Group Decision Making Techniques

An Online Continuing Education Course for Engineers

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1.0 Introduction

Sometimes it is necessary to get the consensus of a group of executives and extract their ideas and expert opinion. We use group decision making to determine the objectives that must satisfy the goals of the organization. These objectives can and do change over time, and they change when the makeup of the group changes. Each can be used to gain a group consensus of goals and objectives. You can apply different methods for group decision making, based on the expertise, dominance, and political nature of the various decision-makers involved in the process.

It is also useful to use group decision making when only subjective data is available about the future to support and develop a model. Because it is hard to look into the future, sometimes the one resource to get a forecast of future events is to poll experts in the field, i.e., get an expert opinion. Group decision making is useful to use when the problem is complex and difficult to define. The "gut feel" of experts can provide good overall information to support a model when no other data is available. The time frame for the decision can dictate the type of model and the type of data that can be gathered for use in the model. Well-structured data and information gathered in group decision making can be used in analytical models. This expertise captured can be combined with objective data to provide a well-represented set of information to solve problems.

2.0 Types of Decisions Made by an Organization

Each level and function of an organization is involved in decision making, in some general capacity. Some of these decisions may be made by individuals on a daily, ongoing basis, while others are made be made by a group to come to a decision on a key matter facing the organization. Below is a list of some of the types of decisions that may be faced by an organization.

- **Programmed decisions** - Programmed decisions are concerned with the problems of repetitive nature or routine type matters. A standard procedure is usually followed, and it is made by a lower-level manager. These may be personnel decisions, purchasing decisions, or other typical operating decisions. These types of decision most likely will not involve group decision making.
- **Non-programmed decisions** - non-programmed decisions relate to difficult situations for which there is no easy solution. These decisions are important for an

organization and may be made at an executive level in the company. These types of non-programmed decisions may involve groups or teams and lend themselves to group decision-making techniques.

- **Routine decisions** - Routine decisions are related to the general functioning of the organization. They do not require much evaluation and analysis and can be taken quickly. Ample powers are delegated to lower ranks to take these decisions within the broad policy structure of the organization and are typically made by individuals in the organization.
- **Strategic decisions** - Strategic decisions are important which affect objectives, organizational goals, and other important policy matters. These decisions usually involve the allocation of significant resources and are made after significant analysis and evaluation. These types of decisions may involve executives who will need to come to a consensus in the decision, hence, they can benefit from group decision-making techniques.
- **Tactical or policy decisions** – These decisions again are upper level, strategic decisions that can affect significant resources or the direction of an organization. These decisions are typically made at executive levels; however, they can benefit from structured decision-making methods and processes.
- **Operational decisions** – Operational decision involves the execution of tactical or policy decisions, and many times are left to individuals and managers to execute at the direction of executives. Many times, these types of decision are carried out by individuals responsible for various functional aspects of the organization.
- **Organizational and personal decisions** - When an individual takes a decision as an executive in the official capacity, it is known as an organizational decision. If the decision is taken by the executive in is one that affects his or her personal life, this would be classified as a personal decision. This would be seen in the case where a key organizational executive decides to take an opportunity at another organization and leave the company. His or her personal decision will impact the organization as a whole.
- **Major and minor decisions** - Decision pertaining to the purchase of new factory premises is a major decision. Major decisions are taken by top management. The purchase of office stationery is a minor decision that can be taken by the office superintendent. Major decisions are well suited for group decision-making techniques.

Understanding and being aware of the types of decisions made by an organization is helpful in looking for opportunities to apply structured group decision-making techniques. It is important to not only know and understand your decision-makers but to also look at these decision-makers to determine what types of decision-making methods may be most beneficial in their decision-making process. The next section of the course will begin to describe the

classification of group decision making methods and general areas where these methods can be applied.

3.0 Classification of Group Decision Making Methods

Group decision making includes diverse and interconnected fields in the areas of preference analysis, utility theory, social choice theory, committee decision theory, the theory of voting, general game theory, expert evaluation analysis, and many others. The goal with group decision making is usually understood to be the reduction of different individual preferences among objects in a given set to a single collective preference, or group preference. The members of the group can use many different approaches or a combination of approaches to arrive at the single collective group preferences. These approaches can be divided into three general fields, which are social choice theory, expert judgment/group participation, and game theory.

The social choice theory involves three broad classifications of decision making, which is comprised of methods that handle voting, social choice function, and social welfare function. Voting is a group decision-making method in a democratic society, which is an expression of the will of the majority. It is a multiple criterion decision-making process whenever a voter casts a vote to select a candidate or policy. The candidates' qualifications may be judged by multiple criteria such as trustworthiness, honesty, capabilities, political stance, and positions on specific issues. These criteria are summarized in a voter's mind, into a value function that is represented by their selection for a candidate. With single-issue voting, the voter considers the single issue as most important over the other issues. The voter rates the candidates in their choices in regard to their value function.

Social choice functions can be viewed as aggregation procedures based on preferential voting systems representing social choice. A social choice function is a mapping that presents a subset of the potential feasible set of choices into a preferential mapping of individual's preference profile. Condorcet's principle, discussed in this course, provides a great example of the aggregation of the preferential ranking of individuals. The Borda function provides this mapping as well.

Social welfare function involves defining fair methods for merging individual preferences into a societal choice. The social welfare function is comprised of a rule which must map the profile of individual preference orderings into one of the possible preference orderings for society itself. Social welfare functions are derived based on several conditions and can be studied from a theoretical perspective

Expert judgment and/or group participation is comprised of methods that include brainstorming, brainwriting, nominal group techniques, surveys, the Delphi method, conferences, successive proportional additive numeration (SPAN) and other modeling, simulation, and cognitive mapping techniques. Other than the two social choice function methods, the

Condorcet Principle and the Borda function, the remaining of the techniques discussed in this course are classified as either expert opinion and/or group consensus. The method selected is determined by circumstances that involve data availability and/or the operating environment. Sometimes the method that the decision-maker feels most comfortable with is selected. It is easier to explain to him and for him to be comfortable with its use.

Game theory uses different forms of the game including the normal form of the game, characteristic function form, cooperative and noncooperative games, zero-sum, constant-sum, and general sum games being grounded in the concepts of the Nash Equilibrium. Game theory is a mathematical technique used in analyzing conflict-of-interest situations. Game theory is concerned with individuals who are pursuing their own self-interest and personal values against other individuals who are pursuing their own self-interest and personal values. Game theory can be mathematically complex and challenging, but its underlying assumptions are simplistic. Large scale games may also be difficult to apply in real-world decision problems; however, investigating the concepts and principles in game theory can be interesting. This topic, however, will not be addressed in this course.

4.0 Group Decision Making Methods

4.1 Condorcet's Principle

In analyzing voting from the Condorcet Principle perspective, there is only one rigorous way of knowing the wish of the majority in an election. This consists of basing this wish on the respective merits of all candidates compared one by one. The candidate should be elected if he beats every other candidate under a simple majority when such a candidate exists. This principle is based in part on an argument involving probabilities of correct judgments and embodies the democratic precept of rule by majority will. The majority candidate constitutes a stable equilibrium in that it cannot be beaten by a challenger in a direct majority vote between the two. The concept behind the application of the Condorcet Principle is similar to a maximin function since it chooses those candidates whose worst showing against the others is as good as possible.

In determining the best rank or preferences, a problem sometimes occurs in which A is preferred to B, which is preferred to C, and where C is preferred to A. This occurs when we directly compare alternatives to one another without using criteria. In the above preference, each alternative is scored against all others.

Condorcet suggests a method to break the cycle and to rank the alternatives. It determines the worst each candidate does against all other alternatives. Then rank each alternative as the best of the worst, so that it is a ranking by the best of the overall worst values.

As an example, a series of preferences ratings were given to a number of individuals. Below shows the following preferences and votes associated with those preferences

15 votes: A is Preferred to B

10 votes: A is Preferred to C

17 votes: B is Preferred to A

12 votes: B is Preferred to C

21 votes: C is Preferred to A

9 votes: C is Preferred to B

Note that the alternatives or candidates were not rated against themselves, i.e., A is Preferred to A

A table was constructed using the information gathered in the voting above.

Table 4.1 Condorcet's Principle Example

Preference	To			Minimum Score
	A	B	C	
A	___	15	10	10 (2nd Rank)
B	17	___	12	12 (1st Rank)
C	21	9	___	9 (3rd Rank)

The table shows, for example, that

- A is preferred to B, 15
- B is preferred to C, 12
- C is preferred to A, 21

Once this table is constructed, we find the minimum or worst value or votes for each of the candidates. You can see that for A, it is 10, for B it is 12, and for C, it is 9. When we find the maximum of the minimum score, we get the rank of B (12) > A (10) > C (9); thus, this is our final rank.

4.2 The Borda Function

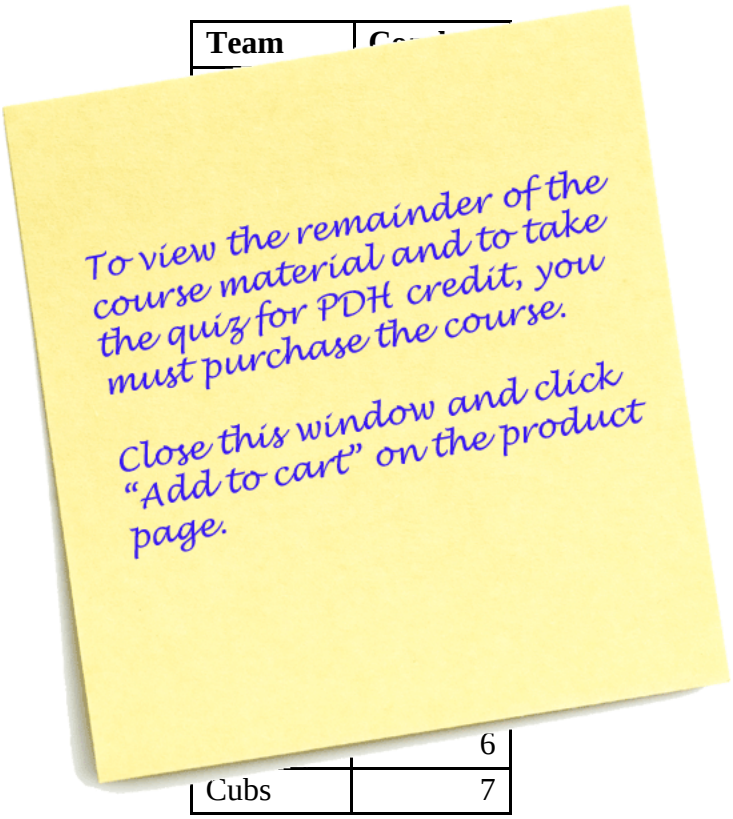
The approach that Borda suggests is that we rank each candidate or team 1 through *n*. Each participant ranks the group of candidates 1 through *n* and then adds their rank scores (team

scores) across each participant. The lowest score is ranked first, and so on to the highest score, which is ranked last. This approach is used in the coaches' poll of football rankings, where each coach ranks all teams 1 through *n* and then adds across each team, and the one with the lowest score is ranked first.

The following example shows how this function works. Three different coaches have ranked seven different baseball teams. The tables below show the rankings of each coach.

Team	Coach 1
Royals	1
Cubs	2
Mets	3
Blue Jays	4
Twins	5
Cardinals	6
Yankees	7

Team	
	6
Cubs	7



The results from the coaches' rankings are shown in the table below.