MULTI CRITERIA DECISION ANALYSIS IN GAINING PROFIT

[1]S.SATHYAPRIYA, [2]P. SNEHA, [3]G.SINDHIYA

[1]Assistant Professor, Department of Mathematics,
[2,3]UG Scholar, Sri Krishna Arts and Science College, Coimbatore

***Abstract*: The project deals with the concept of multicriteria decision making which helps in analyzing the issues in the actual process of the company and finding out the best solutions. Decision analysis is used here to find the optimal strategy path , optimal decision in manufacturing and in gaining profits.**

***Keywords*: HURWICZ criterion , decision analysis and decision tree approach.**

INTRODUCTION :

Multiple criteria decision making (MCDM) refers to making decisions in the presence of multiple, usually conflicting, criteria. MCDM problems are common in everyday life. In personal context, a house or a car one buys may be characterized in terms of price, size, style, safety, comfort, etc. In business context, MCDM problems are more complicated and usually of large scale. For example, many companies in Europe are conducting organizational self-assessment using hundreds of criteria and sub-criteria set in the EFQM (European Foundation for Quality Management) business excellence model. Purchasing departments of large companies often need to evaluate their suppliers using a range of criteria in different area, such as after sale service, quality management, financial stability, etc.

MULTI CRITERIA DECISION MAKING:

MULTICRITERIA DECISION MAKING (OR) MULTICRITERIA DECISION ANALYSIS is a sub-discipline of operations research that explicitly evaluates multiple conflicting criteria in decision making (both in daily life and in settings such as business, government and medicine). Conflicting criteria are typical in evaluating options: cost or price is usuallyone of the main criteria, and some measure of quality is typically another criterion, easily in conflict with the cost. In purchasing a car, cost, comfort, safety, and fuel economy maybe some of the main criteria we consider – it is unusual that the cheapest car is the most comfortable and the safest one. In portfolio management, we are interested in getting highreturns but at the same time reducing our risks, but the stocks that have the potential of bringing high returns typically also carry high risks of losing money. In a service industry, customer satisfaction and the cost of providing service are fundamental conflicting criteria

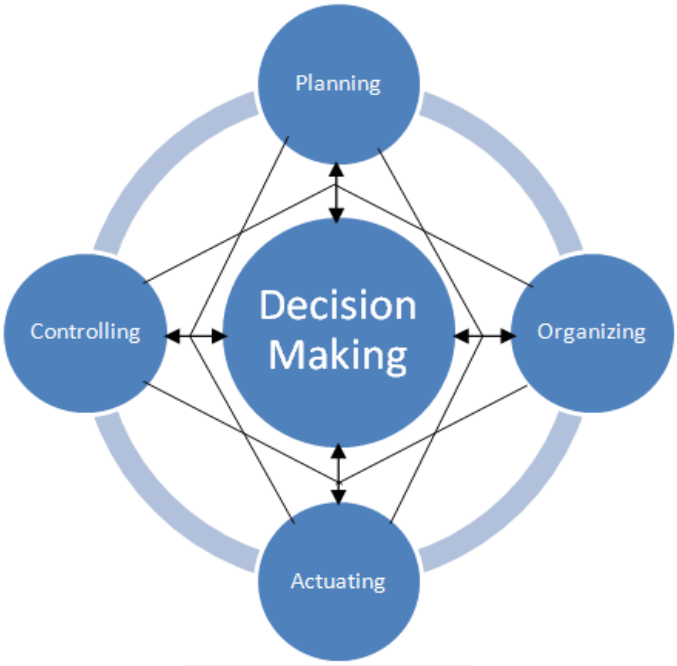
APPLICATION OF MULTI CRITERIA DECISION MAKING:

Many construction activities need to make decisions quickly and accurately.

•Multi-criteria decision analysis is a useful tool to assess constructive processes.
•The main applications of multi-criteria methods to construction are reviewed singly.
•An overview of the most widely applied multi-criteria techniques is provided.
•A statistical analysis is conducted to model the use of the methods under review.

MCDA problems are comprised of five components:

1. Goal
2. Decision maker or group of decision makers with opinions (preferences)
3. Decision alternatives
4. Evaluation criteria (interests) and
5. Outcomes or consequences associated with alternative



DECISION ANALYSIS

Decision analysis refers to a systematic, quantitative and interactive approach to addressing and evaluating important choices confronted by organisations in the private and public sector. Decision analysis is interdisciplinary and draws on theoriesfrom the fields of psychology, economics, and management science.

HURWICZ CRITERION

The **Hurwicz criterion** attempts to find a middle ground between the extremes posed by the optimist and pessimist **criteria**. ... of realism is coefficient of optimism. An α = 1 denotes absolute optimism (Maximax) while an α = 0 indicates absolute pessimism (Maximin).

PROBLEM 1

A decision problem has been expressed in the following table :

Find the

a) Maximum criterion
b) Minimum criterion

	Large cooker(rs)	Medium cooker(rs)	Small cooker(rs)
Company	783	612	543
Distributor	1800	1420	880
Customer	2240	1760	1200

Solution

Let us consider **α**=0.5

FORMULA

p= αmax + (1- α)min

from table:

Maximum of row	Minimum of row	P
783	543	663
1800	880	1340
2240	1200	1720

From the above answer , according to HURWICZ principle , the maximum and minimumsolutions are obtained

. Maximum criterion=1720

. Minimum criterion =663

DECISION TREE APPROACH

A **decision tree** is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility. It is one way to display an algorithm that only contains conditional control statements.Decision trees are commonly used in operations research, specifically in decision analysis,to help identify a strategy most likely to reach a goal, but are also a popular tool in machine learning.

PROBLEM 2

A client ask an agent to sell three varieties of cookers A,B and C for him and agrees to pay him 5% Commission on each sale.He specify certain conditions that agent Must sell property A first and this he must do within 60 days if and when A is sold the agent receives his 5% Commission on the sale .He can then either backout at this stage or nominate and try to sell one of the remaining two cookers within 60 days ,if he does not succeed in selling the nominated property in that period he is not given the opportunity to sell the other and if he does sell it in the period he is given the opportunity sell third property on the same condition .The following table summarises the price ,sellingcost and probability of the sale

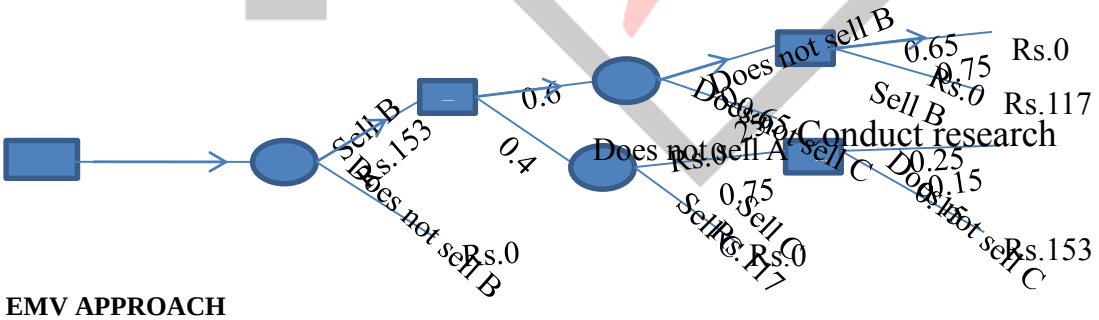
a)Decision tree

b)EMV approach

Cooker model	Cost of cooker	Selling cost	Customer demand
A	543	1200	0.6
B	612	1760	0.25
C	783	2240	0.15

SOLUTION

Agent gets 5% Commission if he sells the properties and satisfies the specified condition. The amount he receives has Commission on sale of cookers A,B ,C will be 325,153,117 respectively. Since the sellingcosts incurred by him are Rs.1200,Rs.1760 and Rs.2240 his conditional profits from sale of properties A,B and C are 875,1607and 2123 respectively.



EMV APPROACH

EMV of node 3=Rs.(0.15*117+0.75*0)
=Rs.17.55

EMV of node 4=Rs.(0.25*153+0.65*0)
=Rs.38.25

EMV of node B=Rs.(0.25(153+17.55)+0.65(0))
=Rs.42.63

EMV of node C=Rs.(0.15(117+38.5)+0.65(0))
=Rs.23.32

EMV of node 2 =Rs.42.63(higher of EMV)

EMV of node A=Rs.(0.6×(325+42.63)+0.4(0))
=Rs.225.98

The optimal strategy path is drawn with arrows. Thus the optimum strategy for the agent is to sell A , if he sells A then try to sell B and if he sells B ,then try to sell C to get an optimum expected amount of Rs.225.98

PROBLEM 3

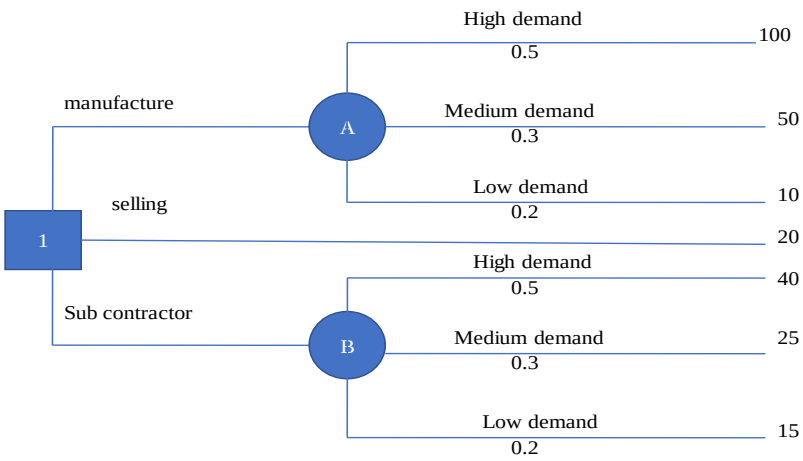
A company dealing with aluminium cookers facing with the problems of selecting the strategies

A) manufacture itself
B)to be paid on a sub contractor
C)selling to prestige smart kitchen

The profit in thousands of rupees that can be expected in each case and the probability associated with sales volume are shown in table

Demands	Probability	Manufacture	Sub contractor	Selling
High	0.5	100	40	20
Medium	0.3	50	25	20
Low	0.2	10	20	20

The decision tree diagram for the problem



- EMV of chance node=Rs.1000(0.5×100+0.3*50+0.2×10)
  =Rs.67000
- EMV of chance node=Rs.1000(0.5×40+0.3×25+0.2×15)
  =Rs.30500

Thus the optimal decision for the company is to manufacture the cooker itself to get the maximum expected profit of Rs.67000

PROBLEM 4

TTK company is currently working with a process which after paying for materials , labour , etc , brings a profit of Rs.240000per week.

The following alternative are made available to the company.

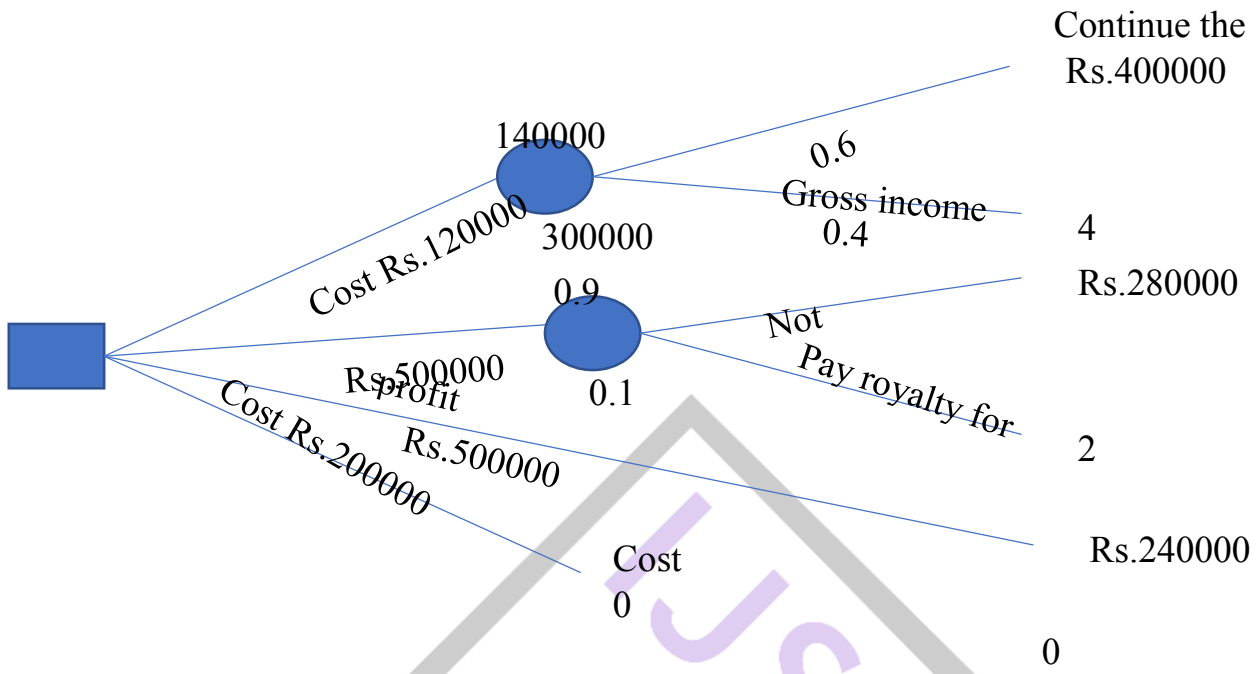
1) the company can conduct research(R1) Which is expected to cost Rs.200000 having 90% chances of success. If it proves a success , the company gets a gross income of Rs.500000

2)the company can conduct research (R2) which is expected to cost Rs.160000 having a probability of 60% success , the gross income will be Rs.500000

3)the company can pay Rs.120000 as royalty for a new process which will bring a gross income of Rs.400000

4)the company continues the current processbecause of limited resources , it is assumed that only one of the two types research can be carried out at a time.

Use decision tree analysis to locate the optimal strategy for the company



As the net EMV is highest for the alternative 'pay supplier for new process' the optimal decision would be to procure new process o royalty basis

DECISION ANALYSIS AT POINT D

DECISION	EVENT	PROBABILITY	GROSS INCOME		EXPECTED INCOME
conduct research	successful	0.9	Rs.500000		Rs.450000
(R1)	not successful	0.1	0		0
			total expected income=		Rs.450000
			less cost	=	Rs.200000
			net EMV	=	Rs.250000
conduct research	successful	0.6	Rs.500000		Rs.300000
(R2)	not successful	0.4	0		0
			total expected income=		Rs.300000
			less cost	=	Rs.160000
			net EMV	=	Rs.140000
pay supplier for	certain	1	Rs.400000		Rs.400000
new process			less cost	=	Rs.120000
			new EMV	=	Rs.280000
continue the					
process	certain	1	Rs.240000		
			EMV	=	Rs.280000

CONCLUSION:

The project is about decision analysis. Every company wants to achieve some set of goals. In this paper some of data have been collected and problems are solved using decision analysis techniques.Here the detailed description about DECISION ANALYSIS is given. The mathematical problems are solved from the data been collected in order to find the optimal strategy for the company to increase the profit.

REFERENCES:

[1] PREM KUMAR GUPTA,D.S.HIRA, S.CHAND , OPERATIONS RESEARCH , S.CHAND AND COMPANY LTD.NEW DELHI-110055.
[2] GUPTA AND HIRA , PROBLEMS IN OPERATIONS RESEARCH: PRINCIPLES AND SOLUTIONS, S.CHAND AND CO.LTD NEW DELHI,2006
[3] MP.GUPTA AND J.K.SHARMA , OPERATIONS RESEARCH FOR MANAGEMENT , NATIONAL PUBLISHING HOUSE , NEW DELHI 1984.
[4] www.mathedu.in
[5] www.mathhelpdesk.in
[6] www.prenhall.com
[7] www.math.upatras.gr
[8] www.mat.gsia.cmu.edu
[9] www.maths.ed.ac.uk