together to overcome the situation and rectify the problem. The quantitative techniques had facilitated the organization in solving complex problems on time with greater accuracy. The historical development will facilitate in managerial decision-making & resource allocation, The methodology helps us in studying the scientific methods with respect to phenomenon connected with human behavior like formulating the problem, defining decision variable and constraints, developing a suitable model, acquiring the input data, solving the model, validating the model, implementing the results. The major advantage of mathematical model is that it's facilitates in taking decision faster and more accurately.

Meaning and Definition of Operations Research
Operations Research has been defined so far in various ways and still not been defined in an authoritative way. Some important and interesting opinions about the definition of Operations Research which have been changed according to the development of the subject been given below:
Operations Research is a scientific method of providing executive departments with a quantitative basis for decision regarding the operations under their control. Morse and Kimbal (1964)
Operations Research is a scientific method of providing executive with an analytical and objective basis for decisions. PMS. Blacket (1964)
OR is the application of scientific methods, techniques and tools to problems involving the operations of systems so as to provide these in control of the operations with optimum solutions to the problem." Churchman, Acoff, Arnoff (1957).

A Brief History [1]
The techniques of operations research owe their origin to the endeavour of applications of scientific, mathematical and logical principles to the solutions of the military problems. The birth of these methods may be traced to the writings of F. W. Lancaster, who, during the First World War, applied mathematical analysis to military operations. He studied relationships between victory of forces and their superiority in fire power and number. Presentation of a very simplified Lancaster model is interesting, if for nothing else, for its historical significance.

The origins of operations research
The formal activities of Operations Research (OR) were initiated in England during World War II when a team of British scientists set out to make decisions regarding the best utilization of war material. Following the end of the war, the ideas advanced in military operations were adapted to improve efficiency and productivity in the civilian sector. Today, OR is a dominant *decision-making* tool.

Objectives of the Study
- To review literature on the topic
- To examine the various real life case studies on the Operations Research
- To understand the theoretical framework of the Operations Research

Review of Literature
Carlos A. Valero [2] examine the status and extent to which administrators of colleges and universities in the state of Virginia apply qualitative and quantitative techniques of management in planning, directing, reporting, and controlling activities for enhancing their administrative and

[1] Applications of operations research techniques in agriculture; Ramesh Chandra Agrawal (1967)
[2] Applications of Qualitative and Quantitative Techniques of Management in Administrative/Academic Decision-Making in Institutions of Higher Education in Virginia

academic decision-making capability. The study was directed to the top and operative organizational levels in two categories of administrators (nonacademic and academic) to determine the types of managerial techniques used, degrees of familiarity with these techniques, frequency of use, managerial benefits and constraints, and individual and organizational factors involved in using such techniques. The qualitative and quantitative techniques were selected from diverse sources of related literature.

Harvey M. Wagner feel that analogously, for many years a few operations re-searchers have been foretelling the day when senior level corporate executive will interact directly via computer monitor to make major decisions. Over the past couple of years, the author observes that many senior executive are making frequent use of micro-computers. Photographs of CEOs with microcomputers on their desks appear often now in business magazines. Doing "what if" analysis using spreadsheet models and gathering factual information from stored data bases have become routine for many high level managers. The author opines demonstrated effectiveness of operation research, many executives throughout the typical large business organization understand the underlying concepts of this language`. The term specialist, if it still has any meaning, pertains to watch for in the next 10 years will not be visible in the form of electronic gear sitting on the chief executive's desk. Rather, it will be evident in the growing and continuing successes of general managers who are making consistent and effective strategic use of formal operations research models.

Jayant Rajgopal [3] propounds that although it is a distinct discipline in its own right, Operations Research has also become an integral part of the Industrial Engineering profession. This is hardly a matter of surprise when one considers that they both share many of the same objectives, techniques and application areas. Operations Research as a formal subject is about fifty years old and its origins may be traced to the latter half of World War II. Most of the Operations Research techniques that are commonly used today were developed over (approximately) the first twenty years following its inception. During the next thirty or so years the pace of development of fundamentally new Operations Research methodologies has slowed somewhat

Rio de Janeiro (2006) observes most operational researchers are confronted with two serious problems: lack of identity and legitimation of our discipline. Lack of identity is related to the specification of our abilities, our craft. Looking at Operations Research journals or talking with participants of international Operations Research conferences will not give a specific answer to our previously formulated question. Some Operations Research people are good computer programmers. Others are good applied mathematicians, while others are good socio-psychologists. Some are good model builders; others are good model solvers. Some are good at identifying problems, others are good at solving problems and others are good at inventing problems. This identity problem, this alienation from Society, is also a problem for other professional disciplines.

Sadhana Chandra and Rahul Karmakar (2018) [4] feel that Computer science and Operation Research are interrelated since their origin, each contributing to the dramatic advances of the other. The main idea of operation research-based modelling in computer science applications is the systematic approach to deal with the problem and get the optimized solution. This is one of the best platforms where we get the best knowledge through profit and loss concept. This study is aimed to find the minimum cost and expected time to finish a project. Operation Research also represents a clear idea about co-operation between intelligent relations with decision making. The optimization models are very useful in computer science, especially in software engineering and computer network domains. A system model can be built and mathematically prove by O.R models. The main overview of Operation Research is to give the perfect solutions to win a war without fighting it. The implementation of O.R. is mainly depended on the person who provides the solution and the person who use the solutions.

Sait Tunc, Oguzhan Alagoz and Elizabeth Burnside (2014) [5] finds that Medical decision making (MDM), the discipline applying systematic approaches to solve the decision-making problems in healthcare, aims to develop standards for ideal decision making, to understand the motivation behind the routine decisions of physicians and patients, and to provide effective tools for physicians, patients, and healthcare policymakers for better decision making. To this end, MDM relies heavily on quantitative models. Applications of MDM include decision problems in breast cancer diagnosis and treatment, disease modeling, drug selection in HIV treatment, optimal timing of organ transplantation, and optimizing radiotherapy treatment planning, among many others.

Steps in Operations Research

Operations Research (OR) is an analytical method of problem-solving and decision-making that is useful in the management of organizations. In operations research, problems are broken down into basic components and then solved in defined steps by mathematical analysis. Analytical methods used in OR include mathematical logic, simulation, network analysis, queuing theory, and game theory. The process can be broadly broken down into three steps [6].

1. A set of potential solutions to a problem is developed. (This set may be large.)
2. The alternatives derived in the first step are analyzed and reduced to a small set of solutions most likely to prove workable.
3. The alternatives derived in the second step are subjected to simulated implementation and, if possible, tested out in real-world situations. In this final step, psychology and management science often play important roles.

[3] Principles And Applications Of Operations Research (From Maynard's Industrial Engineering Handbook, 5th Edition, pp. 11.27-11.44)

[4] International Journal of Mathematics Trends and Technology (IJMTT) – Volume 53 Number 5 January 2018 ISSN: 2231-5373 http://www.ijmttjournal.org Page 369 Operation Research in Computer Science: a Case Study

[5] Opportunities for Operations Research in Medical Decision Making; 2014 May-June; 29(3): 59–62

[6] Operations research Margaret Rouse (2011)

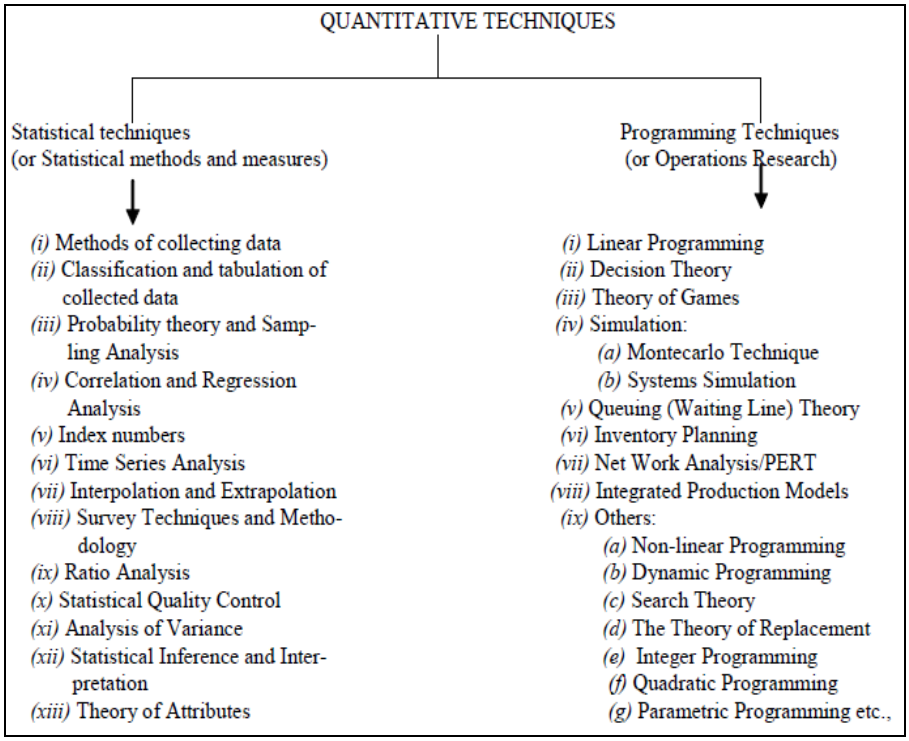

Fig 1: The following chart enlists the name of the important quantitative techniques

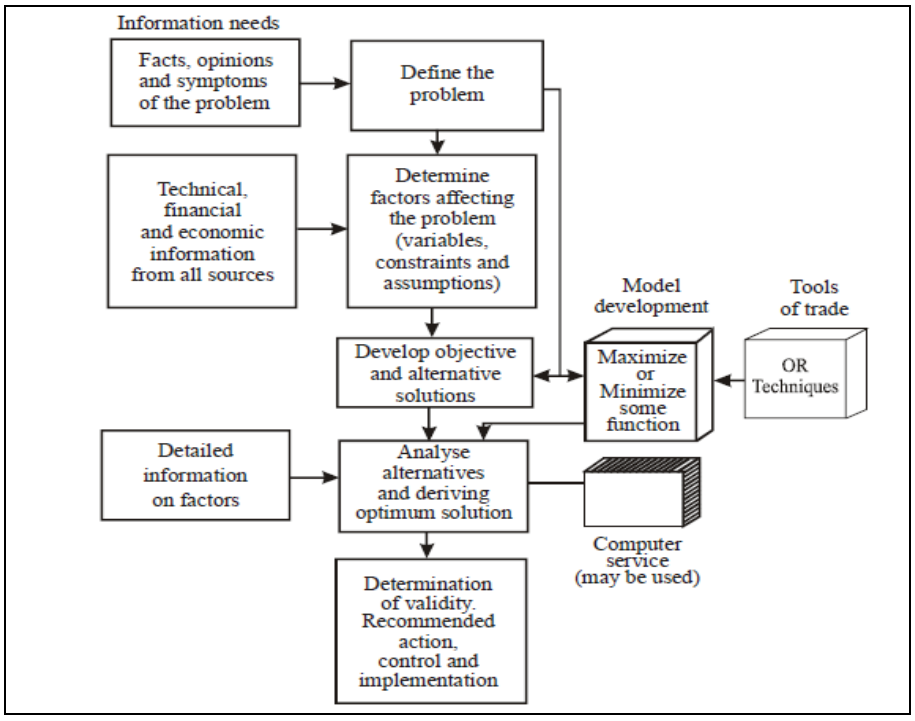

Fig 2: Flow Chart Showing OR Approach

Table 1: Application of Operations Research in Real Life situations- Case Studies

Inventory Optimization and Supply Chain Management Improvements for a Leading U.S. Retailer	Poor supplier relationships had exacerbated the company's inefficient supply chain	The project team identified inventory optimization and cost savings with the potential to increase profits by 20 to 30 percent. The team estimated that process improvements would also increase inventory turns by 10 to 20 percent and that product allocation changes would reduce out-of-stock items and lead to sales increases of between 2 and 5 percent
Supply Chain Redesign for a Major Petrochemicals Company	The company was active in multiple product lines, including polymers, basic chemicals, inter-mediates, fertilizers, specialties, and metals. As a result of this diversity, it had developed an extremely complex, global production and distribution network with multiple storage locations and various modes of transportation for delivering its products to customers.	During the initial diagnostic phase, the project team identified numerous improvement opportunities at the functional level, as well as within each SBU. The strategy blueprint resulted in improved service levels, streamlined planning and operations processes, enhanced operations, and increased reliability.

Lean Principles Improve Operations at an Australian Financial Institution	One reason for the high rate of missed deadlines was that the first-pass rate for loan documents was only 37 percent, meaning nearly two-thirds of the bank's customers had to resubmit or submit additional paperwork.	Implementation of the recommendations led to a reduction of average cycle time for customer settlements from 23 to 3 days. The first-pass rate of loan documents has nearly doubled from 37 percent to 66 percent. Also, the number of customers whose expected settlement dates are missed has dropped from more than a quarter (26 percent) to a mere 5 percent.
Operational Turnaround Saves Time and Money for Southeast Asian Automaker	They would have to shore up a host of critical processes—including product development, procurement, manufacturing, supply chain management, quality control, sales, after-sales, and selected support functions—in order to bring key operational measures to global OEM standards and generate tangible financial results.	The company launched more than 10 turnaround initiatives over a period of five years, achieving $45 million in savings the first year, and more than $500 million by the end of the project.
Category Performance Improvement for a Large U.S. Grocery Chain	While the executive team recognized the need to improve category performance and supplier management, it could not afford to jeopardize the company's current growth trajectory.	The new engagement model drove a fundamental change in how the company worked with its suppliers, moving it to a more collaborative approach.
Operational Excellence in Energy Management for an Indian Tower Company	A leading tower company (owning and managing telecom towers) wanted to reduce its energy costs and address historical inefficiencies in the system, without incurring significant capital expenditure or compromising on customer SLAs.	Armed with the “ideal energy cost” model, the client was able to achieve significant reduction in power and fuel cost of focus regions. It achieved turnaround even in pockets with challenging external environment.
End-to-End Value Enhancement for a Leading Packaged Foods Player in India	A leading Indian packaged foods player with an annual turnover of over US $1 Bn was experiencing intense competition in a growth market. Simultaneous commodity inflation coupled with inability to pass on cost increases to the customer led to sustained pressure on margins.	The organisation achieved overall value enhancement amounting to ~10% of sale over the span of the program. Beyond tangible value enhancement, we established a center of excellence within the client organization and enhanced client capability for continued disruptive thinking
Supply Chain Transformation of an Alcoholic Beverage Company	A leading alcoholic beverages company with a domestic (India) turnover over US $1 Bn was experiencing multiple challenges in meeting customer demand and service level expectations. Nascent supply chain organization and processes, highly regulated route to market, high product portfolio complexity and high supplier uncertainty were some of the key challenges at hand.	The transformation initiative helped the client in achieving best in class customer service levels in the markets addressed (35-40% above the initial baseline). Additionally, sales achievement improved to ~120% on account of increased availability and scientific inventory norms.
Direct Material Cost Transformation Program for a Leading Automotive OEM	A leading automotive OEM had identified cost leadership as a strategic plank for growth. However, application of traditional sourcing-led levers and an ‘inward focused approach’ towards cost reduction had resulted in successive years of limited savings from their internal cost reduction efforts.	Organisation built sustainable competencies within the client organization to ensure long term value creation by enabling improvements in the client’s governance structure, performance management and process adherence to cost reduction methodologies.

(***Source*:** Compilation from the Author)

Table 2: The Research Directions of Optimization Models in Computer Science Domains

Optimization Model	Inventor	Application Domain	Cost	Year of Invention	Useful Components
Linear Model	George B Dantzig and Kantorovich	It is widely used the field of optimization for several reasons such as business, service, industry etc.	Given a System minimize cTx subject to AX<=b, x>=0.	1939 to 1947	The variables are also subject to the condition in the form of Linear equation.
Inventory Model	J.O.Adimoha‘s	It is considered an asset and retail store so the accountant must consistently use a valid method for assigning costs to inventory in order to record it as an asset.	Since inventory is rather expensive.	Not finding the proper invention time.	It serves different product which prescribe maximum And minimum inventory.
Game Model	J.Von Neumann	It is mainly used in economic, political, science, as well as logic, Computer science, biology.	It depends upon the current situation of the problem	1944 to 1970	It is proposed for modelling the strategy b/w two or more the player in a situation Constraining set rules and outcomes
Queue Model	Agner.Krarup.Erlang	It is a mathematical study of waiting lines and the ideas have seen including telecommunication, traffic engineering, shops	Cost provide the service	1878 to 1929	Input source generates customers, service discipline, service mechanism etc.

N/W Model	PERT was developed U.S.Navy company and CPM was developed E.I.DUPont company	CPM and PERT both are project management techniques so that it is needed of western industrial, military establishment to plan, schedule and control complex project.	Cost mainly estimates for each activity	PERT and CPM both are basically started at the same time in 1956 to 1958	Event and Activity
Transportation Model	F.L.Hitchcock, T.C. Koopmans, G.B Dantzig.	It is the simplified version of the simplex technique such as find out the shortest path.	Uses minimum cost to solving the transportation problem	1941(Hitchcock) 1949(Koopmans) 1951(Dantzig).	Solving problem involving several products, source and Several destinations of the product.
Markov Model	Andrei A.Markov	Used in modelling many practical problems such as queuing system, manufacturing system.	Cost is dependent on the product feature	1905	Modelling categorical data sequence.

(***Source*****:** Sadhana Chandra and Rahul Karmakar International Journal of Mathematics Trends and Technology (IJMTT) – Volume 53 Number 5 January 2018 ISSN: 2231-5373 http://www.ijmttjournal.org Page 369 Operation Research in Computer Science: a Case Study)

Conclusion

Quantitative Techniques adopt a scientific approach to decision-making. In this approach, past data is used in determining decisions that would prove most valuable in the future. The use of past data in a systematic manner and constructing it into a suitable model for future use comprises a major part of scientific management. The scope and areas of application of scientific management are very wide in engineering and management studies. Today, there are a number at quantitative software packages available to solve the problems using computers. This helps the analysts and researchers to take accurate and timely decisions. Nowadays Operations research is applied by organizations of all types and in every department at all levels. Availability of faster and flexible computing facilities and the number of qualified Operations Research professionals have enhanced the acceptance and popularity of the discipline.

References

1. Ackoff RL. The art of problem solving. New York: Wiley, 1978.
2. Aiken M, Hage J. The organic organization and innovation. Sociology. 1971; 5:63-82.
3. Bessant E, Bessant AM. Student flow in a university department: Results of a Markov Analysis. Interfaces. 1980; 10(2):52-59.
4. Brien R. The managerialization of higher education. Educational Record. 1970; 51(3):273-280.
5. Cameron KS. Domains of organizational effectiveness in colleges and universities. Academic Management Journal. 1981: 24:25-47.
6. Check land, PB. From optimising to learning: A development of systems thinking for the 1990s. Journal of Operation Research Society. 1985; 36(9):757-767.
7. Fiedler FE. A theory of leadership effectiveness. New York: McGraw-Hill, 1976.
8. Gaither N. The adoptions of operations research techniques by manufacturing organizations. Decision Sciences. 1975; 6(4):797-813.
9. Hopkins DSP. Models for affirmative action planning and evaluation. Management Science. 1980; 26(10):994-1006.
10. Kathawala Y. Applications of quantitative techniques in large and small organizations in the United States: An empirical analysis. Journal Operation Research Society. 1988; 39(11):981-989.
11. Schroeder RG. A survey of management science in university operations. Management Science. 1978; 19(8):895-906.
12. Weick K. Educational organizations as loosely coupled systems. Administrative Science Quarterly. 1976; 21(1):1-19.