Selection of an industrial project in fuzzy environment

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Abstract
The subject of choosing an industrial project for those concerned is of importance in a foggy investment environment. Industrial or service investment projects that contribute to the economic development of the country are considered development activities. The aim of the research is to solve the problem of choosing a project in an environment characterized by stability and factors by adopting a method that deals with accuracy. Which enables decision-makers to grant their decision confidently according to the specific objectives of the Project Scope, and this can be done through the degree of selection for each alternative according to a scenario that this technology has been applied to an industrial project in an investment environment. It turns out that measuring an alternative decision for a particular option is a condition that is measured, that is, there is a link between the operation of an option and the goal associated with that option. The project manager prepares a plan that depends on the project field and assumes that there will be a risk of decay after a period and a gradual loss. The research found the effect of the fuzzy standard such as: (the project cost does not exceed the allocation limits, the ease of completing the project without obstruction, realizing the project on time, and social stability) on choosing a project taking into account the cost and time to avoid loss and obstacles.
Key words: project selection, industrial project, foggy industrial environment, fuzzy logic.

First: research methodology

1-1 Research problem:

The difficulty of choosing an industrial project in an industrial environment that is not clear-cut and making a decision about which projects are the most appropriate, so a method that deals with precision, with Multiple Objective Decision Making (MODM) technology, has been used as a mathematical method.

1-2 Importance of the research:

Enriching the scientific library with scientific research and assisting the decision maker in making a decision that adopts the mathematical model. The research shows the possibility of procedures for applying the model as procedures with successive stages of development to simulate a practical reality.

1.3 Research methodology:

The concept of fuzzy logic was adopted for an environment with unstable factors. For making a multi-objective decision (MODM) where:

$$\{F_1(x), F_2(x), \ldots..F_n(x)\}$$

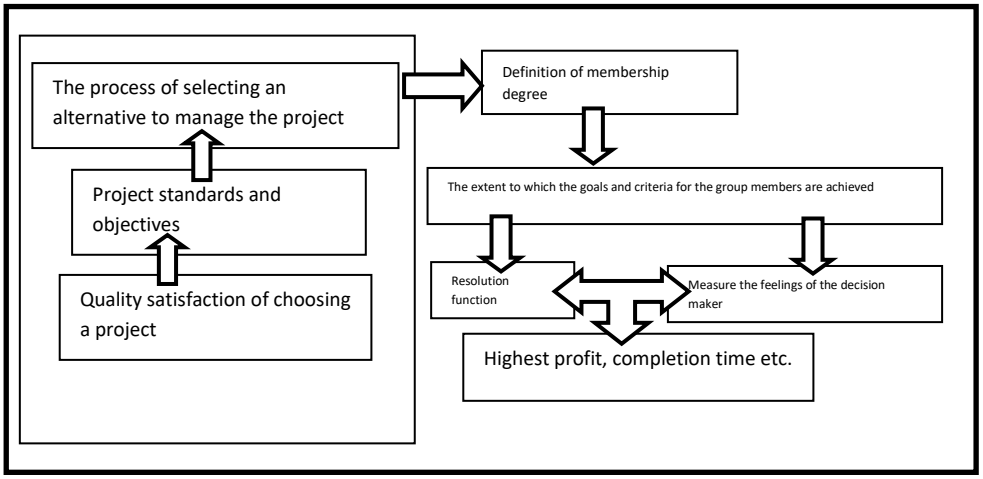
S.t:

$$G_i(x) \begin{bmatrix} \leq \\ \geq \\ = \end{bmatrix} 0,\ i=1, 2, \ldots.m$$

The choice of a suitable project to manage in an unstable environment The factors need an appropriate method based on dealing with accuracy. Foggy logic allows the use of conditions and rules while avoiding thresholds. With the use of this technique, it is possible to deal with the variables as the range of numeric values, while the value of the fuzzy variable itself is called the value of non-fog Grisp value between (100-0) and the range is qualifiers.

So the purpose of managing a project with long-term goals and the quality of the project's activities is measurable and changing, seeking to achieve efficiency and effectiveness at the lowest cost. The researchers directed towards multi-goal blurring as Cheng, 2018) explained the fuzzy logic of making a decision to reach the appropriate option with the accuracy of the information available about the project.

1-4 Research Form:



Second: the theoretical side

2-1 Investing in the project

To achieve the goals of project management in the investment environment (achieving the highest profit ratios or reducing the completion time or reducing the cost of performance in a specific period) of various goals decisions in an environment that includes more than one goal that restricts the choice problem. That project is called to achieve. While some were briefed as being required of the project (MohamedElheddad, 2019). Some researchers wanted to link the objectives to the scope of the project. Also, the goals are nothing but the final results that the projects seek through the management of those projects to achieve and the aim of them is to be in a short period in terms of the speed of its completion, and some of it is long according to the time frame. Perhaps one of the controversial matters when defining the objectives of the project is the conceptual overlap between goals and objectives (Samuel Adams, 2009). From the above, due to the blurring of information in all the selection environment, the blurry knowledge will be clarified.

2-2 Fuzzy Knowledge

All knowledge is determined by verbal words, such as most, very, somewhat, a little ... etc., and it describes an ambiguous event. They are formulated with models to solve complex problems that cannot be solved by traditional methods. What is used in the field of

decision-making and the treatment of mysterious information that lacks accuracy. Fuzzy logic technology aims to provide mathematical functions and judgments between truth and absolute negation between (1.0), based on the experience of system building experts using natural languages (Yager, 1991). Fuzzy logic can be used in cases where the uncertainties associated with the data are caused by foggy and not random or both together, that is, the variables are not fixed but rather foggy numbers, providing a way to reach a conclusion based on a vague, vague and inaccurate problem (Cheng, 2018) . Verbal variables are of importance in fuzzy logic. The sentence assumes knowledge of the sense in the decision-making process and an understanding of the work environment. Language expressions represent the form of fuzzy groups. Therefore, in the practical aspect of the research, a data model will be prepared to select the project using MODM. (IbrahimA., 2013)

Third: The practical aspect of research

Introduction:

In order to achieve the management of a new project that is characterized by success, we must take into consideration that the investor wants a project in the event that it is established in the investment environment that achieves the costs to the minimum, taking into account all the caliphal groups in consideration of even the submersible costs from them, while achieving the maximum limit of the speed of completion and restriction With the plan established by decision-makers, influential people, and profit, and achieving a quality of performance commensurate with what the project aims to achieve within the specific environment.

Fuzzy knowledge and MODM technology

Finding the best course of action for a problem characterized by goal decisions is a contemporary solution to a system with contradictory goals. Competition between industrial projects on the ground compels consideration of inconsistencies and contradictions. Data for project selection status are determined in order to achieve optimal project selection in a cloudy environment. A mathematical model has been built and data prepared to determine selection among projects with criteria and goals while measuring the feelings of the decision-maker and the extent of its best achievement, as follows:

1. Assume that the data for the process of selecting one alternative to manage a project is (ai) from the set of options for alternatives (A) and (a) are the criteria and objectives of the project to be set up in the investment environment and determined by the decision-maker, what is required is to assess how well the issue of satisfaction with the choice is achieved Each of the alternatives to manage the project to be established in the investment environment, given that each alternative is a goal in itself.

$$\mathbf{A= \{ a_1 , a_2 ,a_3 ....., a_n\}}$$

Where A is a comprehensive set of n alternatives, and denotes targets (i) and a set of r from a target

$$\mathbf{O= \{ o_1 , o_2 ,o_3 ....., o_r\}}$$

2. Assume that O1 indicates target (i). The degree of membership of the alternative (a) in –Oi is denoted by the symbol –Moi (a). The degree of membership of the alternative can be defined as the degree to which the alternative meets the relevant criteria for project management for this goal, if the decision function (D) gives all groups of goals so therefore Mathematically, it expresses as follows: D = O1 ∩ O2 ……. . Or

3. The degree of membership that has the decision function D for each alternative a:

$$\mu_D (a^*) = \min [\mu o_1(a) , \mu o_2(a) , \ldots\ldots , \mu o_r (a)]$$

4. The decision taken by the project management executive can be the alternative that achieves the following

$$\mu D (a^*) = \max a \epsilon A (\mu D (a))$$

5. The next stage defines the elements of the option group, which are those used to measure the feelings of the decision maker in the matter of his influence towards each goal as an option and based on the alternative that can be chosen. So, assuming that (bi) is the content of the {P} option group, where: i = 1,2,3, ……, r

6. There will be every project goal to measure the importance of this option for decision-makers to make a specific decision among other options for options available to it, assuming that the option group to measure the feelings of the decision-maker are those spaces between (Strongly agree - I oppose - I do not agree I do not agree - Agree - Strongly Agree). From the foregoing the next stage is the opposite of everything related to the goal in terms of the choice being affected by the decision-maker as: D = M (O1, b1) ∩ M (O2, b2) ∩… ∩M (Or, br)

7. Where M (Oi, bi) is the measurement of the decision-making in the project management to choose the target according to the choice affected. The next stage is to link each goal ((Oi seeks to achieve the project, whether it is the highest profit or reduce the completion time or cost of performance in the specified period or other objectives of the project with the importance of (bi) i.e. in achieving those goals in its importance to achieve them with the investment environment specifically, so that The linking is made logically ie: M (Oi (a), bi) = bi → Oi (a) = bi v Oi (a)

8. Where (a) the measurement of the alternative decision is specified and that the phrase (Oi (a), bi) is a state of the necessity of the decision (a) of the measured decision or the measurement of the decision (bi), here we mean that there is a single relationship between a preference process or (Option) and the target associated with that option. That is, with a variety of targets having the same weights in the selection, each goal will have a single relationship in terms of selection, despite the case of $i \neq j$, it can exist for some of the goals bi = bj. With this aforementioned assumption, the decision model will be:

$$D=\bigcap_{i=1} (bi \cup Oi)$$

9. If we assume that the optimal solution a * is to strive towards achieving the goal of project management to achieve the highest possible profit or optimal achievement plan or goal of maximization, it is:

.1

$$\mu_{ci}(a) = Max[\mu_{bi} -(a) , \mu_{oi}(a)] , C_i = (b_i U o_i)$$

$$\mu_D(a^*) = Max_{a \epsilon A}[Min \{ \mu_{C1}(a), \mu_{c2}(a), \ldots, \mu_{cr}(a)\}]$$

10. That, with the aforementioned, we can use to make a legitimate decision in case of needing to make a decision by the investor in which options are being adopted, and with the following cases of projects:

a) A project that allocates high financial resources for the sake of speedy completion in the shortest possible time with the assumption of stability in the market and social investment environment, so it is necessary to study the available alternatives, which are:

1. An option for the project manager to prepare a plan that relies on building a project with a field that assumes full stability (CS).

2. Two options The project manager prepares a plan that relies on building a project with a field that is assumed to decay after a period and a progressive loss (NS) occurs.

3. An option for the project manager to prepare a plan that relies on building a project with a field that assumes pessimistic measures to avoid a rapid realized loss (FL).

b) The previous data had determined for the decision-maker that there are four objectives for the project board to be established in the investment environment:

i. The project cost does not exceed the allocation limits (CP)

ii. Ease of completion of the project without a hindrance (ED)

iii. The project will be achieved on time.

iv. Impact of social stability (ES)

Here the matter is placed as follows:

$A=\{CS,NS,FL\}=\{a_1, a_2 , a_3\}$

$O=\{C_P,ED,TP,ES\}=\{o_1, o_2 , o_3,o_4\}$

$P=\{p_1, p_2 , p_3,p_4\}\rightarrow[0,1]$

$O_{\sim 1} =\{\frac{0.4}{CS} + \frac{1}{NS} + \frac{0.1}{FL}\}$

$O_{\sim 2} =\{\frac{0.7}{CS} + \frac{0.8}{NS} + \frac{0.4}{FL}\}$

$O_{\sim 3} =\{\frac{0.2}{CS} + \frac{0.4}{NS} + \frac{1}{FL}\}$

$$O_{\sim 4} = \{\frac{1}{CS} + \frac{0.4}{NS} + \frac{0.5}{FL}\}$$

Suppose that the project manager sets a set of options for each of the four project objectives that we mentioned earlier (CP, TP, ED, ES) were estimated as follows in Table (1):

b1	b2	b3	b4	b\1	b\2	b\3	b\4
0.8	0.9	0.7	0.5	0.2	0.1	0.3	0.5

Table (1) shows the scenarios and first targets options.

Source: prepared by the researcher

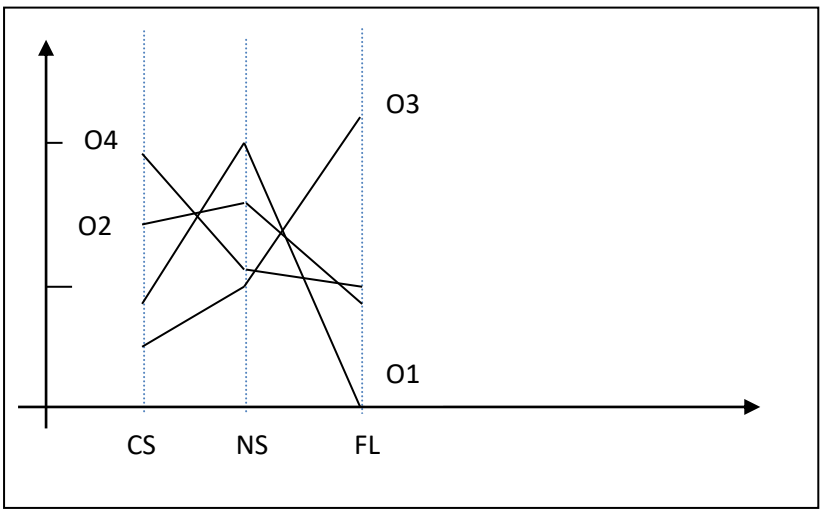


Figure (2) options as a substitute member to achieve the objectives of project management in a cloudy environment.

Source: prepared by the researcher

$D(a_1)=D(cs)=(b'_1\ UO_1)\cap(b'_2UO_2)\cap(b'_3UO_3)\cap(b'_4UO_4)$

D(cs)=(0.2v0.4)^(0.1v0.7)^(0.3v0.2)^(0.5v1)

D(cs)=0.4^0.7^0.3^1=**0.3**

$D(a_2)=D(NC)=$ (0.2v1)^(0.1v0.8)^(0.3v0.4)^(0.5v0.5)

D(a2)=D(NO)=(0.2v1)Λ(0.1v0.8)Λ(0.3v0.4)Λ(0.5v0.5)

D(NC)=1Λ0.8Λ0.4Λ0.5= **0.4**

$D(a_3)=D(FL)=$(0.2v0.1)^(0.1v0.4)^(0.3v1)^(0.5v0.5)=

0.2Λ0.4Λ1Λ0.5= **0.2**

$D(Final)=Max\{D(a_1),D(a_2),D(a_3)\}=Max\{0.3,0.4,0.2\}$

From the above, option a2 will be chosen, which is an option for the project manager to prepare a plan that relies on building a project that is suitable for the investment environment and assumes that the project will face a risk of decay after a period and a gradual loss (NS) with options (b1).

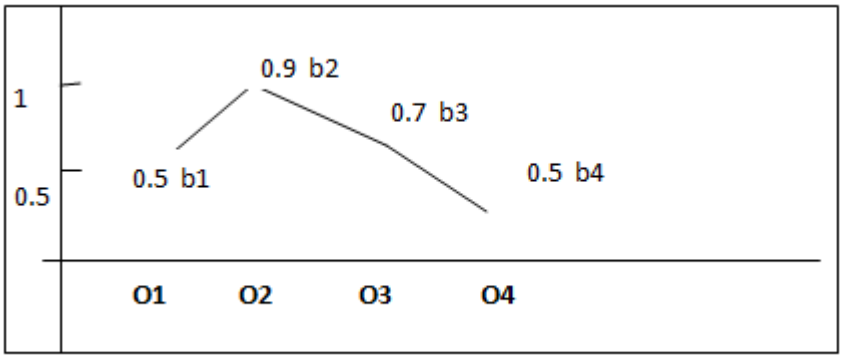


Figure (3) options in the first scenario.

Source: prepared by the researcher

The project management's setting of limitations as a second scenario for options gives other opportunities. If we assume that:

b1	b2	b3	b4	b\1	b\2	b\3	b\4
0.5	0.7	0.8	0.7	0.5	0.3	0.2	0.3

Table (2) shows the objectives of the second scenario.

Source: prepared by the researcher

$D(a_1)=D(cs)=(b'_1 UO_1)\cap(b'_2UO_2) \cap(b'_3UO_3) \cap(b'_4UO_4)$

$= (0.5v0.4)^(0.3v0.7)^(0.2v0.2)^(0.3v1)$

$=0.5^0.7^0.2^1=\mathbf{0.2}$

$D(a_2) = D(NS) = (0.5V1)$
$(0.3V0.8)^(0.2V0.4)V(0.3V0.5)$

$=1^0.8^0.4^0.5=\mathbf{0.4}$

$D(a_3) = D(FL) = (0.5V0.1)\ (0.3V0.4)^(0.2V1)^(0.3V0.5)$

$=0.5^0.4^1^0.5=\mathbf{0.4}$

$D(Final) =Max\{ D(a_1) ,D(a_2),D(a_3)\}=Max\{0.2,0.4,0.4\} =\mathbf{0.4}$

In this scenario, we find that D (a2) and D (a3) both contain the same value 0.4, so it is necessary here to analyze the matter in the following way: D (a2) → 0.4 FromC3 (a2) so this is a value

$\mathbf{K=3\rightarrow \widehat{D}_{(y)}=min\ _{i\neq g}\ [C_i\,(y)]}$

$\mathbf{\widehat{D}_{(y)}=min\ _{i\neq k}\ [C_i\,(x)]}$

The value of 0.4 = D (a3) comes from the second term, i.e. C2 (a3), so g = 2 according to the above equation, and therefore: Dˆ_ ((a2)) = Dˆ_ ((NS)) = (0.5V1) Λ (0.3V0.8) Λ (0.3V0.5)

$\mathbf{=1^0.8^0.5=0.5}$

$\mathbf{\widehat{D}_{(a3)}=\widehat{D}_{(FL)}= (0.5V0.1)\ (0.2V1)^\ (0.3V0.5)}$

$\mathbf{=0.5^1^0.5=0.5}$

With the two values above equal, we apply the following law:

$\widehat{D}_{(y)}=min\ _{i\neq g,h}\ [C_i\,(x)]$ [1] , $\widehat{D}_{(x)}=min\ _{i\neq k,j}\ [C_i\,(x)]$

With j = 3 and the value of Dˆ_ ((NS)) comes from C1 (a3) = C3 (a3) and h = 1, h = 3 we find that:

[1] Continuous Situation

$D^{\wedge}\_((a2)) = D^{\wedge}\_((NS)) = (0.5V1) \wedge (0.3V0.8) = 0.8$

$= D^{\wedge}\_((FL)) = (0.2V1)\ D^{\wedge}\_((a3))$

This results in:

$D\ (Final) = \max\ \{D^{\wedge}\_((a2))\ D^{\wedge}\_((a3))\} = 1$

Therefore, it is assumed that the project chosen by the project manager to prepare the plan to calculate the pessimistic measures in terms of cost and time should be chosen to avoid a quick realized loss with the ease of completing the project without impediments to the second choice with objectives.

Fourth: Conclusions

The researcher reached a set of conclusions through the practical side of the research:

1- The measurement of a particular alternative decision is a case of the necessity of the decision that was measured. We mean that there is a single relationship between a preference process (or an option) and the objective associated with that option.

2- Choosing the option for the project manager to prepare a plan that relies on building a project that is suitable for the investment environment and assumes that the project will face a risk of decay after a period and a gradual loss with the options presented within the scenarios.

3- Hazardous standards such as the cost of the project do not exceed the allocation limits, the ease of completing the project without obstruction, achieving the project on time, the impact of social stability is essential within the criteria of the foggy investment environment.

4- Choosing the project by preparing a plan with pessimistic measures in terms of cost and time to avoid a quick realized loss with the ease of completing the project without obstacles, one of the goals options.

Sources:

1- Samuel Adams , Foreign Direct investment, domestic investment, and economic growth in Sub-Saharan Africa Author links open overlay panel **,** Journal of Policy Modeling **,** Volume 31, Issue 6, November–December 2009, Pages 939-949 .

2- Mohamed Elheddad Foreign direct investment and domestic investment: Do oil sectors matter? Evidence from oil-exporting Gulf Cooperation Council economies , Journal of Economics and Business,Volume 103, May–June 2019, Pages 1-12

3- Cheng-KungChungaHsin MinChen, On fuzzy multiple objective linear programming problems Expert Systems with Applications, Volume 114, 30 December 2018, Pages 552-562

4- Ronald R. Yager ،A procedure for ordering fuzzy subsets of the unit interivel , volume24, issue2, p.143-161. 1981.

5- IbrahimA. BakyaMahmoud A.Abo-Sinnab , TOPSIS for bi-level MODM problems , Applied Mathematical Modelling , Volume 37, Issue 3, 1 February 2013, Pages 1004-1015 .