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The Role and Application of Operational Research Techniques in Industry Management

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ABSTRACT

Today, any occupation and discipline depends on the science of mathematics in an organization. This is felt in the industry and production. Management is also a scientific and specialized activity for better management of a set of factors requiring mathematics. The aim of this study. The role and application of operational research techniques in industry management .In this research, it has been tried by reviewing scientific sources and examples of studies qualitatively can be done analysis of the information and data collected. According to the results of this study Operational research techniques have a lot to do with management tasks in the industry. Operational research techniques contribute to the management of the industry in performing the following tasks. Decision making, Planning, Monitoring and control, Budgeting and Cost management.

***Keywords*:** Operational research, Industry Management, Management Tasks

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1. INTRODUCTION

Today, any occupation and discipline depends on the science of mathematics in an organization. This is felt in the industry and production. Management is also a scientific and specialized activity for better management of a set of factors requiring mathematics. Operations Research science or, the sense of applied mathematics from previous periods, was used, albeit briefly, in decision making and management planning issues.

In the 1950s and 1960s, quantitative mathematical methods (for predicting, estimating, and programming the variables of planning) have been widely used in decision making and determining the criteria for the success of programs and objectives. In fact, research knowledge in real world operations is defined by goals and constraints. Based on this, different models are developed and used as process models in the operation.

One of the components of the progress of each Scientific is Mathematics progress and the most important factor among the factors of the growth and development of industry management, According to the necessity of development in the industry management. It is Must to pay attention to the Operations Research science. In order to achieve this goal, the research has been implemented. In this paper. From the results of the reviews on studies in the field of the role and application of operational research techniques in industry management. Has been paid the analysis of operational research techniques and its role in the management of the industry has been addressed.

2. LITERATURE AND RESEARCH BACKGROUND

The systems approach, has been close connection with the development of OR and management science initially through the work of founders such as Churchman and Ackoff and latterly through innovations such as soft systems. In this paper undertaken a review of the contribution that systems thinking has been making more recently, especially to the practice of OR. Systems thinking is a regularity in its own right, with many theoretical and methodological expansions, but it is also applicable to almost any difficulty area because of its generality, and so such a review must always be selective. We have looked at the literature from both a theoretical and an applications tendency. In the first section consider the original systems theories and methodologies in terms of their recent developments and also their applications. This covers: the systems approach, complexity theory, cybernetics, system dynamics, soft OR and PSMs, critical systems and multimethodology.

In the second part we review the main domains of application: strategy, information systems, organisations, production and operations, ecology and agriculture, and medicine and health. Overall conclusion is that while systems may not be well established institutionally, in terms of academic departments, it is incredibly healthy in terms of the quantity and variety of its applications (Mingers & White, 2010).

A subset of the general class of participative methods is problem structuring methods A substantial number of these have been developed by operation al researchers over the past 50 years, although the term ‘problem structuring’ itself was only introduced into the operational research (OR) lexicon a couple of decades ago (Rosenhead, 1989, 2006; Rosenhead and Mingers, 2001, 2004). Operational researchers and social scientists often make significant claims for the value of systemic problem structuring and other participative methods. So, when

they present evidence to support these claims, it is usually based on single case studies of inter venation. There have been very few attempts at evaluating across methods and across interventions undertaken by various people. It is because, in any local intervention, contextual factors, the skills of the researcher and the goals existence pursue by stakeholders affect the perceived success or failure of a method. The use of standard criteria for comparing methods is therefore made problematic by the need to consider what is unique in each intervention. However, is it possible to develop a single evaluation approach that can support both locally meaningful evaluations and longer term comparisons between methods? (Midgley et al, 2013).

3. OPERATIONS RESEARCH

Operations Research science, or in terms of applied mathematics from previous periods, was used, albeit briefly, in decision making and management planning issues. But the concept and use of today is from the 1950s and the 1960s.

In this period, quantitative mathematical methods (for predicting, estimating and updating of planning variables) have been widely used in decision making and determining the criteria for the success of programs and goals. Indeed, research knowledge in the real world operations is defined by goals and constraints. Based on this, different models are developed and applied in the form of process models in the operation.

That is, we map and modify the variables by means of mathematical functions. In this regard, there may also be qualitative variables that we can conclude if we can quantify them by means of statistical formulas and mathematical functions. In these cases, OR analyzes give a vital and useful application.

The main advantage of OR models in managing decisions is that we are getting into the finer issues. By 1980, mathematical models were of great use. For many variables in qualitative problems, mathematical functions can not be defined and evaluated based on their mathematical functions. Here are the soft analyzes that are non-numerical analyzes. Since 1980, soft or soft analyzes (using objective and informal data in solving problems), the first time Thomas was introduced in hierarchical analyzes and was used.

MCDM

MCDA1 or MCDM2 is a sub-discipline and full-grown branch of operations research that is concerned with designing mathematical and computational tools to support the subjective evaluation of a finite number of decision alternatives under a finite number of performance criteria by a single decision maker or by a group (Lootsma, 1999). MCDA/MCDM uses knowledge from many fields, including mathematics, behavioral decision theory, economics, computer technology, software engineering and information systems. Since the 1960s, MCDA/MCDM has been an active research area and produced many theoretical and applied papers and books (Roy, 2005). MCDA/MCDM methods have been designed to designate a preferred alternative, classify alternatives in a small number of categories, and/or rank alternatives in a subjective preference order. MCDA or MCDM methods have received much attention from researchers and practitioners in evaluating, assessing and ranking alternatives

[1] 1 Multiple -Criteria Decision Analysis
[2] 2Multiple-Criteria Decision Making

across diverse industries. Among numerous MCDA/MCDM methods developed to solve real-world decision problems, TOPSIS3 continues to work satisfactorily across different application areas (Behzadian et al, 2012).

In the last two decades, most of the researchers and decision-making theorists have focused their efforts on the application of MCDM models to complex decisions. These models introduce patterns of decision making as a process that can which are multi-criteria decisions that are in conflict with each other.

Like organizational decisions (strategy selection, organizational development), there are some contradictory criteria. In general, multi-criteria decision-making methods are divided into two general categories. Multi-objective decision-making models (MODMs): The most famous of these models are Armani programming. Multi-Attribute Decision Making (MADM) models: Includes the following models. Compensatory models: These types of models are exchanged between the indexes, which include (simple weight-Topsis-Electre-linear allocation-mean-Shonon-entropy average). Non-Compensatory Models: Compensatory Models: These types of models do not exchange the index between them (such as the method-deletion-mastery-specific satisfactory model-satisfactory inclusion model).

The importance of systems thinking for Operations Research/MS wa s recognised from the star t by founders such as Churchman (Churchman 1963) and Ackoff (1962), systems engineers such as Hall (1962) and cyberneticians such as Beer (1966). However, as Operations Researchdeveloped there was a degree of separation. Operations Research itself tended to emphasise the mathematical and computer modelling approaches at the expense of systems thinking; cybernetics and system dynamics developed separately and somewhat in isolation; and the systems engineering/RAND approach was applied mainly in the US public sector. This fragmentation was challenged in the 1970s ìcrisis in Operations Research (Ackoff 1979; Checkland 1983) which led to the creation of soft systems/ Operations Researchand critical systems. The most recent developme nts have been chaos and complexity theory (Mingers & White, 2010). The hierarchical process (AHP) results in the creation of a number of mathematical algorithms that analyze the factors and qualitative factors affecting decision making by mathematical models.

Topsis

Topsis is a powerful technique for deciding on prioritization based on the proximity of an ideal solution. On the basis that the chosen option should have the shortest distance from the ideal answer and the furthest distance from the worst solution. This method when deciding on several quantitative and qualitative indicators is very useful.

One of the advantages of this method is that in the situation when some of the decision-making indicators are cost-oriented and aimed at reducing them, and some of the indicators are of a kind of profit and aimed at increasing them, this method has the ideal answer, which is a combination It is one of the best achievable values for all indicators. The values used in the topsis method for index data can be quantified quantitatively and qualitatively.

In this area, Aydogan (2011) proposed integrating AHP and fuzzy TOPSIS to evaluate the performance of four aviation firms using five important dimensions: performance risk, quality, effectiveness, efficiency, and occupational satisfaction. Peng, Wang, Kou, and Shi (2011) offered a new two-step approach to evaluate classification algorithms for financial risk

3. The Technique for Order Preference by Similarity to Ideal Solution

prediction using an empirical study that was designed to assess various classifications. Three ranking methods, TOPSIS, PROMETHEE, and VIKOR, were used as the top three classifiers. Zandi and Tavana (2011) presented a structured approach using a hybrid fuzzy group permutation and a four-phase QFD model to evaluate and rank agile e-CRM frameworks according to their customer orientation in a dynamic manufacturing environment. Other publications compared TOPSIS performance to other MCDA/MCDM methods, including AHP, ELECTRE PROMETHEE, VIKOR, DEMATEL and SAW. The purpose of the comparative papers has been to define the ranking differences between the TOPSIS methods and other MCDA/MCDM methods (Behzadian et al, 2012).

TOPSIS has also been extended to treat, in a direct way, data expressed as probability distributions by means of the Hellinger distance (Hellinger, 1909). It means that the TOPSIS with Hellinger distance (Lourenzutti & Krohling, 2014) has opened a new possibility for ranking alternatives expressed in terms of probability distributions in the context of MCDM problems. Due to the stochastic nature of the evolutionary algorithms, in many cases the performance of evolutionary algorithms are expressed in terms of mean and standard deviation (Krohling & Pacheco, 2015).A number of literature review papers, i.e., Behzadian, Kazemzadeh, Aghdasi, and Albadvi (2010) on PROMETHEE and Vaidya and Kumar (2006) and Ho (2008) on AHP, show the vitality of the field and the many methods that have been developed (Behzadian et al, 2012).

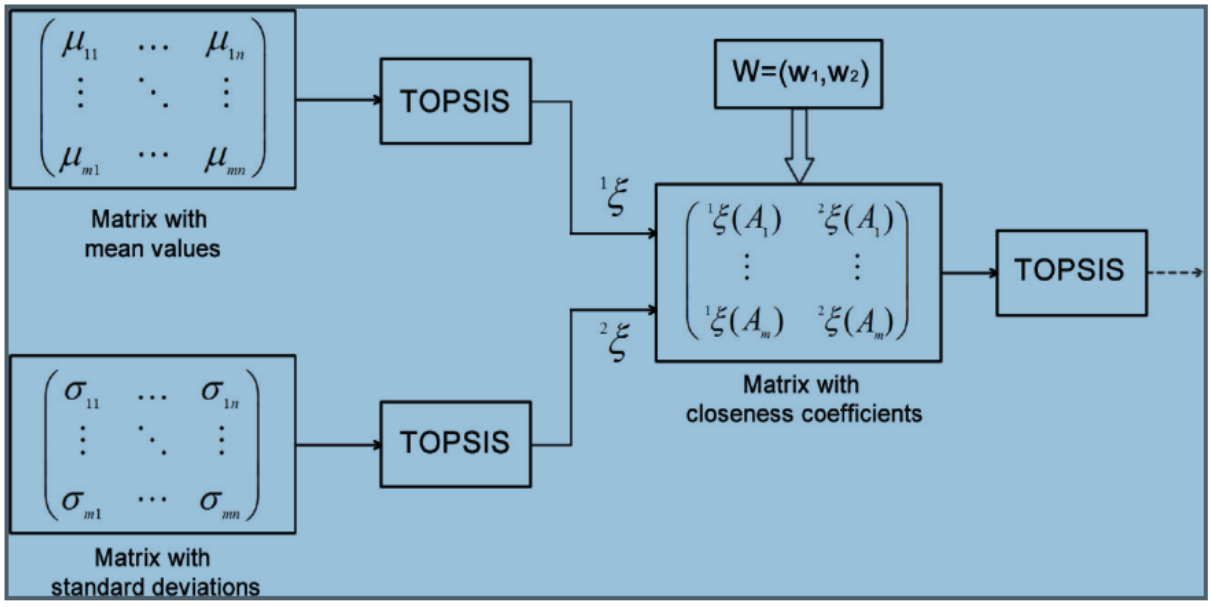

Figure 1. Topsis (Krohling & Pachko, 2015)

Application of pattern Topsis:

- Organize the decision making process
- Managing the process
- Choose the optimal option
- Priority and ranking of options

- Use Topsis in Applicable Case
- The Topsis model is used in the following cases.
- Formation and selection of core lawyers' organizations
- Formation and selection of subsidiary strategies of organizations
- Social decision making
- Purchasing system and suggestions process
- Optimal selection of repairs
- Select the best supplier
- Choosing and discussing sales models
- Selection of market and distribution channels distribution
- Strategic Planning Design One
- Production planning
- Prioritization and optimal selection in investment projects
- Optimal product design
- Innovative
- Design and installation of equipment
- Proper placement for factory induction

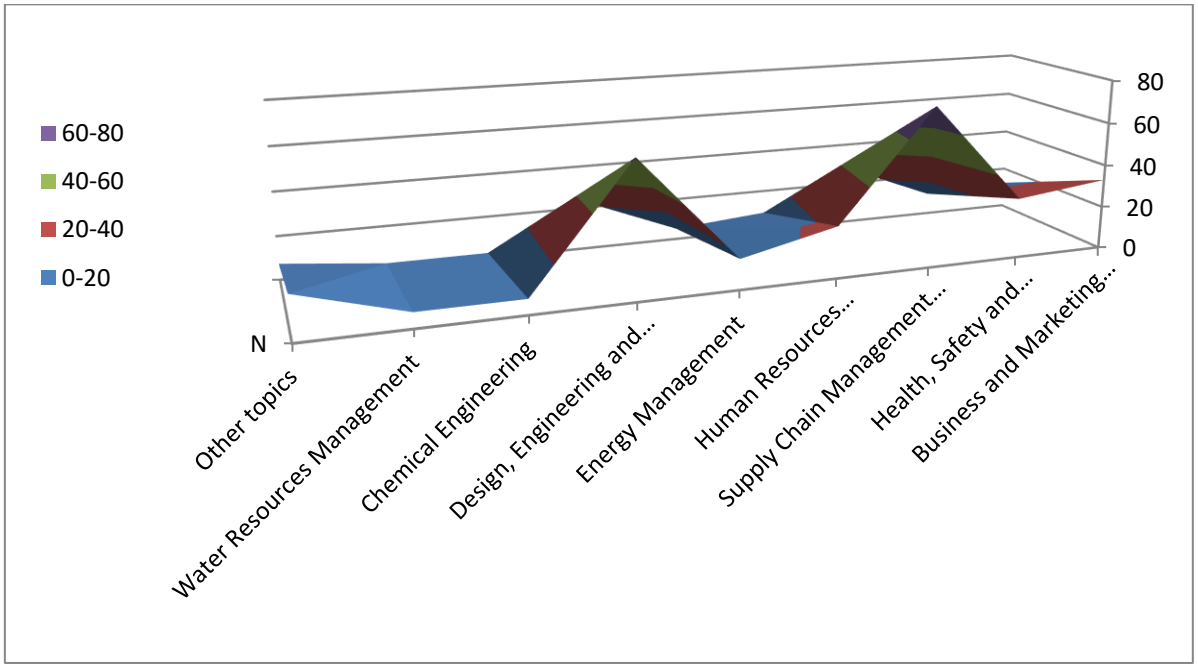

Figure 2. Application areas TOPSIS (Behzadian et al, 2012).

In fact, operational research techniques have a lot to do with management tasks in the industry. Operational research techniques contribute to the management of the industry in performing the following tasks.

- Decision making
- Planning
- Monitoring and control

– Budgeting
– Cost management

Table 1. Classification of models Operations Research (Azar, 2019).

Crisp Models	Hybrid Models	Possible Models	
		Nonlinear optimization	Linear optimization
		Non-linear programming	Linear programming
Markov processes	Dynamic planning	Search methods	Transportation
Queue theory	Inventory control		Allocation
Decision analysis	Simulation		Ideal planning
	PERT-CPM		Integer programming
			Network models

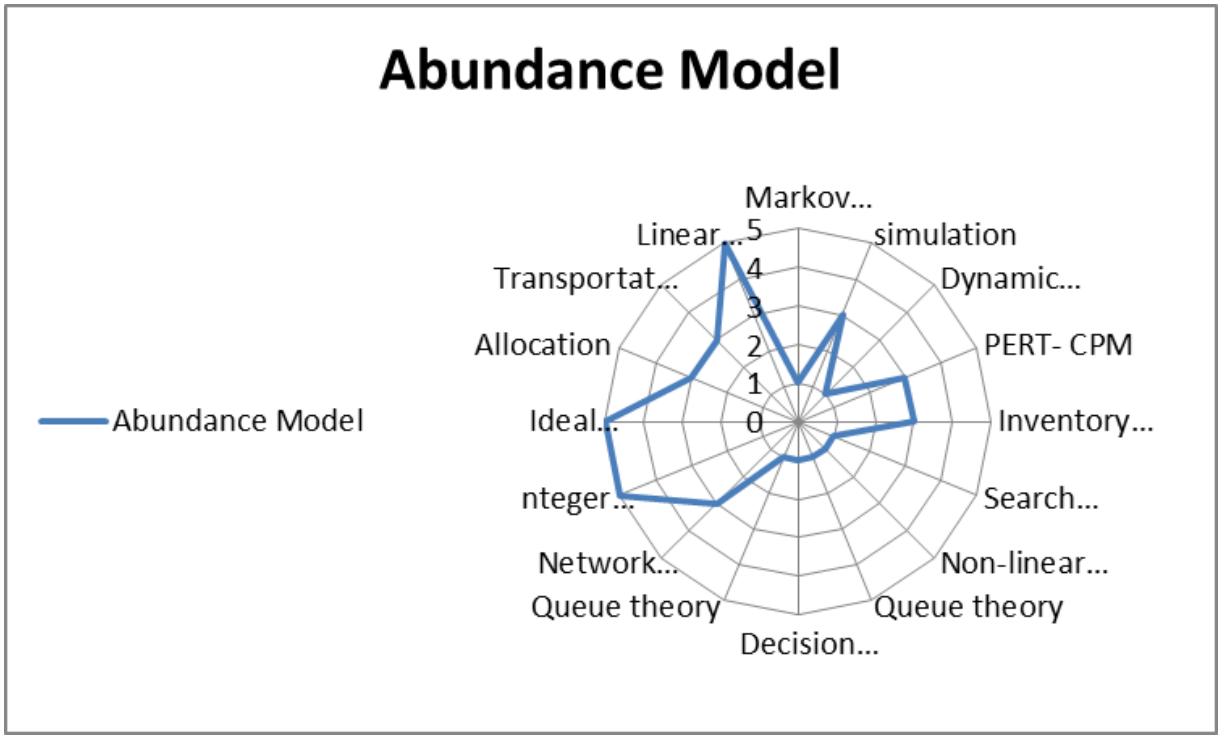

Figure 3. Frequency of use of research models in operation (low = 1.5 = very high) (Azar, 2019).

4. METHODOLOGY OF RESEARCH

The approach of this qualitative research is theoretical and analytical. This research is also descriptive in collecting descriptive information from the analytical branch. Its history and literature were written through library and archive resources and Internet resources studies. In this research, By studying the research literature, Characteristics, components and important behavioral factors and entrepreneurial personality were discussed And finally, According to the these characteristics of the entrepreneurs Their role in industrial development was analyzed. This research, eantime to have a judgments approach to entrepreneurship. Has tried based on their experiences, perceptions, and attitudes of studies, Discusses the role of entrepreneurship in the advancement of the industry.

Case Example

A toy manufacturer produces three types of toys. The labor force and the cost of each production unit are defined in the following table:

Table 2. Data Case Example

Employee labor costs (hours)	Cost of production (Rials)
2	700
3	1000
2	500

The total budget of the factory is 200,000 Rials and the working hours of the factory are 600 hours. The demand for toy type A, 200 units, type B, 300 units for type, 150 units. The selling price per unit of toys is 1200, 1500, 2000. Formulate the problem in such a way that, while satisfying the demand for each toy, the total profit of the products will be maximized.

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

$$s.t:$$

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

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

Findings

The research findings are presented in graphical form based on the analysis and evaluation of related topics in the research literature.

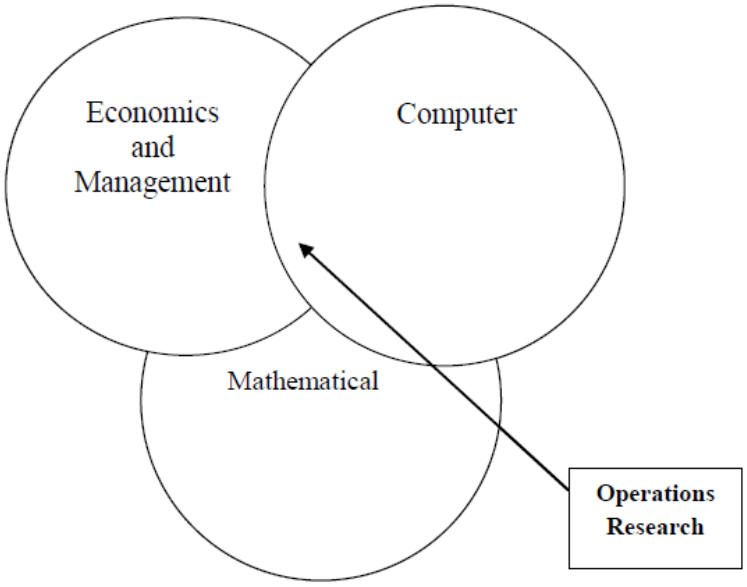

Figure 4. Combined knowledge Operations Research

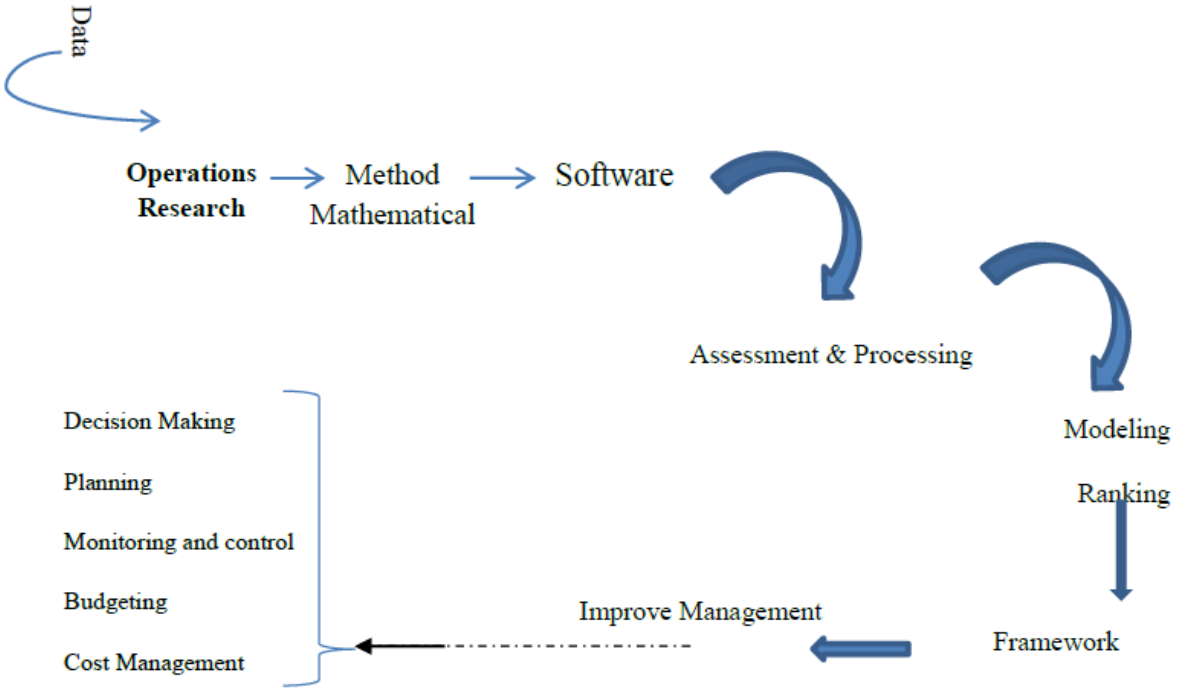

Figure 5. Process Operations Research

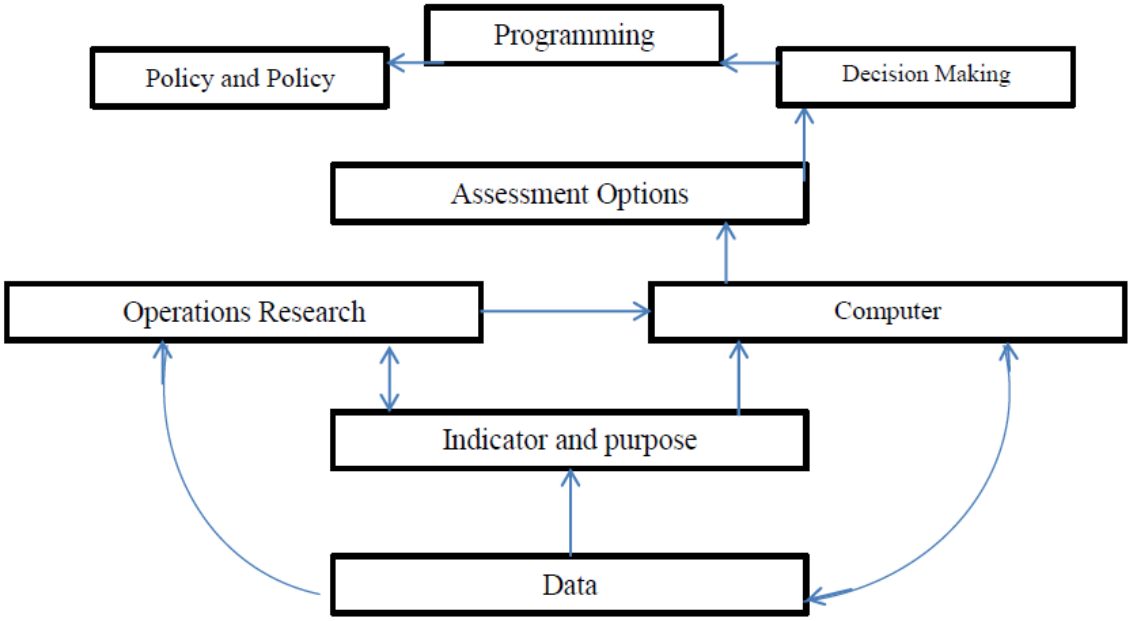

Figure 6. Application of models Operations Research

5. DISCUSSION AND CONCLUSION

Operational research techniques have a lot to do with management tasks in the industry. Operational research techniques contribute to the management of the industry in performing the following tasks. Decision making, Planning, Monitoring and control, Budgeting and Cost management. Operations Research science, or in terms of applied mathematics from previous periods, was used, albeit briefly, in decision making and management planning issues. But the concept and use of today is from the 1950s and the 1960s. In this period, quantitative mathematical methods (for predicting, estimating and updating of planning variables) have been widely used in decision making and determining the criteria for the success of programs and goals. Indeed, research knowledge in the real world operations is defined by goals and constraints. Based on this, different models are developed and applied in the form of process models in the operation. That is, we map and modify the variables by means of mathematical functions. In this regard, there may also be qualitative variables that we can conclude if we can quantify them by means of statistical formulas and mathematical functions. In these cases, OR analyzes give a vital and useful application. The main advantage of OR models in managing decisions is that we are getting into the finer issues. By 1980, mathematical models were of great use.

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