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Consensus Decision Making-Utilising Practical Game Theory Techniques

David Karr (CP Eng, FIIEA)
Federal President
Industrial Engineers Australia (IEA)
Perth, Western Australia
president@iea.org.au

Abstract

This paper is a practical example of utilizing Game Theory for effective Consensus Decision Making. In today's ever increasingly multifaceted world, there is an essential need for complex decisions to be resolved in a responsible optimum manner. The solution process needs to be suitably applied, that appropriately resolves the issue. In most cases, utilising Industrial Engineering (IE) Techniques will result in suitable outcomes. The decision requirements can include personal, business, governance, bureaucratic, environmental, technical and other outcomes, that require resolutions that may have short-, medium- or long-term impacts. Industrial Engineering Practices such as Consensus Decision Making (CDM) utilizing Game Theory (GT), can be utilized effectively, that can in most cases lead to optimal conclusions that benefit collectively in a Holistic manner. It should be noted that GT leads to optimized solutions and NOT to universally accepted outcomes in some cases. Due to circumstances, the need for effective consensus decision requirements is a major challenge. This is mainly due to the participants varying vested interests, backgrounds etc. This can lead to conflict or disagreement. The challenge then becomes how best to solve the challenges for optimum outcomes that satisfy all or the majority of the parties involved to a greater extent. A solution is the introduction of Consensus Decision Making Utilising Game Theory. Consensus Decision Making allows for a positive methodology, treating all participants equally, leading to meaningful agreements for the group.

Keywords
Consensus, Decision, Benefit, Conflict, Optimum.

1. Introduction
In our society, respectful agreement is the norm for a multitude of various situations. These could include normal daily activities such as domestic circumstances, purchasing items in a store, business decisions in the workplace, authority decrees or even international differences.

1. Consensus Decision Making is a creative and dynamic way of reaching agreement between all or most members of a group. Instead of simply voting for an item and having the majority of the group getting their way, a group using consensus is committed to finding solutions that everyone actively supports, or at least can live with (Seed, 2022). (www.seedsforchange.org.uk)

The need for an appropriate outcome, hopefully for all interested parties, is the ultimate state of affairs.
By utilising effective communication techniques holistically, Industrial Engineers (IE) are able to successfully achieve effective outcomes benefiting organisations and even individuals in their daily lives

Traditionally decisions are usually made unilaterally (top down organisations), dictatorially (dictatorships or strong organisations or strong personalities) or by senior management or rubber stamped (weak democracies following strong leaders)

Many ancient societies have hierarchical or ingrained traditional customs that are respected within the group. Thus situations that may in other societies or communities require many "vested interested" parties requirements to be satisfied, maybe be resolved simply and expeditiously. But in many cases especially in democratic societies, simple and easy solutions may not be possible or acceptable (National-Partner-Recommendation-Consensus-Decision-Making-Process-incl-Modified-Consensus, 2020).

2. Challenges Impacting on Acceptable Consensus Decision Outcomes

The challenge of reaching acceptable mutual outcomes in complex situations, occurs when there are diverse ideas or vested interests, which facilitates the need for diplomacy or suitable consensus decision making. This is especially prevalent when the viewpoints are diverse, contradicting or even opposing.
Contributing circumstances that can create differences can include:

- Unwillingness to agree or compromise
- Diverse vested interests
- Stubbornness
- Economic or cultural backgrounds
- Language
- Education
- Societal standing
- Religious
- Nationalistic
- Age
- Environmental
- Mental
- Intelligence
- Personality traits, and values
- Ineffective Leadership
- Cultural Diversity
- Or even irrational condition at a particular time

Some examples of the above situations include:

- An argument between a parent and a child
- Differing views on how to solve a technical problem in the workplace
- Strategy moving forward from a fossil fuel energy system, to one of utilising more environmentally friendly energy sources
- Balancing a national budget
- Optimum transport/traffic management in Metropolitan areas.
- Pricing of goods/services between supplier/customer
- Property owner tenant dispute resolution
- Solving dispute between 2 or more nations
- Reluctance to change work practices
- Bureaucratic intransigence
- Business to business agreements
- Avarice
- Choice of Restaurant
- Holiday location

3. Decision Resolution Methodologies

There is a need to resolve the above situations in a civil manner to the satisfaction of the various parties in the main. Unfortunately, in the last few years there have been forceful conflicts around the globe, some caused by individual viewpoints unfortunately. In the 21st century, these aggressive methodologies employed, are not really acceptable, in order to resolve conflict. There are of course better options to resolve these differences.

On the other hand utilizing CONSENSUS DECISION MAKING techniques in order to resolve issues in an intelligent manner, leads to far more improved outcome. This can include less stress, lower economic cost, reduced impact on the environment and a reduced timeframe as well as less destruction and human misery.

By applying Consensus Decision Making, this can be understood as participants making decisions by agreement rather than by majority vote and being inclusive to the extent possible, all necessary interests are represented or, at a minimum, approve of the decision.

Some of the consensus decision making techniques can include:

- Openness by all participants
- Acceptance by participants to Change
- Ability of participants to communicate effectively
- Explaining issues taking into account group backgrounds
- Explaining acronyms in full context initially
- Respecting all participants and their views
- Equality of all participants
- Allow all participants an equal say even if in disagreement with others
- Having a suitable competent neutral facilitator
- Being prepared prior to meeting
- View differences of opinion as helpful rather than harmful
- Discussing issues as objectively as possible
- Suitable safe location for discussion(F2F/Hybrid/Online)
  Reference 2.

4. Industrial Engineering (IE) Methodologies Aiding Consensus Decision Making

Utilizing core IE methodologies, allows for complex issues to be resolved optimally. Some of the IE basic practices include:

- Operations Research Techniques
- Game Theory
- Optimal Data Analysation
- Numerical Methods/Linear Programming
- Lean Management
- Circular Economy
- Effective Supply Chain Systems
- Business Process Re-Engineering
- Systems and Process Engineering
- Cost Benefit and Value Analysis
- Etc

For the above techniques to be beneficial, the fundamental hypothesis is that effective open communication and analytical approaches within a holistic approach, be employed for all or most of the process. Game Theory permits for optimum decision making to be arrived at allowing a more open objective process to be followed.

To clarify, Game Theory is that branch of mathematics concerned with the analysis of strategies for dealing with competitive situations where the outcome of a participant's choice of action depends critically on the actions of other participants. This usually leads to a democratic, harmonious and optimal resolution process for simple or very complex challenges. Game theory has been applied to contexts in business, society, war, and even in government.

Game Theory was developed by John Nash-American Mathematician comprises (John and Naf, 1950)

- Is a very democratic method of problem solving
- The makeup of the participants is important so as to allow for as unbiased outcome as possible

- It allows all participants to equally have their input/concepts heard
- The input is then collated and refined
- Ranked Balloting then determines each participant's choice
    - Ranking occurs by first choice having the highest value and so on
- The ballot results are then published. NOTE 1
- Further Benefit and or Risk Analysis (by each participant) can be undertaken with respect to various criteria such as costing, timing, impact to business etc
- The benefit/risk analysis results can be attached to the initial GT analysis for final decision choice
- In some cases, the initial concepts and ideas to be revisited.
- It removes the intra organizational conflict, competition, dysfunctionality leading to optimal business outcomes building inter personal trust
- Utilizes Intelligent Objective Consensus (IOC)

NOTE 1 Applications such as Slido can be utilized as well as spreadsheets.
NOTE 2 Game Theory does not necessarily lead to universal agreement in all cases. However GT can be utilized for optimized outcomes. Reference 3.

5. Utilising Consensus Decision Making Process Utilising Simplified Game Theory (GT)

In short, Game Theory is the mathematical study of strategy and decision making where multiple players make choices that affect each other's outcomes. It involves the analysis of various scenarios where the payoff of a player's decision depends not only on their own actions but also on the actions of other players

The process of utilizing simplified Game Theory (GT) comprises of 3 major phases.

- Potential Solution Evaluation-utilising objective/subjective decision making in selecting possible solutions
- Criteria identification to be used leading to consensus decision making
- Benefit and Risk Analysis applied utilising selected Criteria applied to issue potential solutions.

The process can be repeated if "fresh" input of ideas or possible solutions are produced.

6. Practical Example of Utilizing Game Theory

For the purposes of undertaking this exercise SLIDO Application(www.slido.com) will be utilized.
Solution Evaluation

1. Identify project, strategy etc
2. Involve suitably representative participants in process.
3. Ask participants for their input-solution, options. NOTE all participant are EQUAL.
4. Collate, sort input, identify optimized solutions(s)
5. Undertake a preferential multiple-choice poll. Can utilize SLIDO.
6. View results and select top 3 to 5 possible options. (Figure 1).

Figure 1. Poll results (slido) example

Criteria identification

1. Similar process to Solution Evaluation, identifying influencing Criteria to be considered(eg cost) Step 1 to 5
2. View results and select top 3 to 5 criteria options as required (Figure 2).

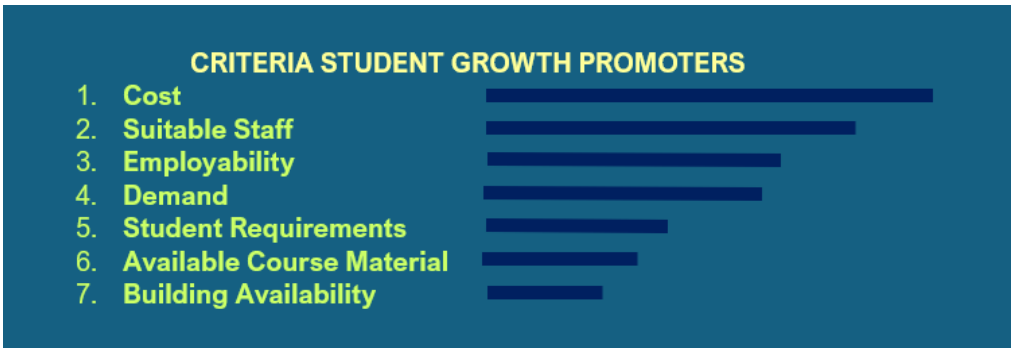

Figure 2. Applied selection criteria results example

Benefit and Risk Analysis applied utilising selected Criteria applied to issue potential solutions

1. Apply the various selected criteria to each of the top 3 to 5 selected possible solutions
2. Note that the Benefits are considered Positive contributors, and Risks are considered Negative contributors.
3. Identify the Optimum Option. Refer Figure 3.
4. NOTE reviewing the outcome and the possibility of returning to the Solution Evaluation stage may occur.

		BENEFIT/RISK ANALYSIS																								
TOPIC		STUDENT GROWTH PROMOTERS																								
		CRITERIA																								
SOLUTION No	SOLUTION	COST						SUITABLE STAFF						EMPLOYABILITY						DEMAND						
		HIGH BEN 2	LOW BEN 1	NO BEN/ RISK 0	LOW RISK -1	HIGH RISK -2	1 CHK TOT	HIGH BEN 2	LOW BEN 1	NO BEN/ RISK 0	LOW RISK -1	HIGH RISK -2	2 CHK TOT	HIGH BEN 2	LOW BEN 1	NO BEN/ RISK 0	LOW RISK -1	HIGH RISK -2	3 CHK TOT	HIGH BEN 2	LOW BEN 1	NO BEN/ RISK 0	LOW RISK -1	HIGH RISK -2	4 CHK TOT	TOTAL B/R
1	New Courses	8	3	0	-3	-6	**2**	12	3	0	-1	-10	**4**	10	4	0	-2	-10	**2**	4	5	0	-4	-8	**-3**	**5**
2	More Research	18	5	0	0	-2	**21**	8	3	0	-5	-8	**-2**	6	3	0	-5	-10	**-6**	4	4	0	-5	-6	**-3**	**10**
3	New Department	14	3	0	-2	-10	**5**	18	5	0	0	0	**23**	2	1	0	-3	-22	**-22**	10	4	0	-5	-2	**7**	**13**
4	More Promotion	4	3	0	-3	0	**4**	16	7	0	-2	0	**21**	10	4	0	-2	-6	**6**	12	7	0	-2	0	**17**	**48**
5																										######
6																										######
7																										######
8																										######
9																										######
10																										######
	CHECK	**44**	**14**	**0**	**-8**	**-18**	**32**	**54**	**18**	**0**	**-8**	**-18**	**46**	**28**	**12**	**0**	**-12**	**-48**	**-20**	**30**	**20**	**0**	**-16**	**-16**	**18**	#VALUE!

Figure 3. Applied benefit and risk analysis results example

Possible Consensus Decision Making topics for this presentation could include:
Sustainable Energy Solutions
Optimum transport/traffic management in Metropolitan areas
Managing population growth in Developing Countries
Managing and Accepting Disruptive Technological Change
Efficient Airport Air Traffic Management Approach
Minimization of Population Health Issues in Developing Countries
Future Food /Protein Sustainment

7. Conclusion

In conclusion “concepts of game theory permit a wide range of applications, at the same time they are selectively useful in solving problems of a certain type, in drawing attention to certain features of a problem, and in reaching certain types of conclusions.” (Martin, 1978).

The need for a suitable methodology allowing for the resolution of many simple or complex issues allowing for acceptable agreement is essential. An applicable Industrial Engineering technique that facilitates effective Consensus Decision Making is the utilization of Game Theory developed by John.

It should be noted that Game Theory may not lead to Universal acceptance in the decision making process in all cases. However, Game Theory when utilized effectively, usually leads to optimum solutions. These outcomes can be acceptable to all or most of the participants in many cases.

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Biography

David Karr Graduated as an Industrial Engineer BSc (Eng Mech in the Industrial Option) in 1976 at University of Witwatersrand (Wits), Johannesburg, South Africa in 1976. He received a Graduate Diploma in Engineering at Wits 1979. David has worked in various Production and Industrial Engineering roles in manufacturing, service industries and consultancy for over 45 years in South Africa, Canada and Australia. He also has training experience as a lecturer(casual) at TAFE (technical college) for 13 years delivering training in various aviation business units. He has worked for Siemens (Routing Eng) and Colgate Palmolive (IE) (South Africa), Pirelli Cables (IE) and Canada Post (IE) (Canada), BOC Gases (Australia) (Production & Project Manager) across production quality, project management, supply chain management, design and improvements of production line and layouts of work area and data optimization. Industry experience included batch and process type manufacturing as well as large and small sites mainly with large multinational or national companies. He has delivered Game Theory presentations to Curtin University, Perth, WA, University of Melbourne and Industrial Engineers Australia. Also he has applied practical Game Theory industry circumstances. He has its own Business Consultancy undertaking passenger surveys, time and motion studies, setting up preventative maintenance systems for various clients and introduction of digitised autonomous processes. David has been very active in professional organisations in Canada (Canadian Society of Industrial Engineers (CSIE) and in Australia (Industrial Engineers Australia (IEA) and Engineers Australia (EA) He is a fellow and Federal President of Industrial Engineers Australia and Chartered Professional Engineer of Engineers Australia.