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Decision Mapping: The Methodology and Applications

INTRODUCTION

Decision-making both as an art and science offers a challenging field for the investigator to unravel the intricacies involved so as to enhance the quality of decisions made by the managers. The scientific approach to decision involves the estimation of probabilities of success related with each outcome and which is not always possible considering the complexity of the decision environment. In the artistic method, the decision maker solely depends on the personal experience and the intuitions which are not always wrong as far as the prediction of outcomes are concerned. In the traditional method, decision-making comprises the stages of problem identification, evaluation of the problem, identification of alternatives, establishment of criteria to evaluate alternatives and the selection of an alternative. In the decision making model of Herbert Simon, there are three stages i.e. intelligence, design and choice, all of which are necessary to accomplish effective decisions. The different decision making models, which range from perfect rationality to perfect irrationality, portray the uncertainty and the risk associated with each decision. This is because unsuccessful outcomes are endemic to the very process of decision making. The objective of any decision making model is to minimize the uncertainty and to correctly estimate the risk that may eventually facilitate better decisions. Even in the artistic approach the objective remains the same but decisions are taken outside a scientific frame. The combination of a scientific and artistic method results in another approach to making decisions which is the method of decision mapping.

Decision mapping as a method is presumed to enhance the effectiveness of decision making because it considers the problem from the scientific level and there is also scope for the inclusion of personal judgments.

Decision mapping attempts to mirror the reality situation that is assumed to be in operation in the decisional context. According to Rhodes (1991) map is a useful tool to represent the thought processes required for any

Abstract

Decision mapping is a way of understanding and resolving the decision making problem with the aid of maps or diagrams that capture and reduce the complex problem into its constituents. The traditional models of decision making may be compared with the decision mapping in that both reduce uncertainty and the two differ in that maps are easy to use while complex decision models are difficult in many situations. Decision mapping attempts to mirror the reality situation presumed to be operating in the decisional context. In the deciphering of the decisional problem, the mapping methodology uses different procedures to generate different types of maps, all of which enhance the quality of decisions. The important forms of maps include causal map, effectual map, conceptual map and cognitive map. These maps have varied applications in different decision making problems be it from the area of human resources, marketing or finance. Maps as decisional tool enhance the quality of decisional outcomes.

type of task like making a decision. While maps can be constructed in many ways using different methodologies, they essentially externalize the internal (cognitive) processes that go into the solution of problems. Maps without or with sequence are pictures or diagrams that represent the mental tasks engaged in by the participants or the decision makers. Moreover maps lay bare the territory out in front of the decision maker that unravels the wider arena of the decision problem.

Decision map deciphers the problem into simple and methodical form. In the deciphering activity, attention is paid to the entire cluster of variables that have given rise to the problem at hand. And the recognition of the cluster pattern removes the impediments to the identification of the decisional alternatives that are part of the decisional outcome. The spreading out of the variables shows the interconnection that exists in the problem along with the relations that contribute to the decisional alternatives.

Decision mapping diagrams the whole multidimensional aspects of the decision problem. Spatio-temporal representations make it possible the arrangement of the physical dimension that enter into decision making in a significant way. Besides the physical dimension the psychological dimension of the problem also gets merged in the map that comprehensively analyses the decisional outcomes. The form and content of the diagram represents the processes of decision making which in effect can mean the stages or steps involved in the realization of decisional outcome. Mapping presents the nature of the relations subsumed in the task of decision making. All the forms of relations, positive and negative, strong and weak and interacting ones can be pictured so as to have better control over the decisional space, defined as the entire gamut of the decision problem. The dimension of the decisional space incorporates the entire length and breadth of the variables that act and interact in the framing of the decisional problem. In effect the decisional space excludes irrelevant variables from the purview of the decision maker and includes pertinent variables that significantly affect the decisional outcome.

In comparison to the traditional form of decision making where the alternatives are analyzed using words, maps offer a visual language that breaks out of the linear trap of words (Rhodes 1991). Again in the former method of decision making, the sequential reproduction of words may not actually bring out the complexity of decision making whereas in mapping the complexity of the problem is brought out in single exposure. Moreover mapping approach causes a broader perception and greater diversity of ideas (Slavi and Piet, 2006).

Decisional problem and the decisional space generates the decisional map, which delineates the pattern of variables that act and interact leading to a specific combination process revealed in the suitably constructed diagrams which make an imperative form of decision

making. The interacting complex variables, both explicit and implicit, and which confound the decision making process get unwound in the mapping scheme. This is made possible because the intricacy of the problem gets reflected in the different mapping arenas that expose the nature of dynamics in any decision making task. As the problem gets unwound, the different combinations and permutations of many variables make the mapping space truly encompassing and all inclusive.

Decision map serves the following functions: unravels the intricacy of the problem, analysis of the interacting pattern of variables, visualization of the problem is aided, loopholes and exceptions are easily brought forward, analysis of causative and effectual reasoning besides the portrayal of cognitive and conceptual relations, simultaneous and successive consideration of variables along with the presentation of the entire spectrum.

Decision map thus explores the entire decisional space that branch out into unknown and known terrains relating the problem and bringing out varied resolutions leading to a particular alternative. The decisional problem and the decision making processes are laid out in front of the decision maker that unravels the wider arena of the decision making process.

DECISION MAPPING VS. DECISION TREES

Decision mapping has its parallels in decision trees in that both attempt to exemplify the decision process. A decision tree analysis involves constructing diagrams

Table 1: The Main Differences Between Trees and Decision Mapping

Decision Mapping	Decision Tree Analysis
<ul style="list-style-type: none"> • Concept-based, supported by theory and knowledge • Non-linear • Multipronged • Sequential and/or Non-sequential • Broad-based • Considers the framework and implications of the problem from a wholistic view • Considers and analyses the problem in detail followed by the consideration of multiple alternatives 	<ul style="list-style-type: none"> • Action based supported by experience • Linear • Not multipronged • Usually Sequential • Narrow-focused • Considers the probability rate of two or more action paths • Traces the action originating from the problem

with all possible courses of action, states of nature and the probabilities associated with the states of nature (Sharma, 2004). The commonalities between the decision trees and decision mapping centre around the analysis of the decision problem and the development of decision alternatives but the method and ways differ in the two techniques and each has its own unique ways. The differences are pointed out in Table 1.

MAPPING METHODOLOGY

As methodologies differ, different maps of different contents, forms and textures can be produced. Conceptualisation differences lead to the emergence of different maps that indicate and portray the decisional problem in multiple ways. Mapping methodologies result in diagrams or pictorial representations of a person's or group of person's entire representation of the decisional problem. Swan (1995) distinguishes causal maps, conceptual maps and cognitive maps all of which draw the decisional processes keeping the dominance of a particular orientation. Besides these maps, another form of map, the effectual map approaches the decisional problem from the perspective of effectual reasoning in decision making. A causal map that portrays the causative dynamics reveals the belief system (Swan, 1995) as well as the knowledge system of the person. Effectual maps show the effectual reasoning involved in decision problems and they go by the effects generated in a problem analysis situation. Cognitions of individuals represented in cognitive maps demonstrate the diversity of decision problem analysis and decisional outcomes. And maps that unravel the conceptual relations are called conceptual maps.

Map construction can follow different methodologies depending upon the type and purpose of map being made. However certain general steps may be stated keeping the overall nature of the maps and that maps are used for greater explanatory purposes. The general way of constructing the maps can include the following:

Statement of the Purpose The overall and the specific objective of drawing maps in the context of the type of the map facilitate greater understanding and representation. It is better to clarify the objectives in terms of the decisional problem and the decisional outcomes envisaged.

Generation of Statements Statements, indicative of the causes, effects, concepts and cognition accomplished in a group or in individual situation, refer to the decisional problem and the decisional outcomes. These statements pertain to different functional aspects that enunciate the problem in greater detail. The multifaceted statements refer to the entire dynamics behind the problem.

Classification These statements may be initially identified as raw in form and the substantive statements

may be separated from this general pool. Later the substantive statements alone are included in the map territory.

Codification The generated explanations based on criteria like similarity, relations, sequential relations, temporal relations and spatial relations any of which can be used keeping the nature of the map. Codes may take letters and numbers like A1, A2, B1, B2.

Ordering and Grouping of Codified Statements The statements codified based on any criteria may have to be further ordered and grouped into related/unrelated categories or based on any criteria that fit the map on domain.

Derivation of Core Explanations The ordered and grouped statements/explanations may have to be further analysed to identify the core ones. The agreement among the persons supported by expertise will help in the making of core explanations.

Drawing of Diagrams/pictures The drawing can be squares, triangles, circles with or without arrows from bottom to top or vice versa or left to right or vice versa. Apart from these general ways, other creative forms may be used so as to enhance the quality of presentation.

Final Layout The drawn diagrams are arranged in the intended manner keeping the problem at one end and the solution at the other end, left or right and bottom or top.

GENERAL FEATURES OF A DECISIONAL MAP

The general feature of any decisional map are as under:

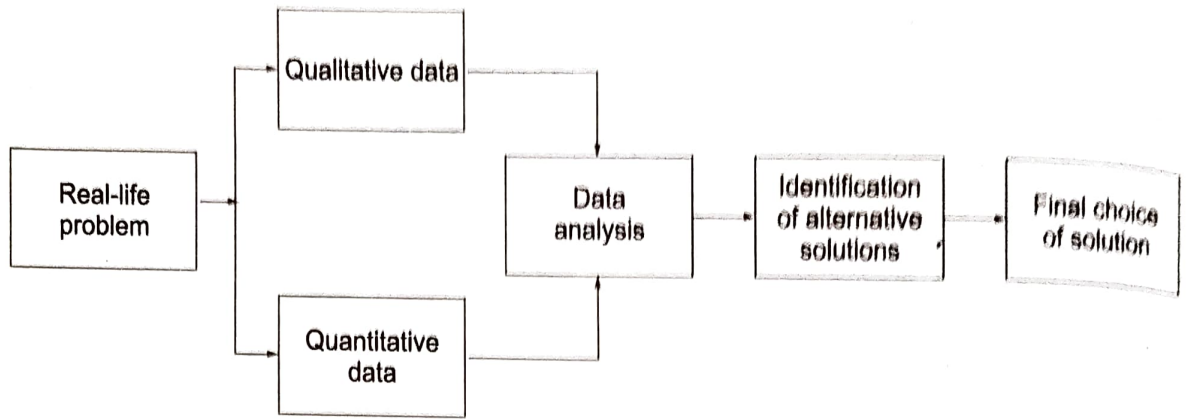
- (a) Boxes, circles, triangles or squares contain the explanatory statements. Line arrows also indicate the direction of statements.
- (b) Maps may be plotted horizontally and /or vertically.
- (c) Maps are also drawn in upward and downward directions with arrowheads.
- (d) Interrelations of causes, effects, concepts and cognitions are indicated by arrow lines.
- (e) Clusters and sub clusters are indicated by grouping of statements.
- (f) Nodes or origin of statements may or may not be indicated by small circles.
- (g) Crisscrossing arrows indicate relations or similarity in cognitive maps.

An Example of a General Decisional Map The general decisional map follows no specific form of reasoning since it incorporates the general features of map. It is more in agreement with the common principles of decision making which is illustrated with the different steps of decision making. The general decisional map portrays

the state of the decision making process by dovetailing of the entire contents and process of decision making. The delineation of the decision making process into stages and substages captures the entire stream in its broadness.

The figure 1 brings out the different activities pertaining to the process of decision making, which do not follow any specific type of methodology.

Fig. 1 General Steps of a Decisional Map



TYPES OF MAPPING

Causal Mapping Causal mapping takes shape from an analysis of the causative framework of the decisional problem. The decisional problem is disentangled by the method of finding out the nature of the causative dynamics that has contributed to the decisional problem. In some cases tracing the development of the problem may bring out the solution in quick ways. The analysis of the decisional problem into general and specific causes of the emergence of the problem thus externalizes the nature of the decisional problem in diagrammatic forms.

According to Huff (1990) causal maps more appropriately represent the patterns of explanation of events or actions. The externalization of the causes brings out in clear form and contents the underlying mechanism of the decisional problem. Cause mapping captures the richness of context and processes (Barnes, 2005) in that the exposition of causes simplifies the decision task.

Jenkins and Johnson (1997) have dealt with the components of causal map. In their view arrow lines can be used to represent causal reasoning involved in managerial actions. The important constituents as enlisted by them include nodes-location of a statement/explanation leading to another statement or node- and links or arcs that represent the flow of causality. Three other properties of causal map according to Jenkins and Johnson (1997) are link to node relations, clusters and chain length. Link to node relations depicts the proportion of links to nodes in which links or arrow lines indicate the direction of causality, whereas the nodes unravel the

causative dynamics by the insertion of the statements. Cluster represents the grouping of statements on a single plane. In certain mapping format there can be the combination of main cluster and sub cluster in which the main cluster represents a major idea and the related idea is represented in the subcluster. A chain length implies the sequential set of causes of links starting from bottom to top or left to right.

The use of double platform in causal mapping implies that the first platform of map deals with the analysis of causative dynamics while the second platform contains the decisional alternatives. The linked interpretation of the two causal maps thus paves the way for the solution of the decisional problems from the causative perspective.

Fig.2 indicates the causal map that involves a specific decisional problem in soft drinks. The analysis of the causative dynamics leading to the decisional problem is represented on the first platform and the second platform subsequently represents the decisional alternatives.

Effectual Mapping In this form of mapping effects along the intended lines are drawn utilizing or exploring the available means consequent to the decisional problem. The given or explored means are selected keeping different effects. Thus effectual reasoning capitalizes on the available means so as to produce effects of value intended. A decision involving effectuation (Sarsavathy,2001) consists of a given set of means, a set of effects or possible operationalisations of general aspirations, constraints on possible effects and criteria for selecting between the effects all of which can be

Fig. 2(a) Decisional Problem Analysis – Causative Map

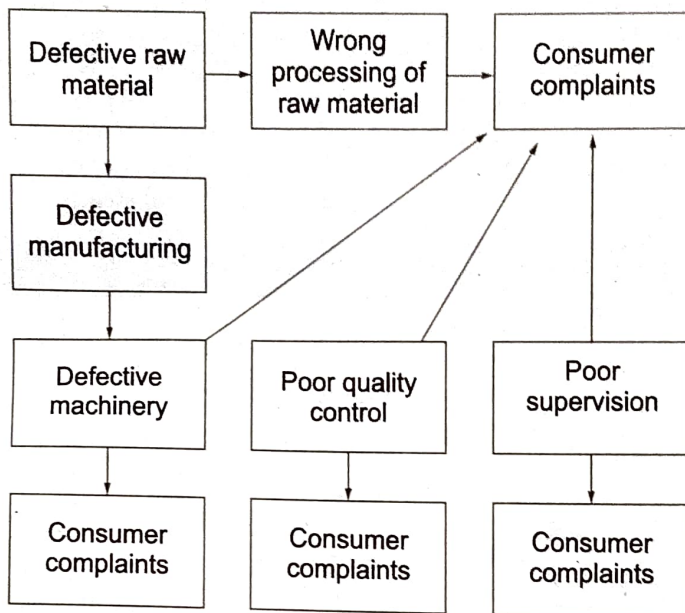
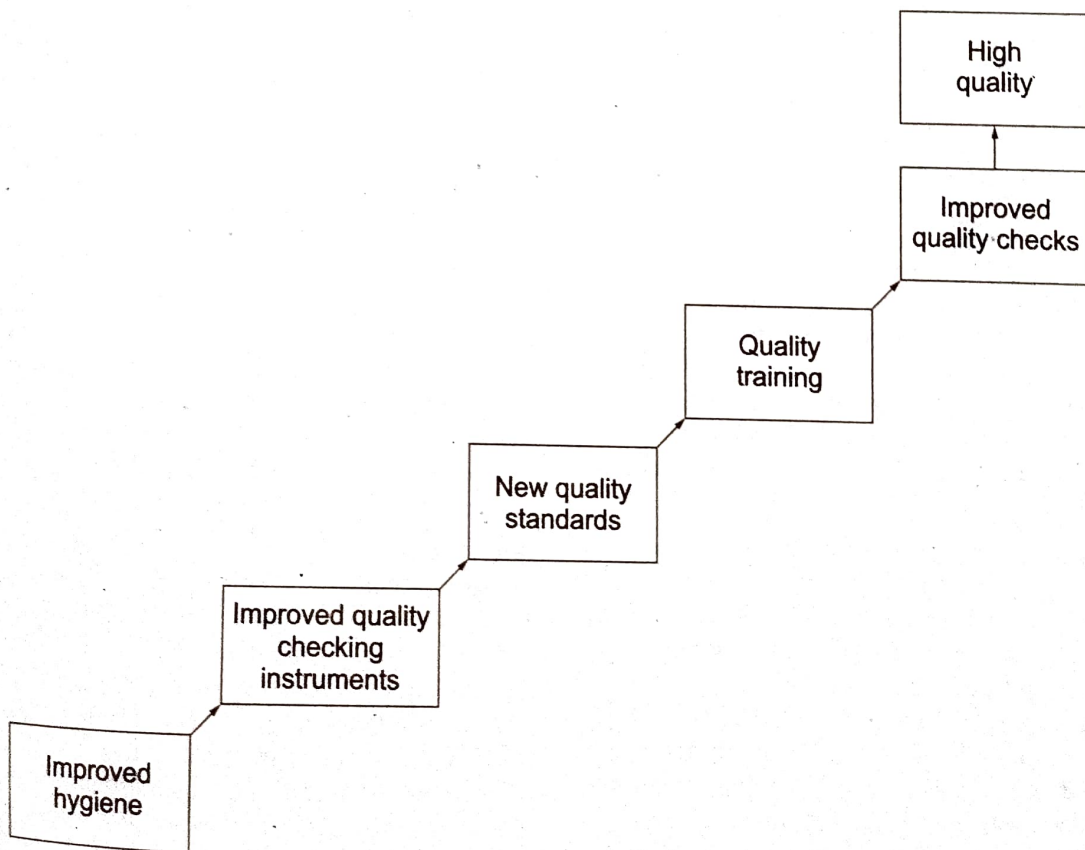
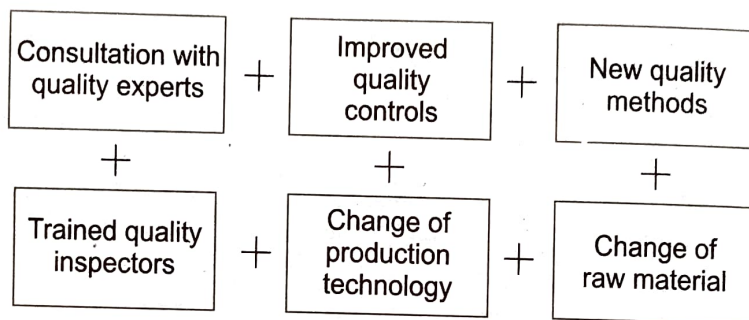


Fig. 2(b) Decisional Alternatives – Causative Map



translated into the mapping arena in order to picturise the decisional problem and space. Effectual decision making uses different criteria to select from the available means so as to be in an advantageous position in the decisional outcome. Fig. 3 shows the effectual reasoning that marks certain types of decisions. Effectuation as against causation uses a single platform here in the decision making activity. This is because specification of the effects guides the decision maker making a decision as far as the available means.

Fig. 3 Effectual Map to Improve Quality



cognitive activity like decisionmaking. This form of cognitive mapping does elaborate the structure that is specific to a problem. In the advanced form of mapping besides elaborating the content (the what components) of managerial cognitions, how the cognitions and what strategies are resorted to by the managers are laid out in visuo-spatial form. Cognitive mapping limits the bias in decision making (Hodgkinson, et.al, 1999) thereby making the decision making process objective and scientific.

The cognitive mapping of decision making follows two related approaches: identification of the cognitions pertaining to the decisional problem and the specific cognitive strategies used to disentangle the decisional problem. Generation of the cognitions and the specific strategies used to derive the cognitions form the two platforms of the cognitive map. Fig. 4 represents the individual cognition of a manger in solving a decisional problem of soft drinks.

Cognitive maps thus bring out the knowledge and cognitions of mangers engaged in organizational decision processes (Narayanan and Fahy, 1990). And cognitions of individuals can be represented in many ways. Two general approaches to cognitive mapping may be identified: ideographic and nomothetic. According to Goodhew and others (2006) in nomothetic approach, used in aggregation and comparison of maps, the predefined concepts themselves become the focus of the study in identifying the relations. In ideographic method the inclusion of concepts are not limited by common agreement wherein the individual exercises the power of

Cognitive Mapping Cognitive map is an individual's internal representation of the decisional problem and the outcomes. In Rhodes's views (1991) cognitive maps represent data, items, memories, images and values that are unique to each person. Cognitive maps are the visual spatial layouts of the internal cognitive processes that represent the problem domain or decision making task. Further cognitive mapping portrays the cognitions of managers or the graphic representations that represent the content and structure (Swan, 1995) relating to any

generalization and abstraction in drawing the map. In effect the two approaches imply that cognitions of many individual mangers can be pooled together and representative maps may be constructed and the individual cognition of a manger alone may be represented on a single map signifying the unique individual process.

Conceptual Mapping The mapping methodology that reveals concepts and relationships among concepts (Swan, 1995) with the help of a diagram that displays the mental tasks (Rhodes, 1991) point to the importance of conceptual map as a tool of decision making. Concepts as generalizations and abstractions are derived from the data generated for the purpose of solving a problem or making a decision. Conceptual analysis may be accomplished using content analysis, factor analysis, systematic coding of relationships, interview techniques and computer software that produce models of concepts (Swan, 1995).

Conceptual mapping lays bare the theoretical and knowledge based view of the decisional problem which is approached from the concepts that enable problem resolution. Conceptual mapping graphically portrays the domain of ideas in a framework that provides decisional clarity and certainty. Kane and Trochim (2007) illustrate the use of different forms of conceptual map like point map in which statements are arranged in a certain way, cluster map that shows the clustering of the statements and point rating map that expresses the relationships of statements by a sort of rating.

The decisional problem is solved by the use of existing knowledge and theory. The data generated may be

Fig. 4(a) Converging Cognitive Analysis of the Decisional Problem – Cognitive Map

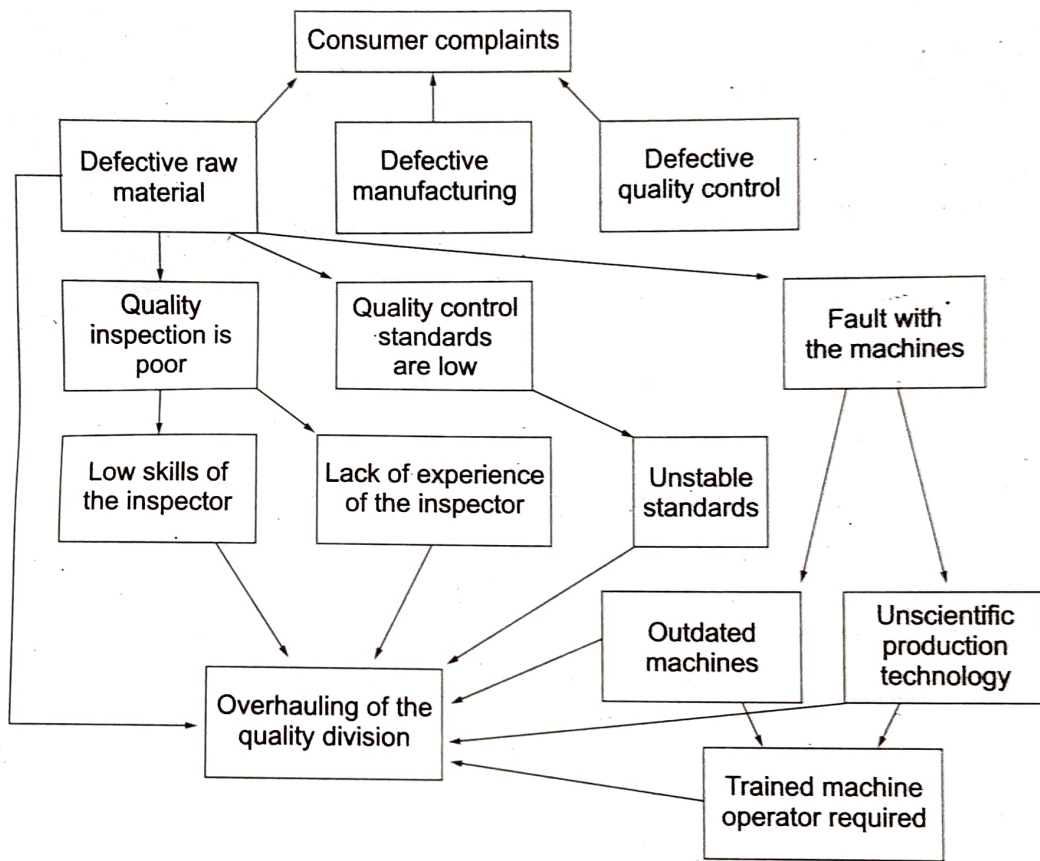


Fig. 4(b) Decisional Alternatives – Cognitive Map



analyzed to derive the contents of the conceptual map. Thus analysis of the decisional problem and the identification of alternatives are made possible with the help of conceptual thinking directed at decision making. Fig. 5 graphs the conceptual thinking as far as the

derivation of concepts help a decision maker in enhancing the effectiveness of decisions. The classification of the problem in different conceptual relations and the generation of alternatives in a particular class clarify the decision making process.

COMPARISON OF MAPS

The different maps outlined show different patterns in terms of representations and form and the contents by and large are similar in that all of them deal with the same decisional problem. The approach adopted in each map differs compared to the other map. The approach and the conception of the causative map is different from

the effectual map owing to the theoretical differences, which is the case with all other maps. It is to be noted that maps cannot be differentiated based on their appearance, which means that there is no fixed form of constructing a causative map or an effectual map. As a general rule it may be stated that causative maps are drawn in chain form and cognitive maps are drawn in interrelated manner. Similarly effectual and conceptual maps are

Fig. 5 Conceptual Map

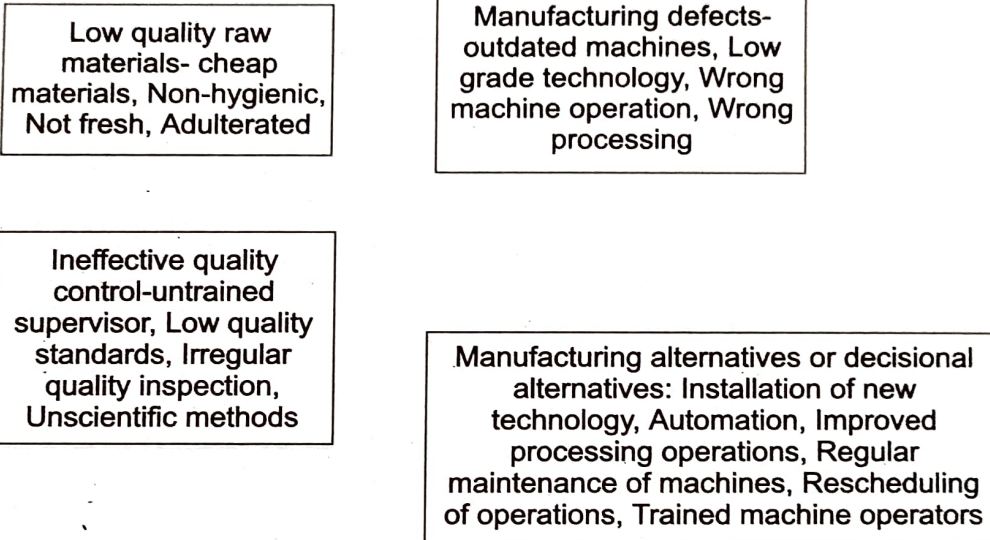


Table 2 Main Differences among the Maps

Criteria of Difference	Causative	Effectual	Conceptual	Cognition
General Pattern	Analysis of causes	Analysis of effects	Identifications of relations & classification	Identification of cognitive processes
Procedure of Analysis	Cause to solution	Effect to solution	Concept to solution	Cognition to solution
Unit of Analysis	Cause	Effects	Concepts	Cognitions
Contents of Maps	Causal dynamics and alternatives	Effectual dynamics and alternatives	Conceptual relations and alternatives	Cognitive dynamics and alternatives
Decision-making Process	Selection of alternatives from causal dynamics	Selection of alternatives from effectual dynamics	Selection of alternatives from conceptual relations	Selection of alternatives from cognitions generated
Underlying Principles	Identification of causes lead to decisional alternatives	Identification of means leads to decisional alternatives	Conceptual clarity and relations lead to decisional alternatives	Multiple cognitions lead to decisional alternatives
Decision-making Principle	Reduces Uncertainty and Irrationality	Solution driven	Broadening and widening of the decisional problem	Knowledge generation
Application	Repetitive static solutions	Novel and practical solutions	Theory driven solutions	Abstract and knowledge based solutions

drawn in boxes with or without arrows. The important differences among the maps are shown in Table 2.

CONCLUSIONS

Decisional maps thus pave the way for an effective decision making process in different managerial situations. The significant advantage of the maps rest with the quick and early disentanglement of the decisional problem leading to decisional outcomes. The maps which primarily aim at unraveling the decisional problem are of immense help to anyone serious about positive outcomes. The different types of maps, causal, effectual, cognitive and conceptual tap different angles of the decisional problem and each have a different approach and methodology. The selection of the type of map depends upon the nature of the problem and how the problem is approached from a particular angle. Finally regardless of the type, all maps result in effective decisions.

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