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USE AND APPLICATION OF OPERATIONAL RESEARCH IN INDUSTRY & MANAGEMENT

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ABSTRACT

In today's ever-changing industrial environment, OR offers scientific techniques, tools and models for planning, management, control and decision-making. Scientists have done a lot of research on the quantitative uses of OR in various areas, especially in India where population is increasing and demands innovation in supply chain, service and production. This article emphasises the importance of OR methods such as problem solving, linear programming, simplex, transportation modelling, job flow and game theory in industry problems. They not only save money and avert inefficiencies, but also help with productivity and decision-making. Every business, no matter what industry it is in, relies on OR tools to optimize and constraint handle. Moreover, this paper explains the most important activities that OR allows for – planning, organizing, scheduling, budgeting, cost-control.

1. INTRODUCTION

Mathematics is an art and a science that cannot exist without, and it has transformed production and industry. Complex elements in these areas are too complex not to be governed by mathematical operations. Practical mathematics and research science were earlier used temporarily to solve problem of decision and planning. Quantitative mathematics became an accepted method for standard-setting and programme goals in the 1950s and '60s. These approaches allowed for the definition of goals and constraints, which were the backbone of operational

knowledge in the real world. Therefore many models were created and deployed as process models for several operations. Mathematics is an engine for management development, and the bedrock of science, especially for industry management. Operations research was central to this pursuit. This paper describes the use of operational research methods for industry management and how these tools can be applied for industry governance.

2. REVIEW

Originally developed by Churchman and Ackoff and later matured with soft systems – is very much at home within the development of OR and management science. In this article we review some of the recent contributions of systems thinking – and especially its contribution to OR. Because systems thinking is theoretically and methodologically so well developed, it can be used to solve a wide range of problems. But because it's such a broad category, critics have to zero in only on some of the details. The paper reviews literature in both the theoretical and the applied aspects, beginning with the earliest systems theories and their contemporary evolution, and continuing with their application. Major applications include strategy, information systems, organizations, production and operations, ecology and agriculture, and medicine and health. Systems thinking, while not privileged with institutional support in the academic community, are alive and well because of its multiplicity of uses (Mingers & White, 2010).

The methods of problem solving are a subset of participatory methods. While "problem structuring" was recently added to the OR vocabulary, there are many frameworks created in the past 50 years. The value of systemic problem modelling and participatory approaches is celebrated as highly productive. But the proof of such claims tends to come from small case studies. Experiments on interventions and strategies in different settings lack complete evaluation, partly due to local characteristics (such as the specialist's experience and stakeholder goals) playing a large role in whether an intervention or strategy has any effect. This variation makes standardising methods of comparison very difficult. However, establishing an evaluation system that juggles local relevancy with global comparableness is a worthy aim (Midgley et al, 2013).

3. OPERATIONS RESEARCH

The applied science and research science of operations research (OR) were briefly employed in earlier times for the planning and decision-making of management.

But its systematic implementation got under way in the 1950s and ’60s. By this time, quantitative approaches were at the centre of decision making and standards for programme attainment. We identified aims and constraints, and this was what made up the operational know-how applied to practical issues. This produced and applied process models. Variables in process models are described and transformed with mathematical functions. If qualitative variables are quantified with statistical formulas and mathematical functions, insights and interpretations can be derived. OR studies are a must-have in these kinds of cases, both for use and for theory. The use of mathematical models had been widely extended by 1980. But there were also some qualitative difficulties involving many variables, where mathematical functions were difficult to characterise and compare. Non-numerical and soft analyses (hierarchical and informal data analyses, Thomas has developed since 1980) helped to fill in these gaps.

4. MULTI-CRITERIA DECISION-MAKING (MCDM)

One of the main branches of operations research is multi-criteria decision analysis (MCDA) or multi-criteria decision-making (MCDM) (Lootsma, 1999). MCDA/MCDM combines mathematics, behavioural decision theory, economics, and computer science, and software engineering and information systems. This is a science that has been producing theoretical and practical work since the 1960s (Roy, 2005).

The aim of MCDA/MCDM algorithms is to find a favorite option, or group options into different classes, or rank options based on preference. They have become popular for analysis, rating, and ranking options across different verticals. Of these many popular methods, TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) has been very effective in a lot of applications (Behzadian et al., 2012).

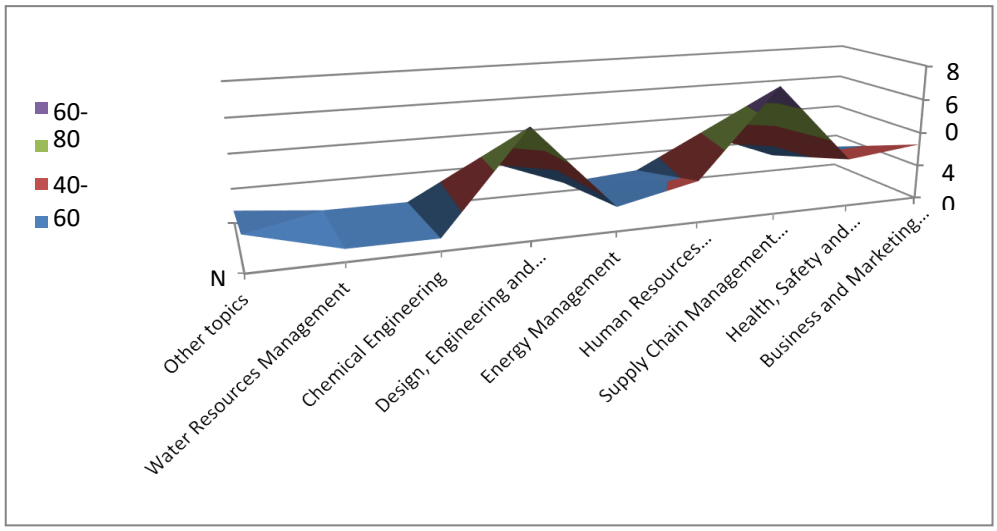
In the past 20 years, MCDM models have been used extensively by scientists and decision-makers. These models design decision trees that support competing demands, as we see in many areas of organizational life (eg, strategy formulation and organisational change). Multi-criteria decision techniques have two broad kinds. One of the most famous models is Armani’s design system. Compensatory models, for example, are multi-Attribute Decision Making (MADM) models that use quantitative methods to assess trade-offs and come up with optimal solutions.

5. TOPSIS

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) model is ideally used in situations where there are more than two criteria and a few options to rank. These are some typical scenarios in which TOPSIS can be of use:

- Establishment and appointment of main legal institutions.
- Structure and further strategy selection of the organization.
- Social decision-making processes
- E-shopping systems and referral networks.
- Finding optimal solutions for the problems in hand.
- Vendor evaluation and selection
- Analysis and recommendation of sales model.
- Market/Distribution Mode of Selection.
- Strategic production planning design
- Prioritization of investment initiatives
- Optimal product development
- Process & Solution innovation.
- Equipment design and installation
- Choosing good sites to set up factory in.

FIGURE 1.1: TOPSIS APPLICATION DOMAINS (APPLICATION AREAS) TOPSIS (ORDER OF PREFERENCE BASED ON SIMILARITY TO IDEAL SOLUTION) (SOURCE: BEHZADIAN ET AL., 2012)



6. MANAGERIAL TASKS AND OPERATIONAL RESEARCH

The Mission of Operative Research rather, supervisory functions in the industry heavily depend on O.R. methods. These tools help the management to do the following:

- Decision-Making
- Planning
- Control and Observation
- Budgeting
- Cost Management

Operational research methodologies guarantee processes that are well arranged and productive for meeting these managerial duties.

Crisp Models	Hybrid Models	Possible Models	
		Nonlinear optimization	LO
		Non-linear programming	LP
MP	DP	Search methods	T
QT	IC		A
DA	Simulation		IP
	PERT-CPM		IP
			NM

TABLE 1.1: ORGANIZATION OF MODELS IN OPERATIONS RESEARCH. (SOURCE: AZAR, 2019)

7. RESEARCH METHODOLOGY

The theoretical and analytic methods in this qualitative study were used. Besides collecting descriptive information from analytic data, the research is descriptive. History and literature were assembled from library, archive and web sources. It looks at traits, features, personality components, entrepreneurial personalities, based on research studies. At last, the role of these entrepreneurial characteristics in industrial development was weighed. The studies will look to assess

entrepreneurship from a disapproving perspective with sector building from the entrepreneurial experiences, perceptions and mindsets observed in previous research.

Case Example: The company that makes toys makes three different toys. Costs and labor costs for each production unit:

Workers expense	Costof production (Rials)
2	700
3	1000
2	500

TABLE 1.2: COST

The factory is in total of 200,000 Rials and has 600 hourly paid workers. The quantity that needs to be produced is 200 types of toys of type A, 300 kinds of toys of type B and 150 kinds of toys of type C. The toys sell for $1200, $1500 and $2000 respectively per piece. The idea is to find a method that can produce the most total profits on toy manufacturing with sufficient demand for each toy to satisfy consumers.

$$MaxZ=(2000-700)x_1+(1500-1000)x_2+(1200-500)x_3$$

$$s.t:$$

$$\begin{cases} 700x_1+1000x_2+500x_3 \le 200000 \\ 2x_1+3x_2+2x_3 \le 600 \\ x_1 \ge 200 \\ x_2 \ge 300 \\ x_3 \ge 150 \end{cases}$$

$$x_1, x_2, x_3 \ge 0$$

8. FINDINGS

The studies are plotted, and drawn based on a review of similar research in the literature.

FIGURE 1.3: INTEGRATED KNOWLEDGE IN OR

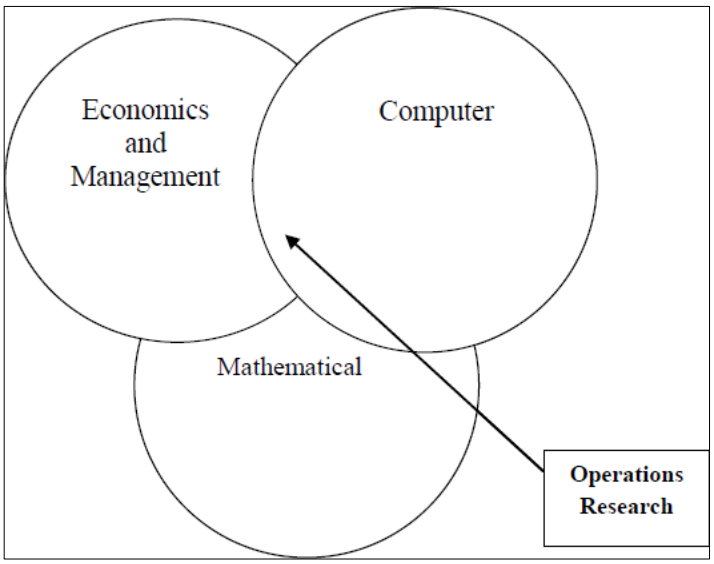
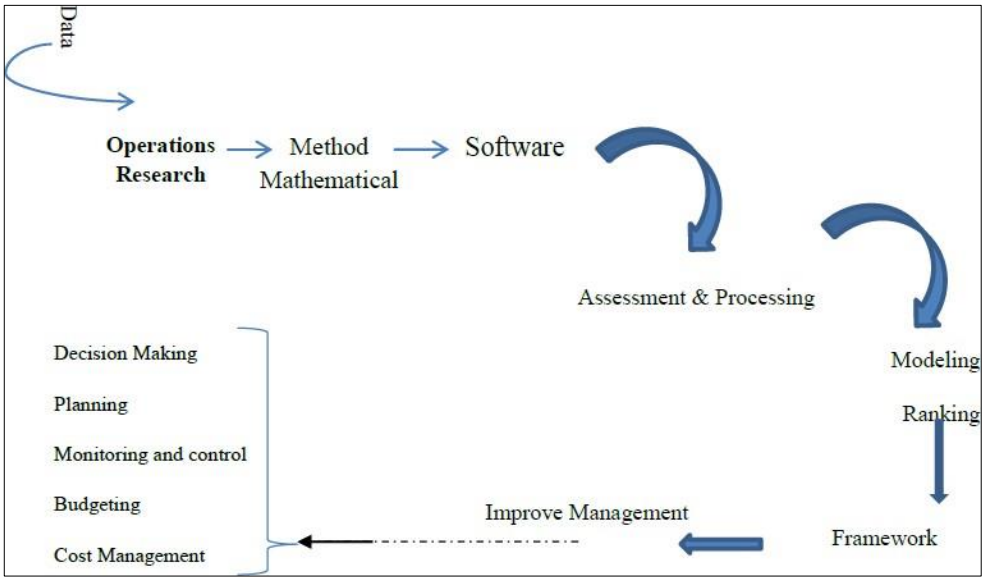


FIGURE 1.4: OR PROCESS



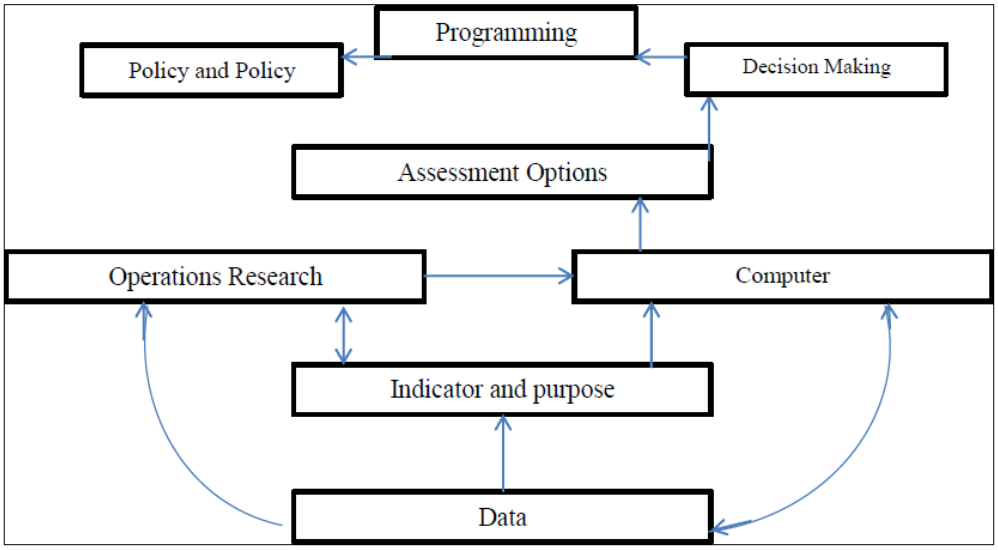


FIGURE 1.5: USE OF FLOWCHART IN OR

9. CONCLUSION

The management functions in the industry have direct ties to operational research. These methods help industry management in decision making, planning, analysis, costing, and estimating. Application of applied mathematics and research science to management planning and decisions – although is only in brief. But the idea and practice started in the 1950s and ’60s. In this time, quantitative mathematical techniques were often used in making decisions and setting the criteria for the fulfillment of programmes and aims (eg, prediction, estimation, and revision of planning variables). In fact, in practice, real-world activities have purpose and limits that govern research knowledge. Then, on the basis of this, a lot of models (process models) are created and applied. These models encoding variables are created by mathematical functions. if qualitative variables could be quantified using statistical procedures and mathematical expressions, we might be able to make some inferences. OR research is both necessary and useful in these cases. This is the biggest benefit of OR models for decision management, because you get to really dig in.

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