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A Fuzzy Assessment Model to Evaluate the Potential Positive Impact of Covid-19 on Construction Projects

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Abstract: The global corona virus pandemic (COVID-19) has shown a range of internal and external factors affecting construction industries resulting in unprecedented delays for many public projects, disruptions, and uncertainty about construction projects. This situation made the construction industry tend to use more advanced techniques to reduce the negative effective factors. This paper seeks to provide a qualitative worldwide perspective on the lessons learned from the COVID-19 pandemic and its positive effects on construction projects in the future. Following a thorough assessment process and conversations with experts in the building sector, eighteen factors were determined. The survey was distributed to determine the degree of importance of each factor. The data were collected from 132 respondents through a questionnaire distributed to engineers, contractors, and consultants. The data were evaluated using the Relative Importance Index (RII) based on the relative percentage of importance to calculate weights, then applied in the MATLAB program's fuzzy logic to calculate the probability of impact ratio. Based on the findings, a quantitative analysis of the factors affecting the projects was carried out using the fuzzy model. Thus, the fuzzy model was developed to estimate the percentage of time reduction in the schedule resulting from COVID-19's effects on construction projects. This study removes the ambiguity about the negative impacts on projects through which the construction industry strategic plan can be developed to take measures that lead to the application of modern technologies to reduce conflicts by avoiding or reducing the negative effects in construction projects.

Keywords: COVID-19; Pandemic; Fuzzy logic; Impact; Model; Construction project.

1. Introduction

Around the world, the COVID-19 pandemic has affected daily life of the public and the economy. Many countries worldwide have responded to the pandemic by enacting strict restrictions to stop the disease from spreading. Although uncertainty and vulnerability led to the closure of many businesses, construction projects have shown an essential role in societal economic, social, and political progress [1]. Pandemic COVID-19 has emerged in our world affecting the construction projects. Due to this pandemic, building work has been halted as per the Movement Control Order (MCO) by order of the government. Working from home might not be the answer to the issue, as physical work must be done on sites. The impact of the emerging corona virus on government income has produced the likelihood of cancellation or delay of many public projects and affecting the creation of new construction projects [2]. If any of the important construction projects are delayed, it will have a considerable effect on economic growth. Therefore, finding an appropriate solution to mitigate the negative effects of COVID-19 is essential to prevent negative economic growth that could ultimately result in an economic decline. few studies have discussed the pandemic impact on construction projects but did not give a solution to address ambiguities in cost and time in the construction projects industry, The impact of COVID-19 on projects performance and factors to implement projects within the schedule were investigated by collecting data through discussions with selected experts or surveys [3]. According to new data published by the Air Transport Action Group of which IATA is a member, statistics supplied by the International Air Transport Association (IATA, 2020), border restrictions strengthened by COVID-19 will result in the loss of 1.7 million jobs in the Middle East [4]. Every construction project has actively embraced remote or work from home working techniques rather than working in an office, bringing practices such as social distancing [5]. To allow economies to gradually recover, World leaders are partnering to develop and carry out policies that produce favorable results, provide a secure environment, and safeguard the welfare of their citizens [6]. This study is conductus to assess the impact of environmental issues on construction projects under the influence of Covid-19 and about lessons learned from the pandemic to minimize negative impacts on projects and increase positive impacts. This is accomplished by implementing a set of preventive and precautionary measures, employing digital technology as mentioned in data collection, and using fuzzy logic model in the MATLAB program to predict the possibility of a positive impact on the project schedule and developing appropriate solutions.

2. LITERATURE REVIEW:

2.1 Impact of covid -19 on construction projects

The COVID-19 epidemic began in 2020, and since then, it has affected people's lives all over the world [7],[8]. In

order to stop the spread of COVID-19, social distance has been the norm in most countries. There have been fewer job postings since the pandemic began, in part due to work disruptions caused by virus-control measures and a scarcity of personal protective equipment (PPE) due to increasing demand among healthcare personnel. Although some studies have attempted to examine the economic and industrial consequences of COVID-19, reviews fall short due to the current level of uncertainty for some of the factors affecting construction projects. However, some studies were evaluated the economic effects of the pandemic breakout on 30 countries' economies and found that GDP is predicted to suffer losses of between 3 and 6 percent in some and as much as 15 percent in others [9]. Many projects have been halted or delayed as a result of supply chain problems and staff shortages caused by quarantines [10]. According to a survey conducted by the Associated General Contractors of America (AGC), 28% of its members reported that COVID-19 caused the suspension or postponement of projects in the United States [11]. As a result, the majority of social activities have given way to online pursuits like working from home and taking online courses [12]. However, serval industrial tasks that are critical to society, such as the building industry, are not possible to execute online [13], [14]. COVID-19 has caused some construction projects to be postponed or stopped, increasing costs, and resulting in economic loss for the entire construction projects [15]. By way of a chain reaction, these loss and failure in the building projects could have a detrimental influence on the overall economy [16]. An agent-based technique was utilized in a recent study on the risk of COVID-19 outbreaks at construction sites to categorize the risk of contact-borne illness as low, medium, or high [13]. Although there has always been a labor shortage in the construction business, the corona virus pandemic has made things worse because a sizable portion of construction employees have reportedly tested positive for the corona virus [17]. Due to the fact that COVID-19 is primarily disseminated through human contact, interactions between construction workers have significantly contributed to the delays of projects [18]. Identified as one positive side of the COVID 19 the potential to improve on virtual alternatives [19]. Employees in the contracting industry were provided essential technology, such as laptop computers and cellphones, to enable them to work from home. A company's monthly paper printing has lowered from 35,000 pages to 1000 sheets as a result of remote working [20]. Despite the number of challenges, the outbreak has created new chances for risk management measures to combat the impacts of the pandemic in the construction industry, as well as demand in the transportation, residential, medical, and decreased financing rates [21].

2.2 Previous studies of the fuzzy set theory

Zadeh in 1965 developed the fuzzy logic theory that was used in dealing with many problems characterized by a fuzzy system[22]. Fuzzy logic allows for the handling of ideas that can't be stated as true or untrue but are only partially true. [23] developing a project business network analysis approach using fuzzy set theory, (FNET) has been developed to model the accuracy and ambiguity of data taken from experts due to the uncertainty associated with the project environment. Other studies claimed that fuzzy set theory can be utilized to explain the uncertainty associated with time elements in project networks [24]. Due to a sheer lack of information about activities, the values of project variables are often estimated by experts. Many of the values are determined using fuzzy logic and/or incomplete information. This type of data may be best represented by fuzzy set approaches rather than probabilistic ones. Others proposed fuzzy-set-based methods to address construction scheduling challenges in the face of uncertainty [25]. Scheduling models primarily evaluate the influence of time variation on project length or take resource restrictions into account. None of the non-deterministic construction scheduling models have been proposed to the authors' knowledge to solve time-cost trade-off problems[26]. The fuzzy logic theory was used to assess the effectiveness of the relationship-based construction industry in Australia, That Suggest using the PROMETHEE approach in fuzzy environments to identify the network's critical path while taking time, cost, and safety and quality criteria into consideration [27], and suggested a fuzzy evaluation model for Estimating the probability of delay in Turkish construction projects [28]. Tools based on fuzzy groups were given to model the behavior of managers in anticipating time and cost. The results indicated that managers can represent the range of potential time and cost values in addition to the degree of belief associated with them through fuzzy logic and contributed to the analysis of the time and cost optimization decision in a more flexible and realistic way[29]. In another study used two theories, the variable fuzzy group theory and the analytical theory, to solve the problem of ambiguity [30]. The study of research is the starting point for analyzing the effects of COVID-19 on construction projects in Egypt and investigating the impact and management in terms of their schedules using a range of factors arising from the opinions of construction experts and applying fuzzy logic in the MATLAB program. Moreover, it highlights recommendations made by industry professionals who proposed taking advantage of the epidemic to educate policy makers and stakeholders in the building industry about the value of using digital business continuity systems, and educating workers about the handling and control of the virus, and construction site health and safety to navigate safely through the outbreak.

3. RESEARCH METHODOLOGY:

A comprehensive literature review of the impacts of COVID-19 on construction projects was conducted using interviews with four project managers and members of project teams who work within large construction companies in Egypt. Thus, the most important factors are identified and categorized in terms of internal factors and external factors. Several reasons for each of the factors were identified and listed in a questionnaire filled out by experts on various construction projects. Those experts

include engineers, consultants, and contractors. In addition, specialists are selected based on their qualifications, with special attention paid to their educational credentials. Data were analyzed using the relative importance index (RII). Then identify the most important factors and consider them as inputs to Create a model using the fuzzy inference system (FIS).

3.1 Sampling

The sample size was chosen based on the determined minimum sample size, which is detailed further below. The sample size of the limitless population was calculated using Equation (1):

Infinite Sample Size $SS = [Z^2 p\,(1 - p)]/\,C^2$ (1)

where:

SS = Sample size.

Z = Z value (e.g., value = 1.97 for 96 percent confidence level).

P = percentage picking a choice, expressed as a decimal (0.50 used for sample size needed).

C = margin of error (8 percent).

$SS = [1.97^2 \times 0.5 \times (1-0.5)]/\,0.08^2 = 151.597$

The correction for the finite population was calculated using equation (2):

$SSnew = SS/\,[1 + \{(SS - 1)/Pop\}]$ (2)

where POP (the theoretical population) = 1000

$SSnew = 151/[1+\{(151-1)/1000\}] = 131.304$

Based on the above equation, it was completed 132 questionnaires were received.

3.2 Questionnaire Design

The questionnaire was designed with the study's objectives in mind and to answer the study Question. the questions were carefully phrased to be easily understood by respondents. To rate how a specific factor positively affects construction projects respondents were required to use their own experiences on building sites and to evaluate the positive effects of COVID-19 on the construction industry. It ranks the pros and their response to the site on a five-point scale of 1 to 5 with the rating of, (1) representing very low impact; (2) low impact; (3) medium impact; (4) high impact; (5) very high impact according to the degree depending on how much of an impact each component has on the construction process .

3.3 Collected data:

data collection via questionnaires will be the primary way for assessing this study. A questionnaire was carried out to examine the influence of COVID-19 on various construction projects. The data were collected through various experts working on construction projects. This data includes 132 respondents who answered the questions based on the various projects and then classified the positive factors into 18 positive factors in descending order of RII. The questionnaire was filled out by experienced construction professionals including engineers, contractors, and owners from the public and private sectors, with a proportion of 54.8%, 30.20%, and 15.62%, respectively as shown in Fig 1. Then divide the number of responses into a percentage according to their experience in managing construction projects obtained from experts, as shown in Figure 2. The researcher used the relative importance index to analyze the impact of COVID-19 on construction projects.

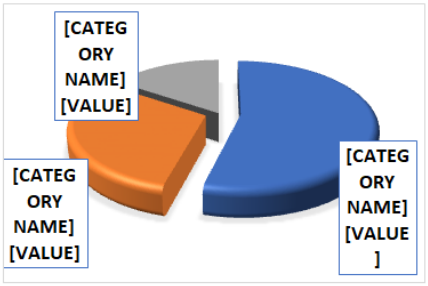

Fig1. Percentage of experts

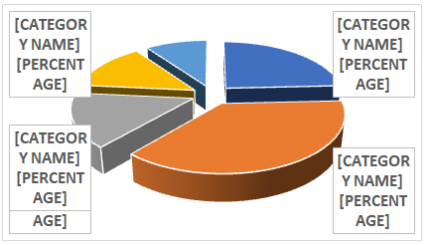

Fig 2. Respondent's experience in managing construction projects

4. DATA ANALYSIS:

The relative importance index is considered the basis for applying auditing standards, especially the analysis of questionnaires and the standards for preparing the report, as the use of materiality is closely related to these standards, especially in the field of the impact of errors and irregularities and appropriate decision-making because of the influence of factors. The influence of Covid-19 on construction projects was investigated through relative importance index (RII) to obtain weights as the input unit for MATLAB .RIIs are determined for each factors as in equation [31]:

$RII = \sum Wi * Xi / (A*N)$ (where i =1, 2, 3…, N)

The following concepts are represented by the symbols in this formula:

RII= Relative importance index.

Wi= The respondents' weighting of each factor (ranging from 1 to 5).

x = The frequency of each cause's response

A= Highest weight (i.e., 5 in this case).

N= Total number of participants.

The range of the RII value was 0 to 1 (0 as not inclusive); and the higher the RII, the more significant the cause of the effect. Table 1 shows the reasons which are rearranged in descending order according to their corresponding RII values. Then, the causes are ranked according to their RII so that the cause with the highest RII is assigned a rank of 1. And internal and external factors affecting projects because of COVID-19 are identified as shown in Table 1. Although all factors may have an impact on projects, it is very difficult to deal with all factors at once. So, to solve this problem, we will only consider five higher-order factors for further analysis. It helps that five factors can be dealt with and because they are the factors that most influence the schedule was chosen based on the RII value, and the RII values for the top five factors were used to forecast the likelihood that the project will be completed faster or in accordance with the schedule, as shown in Table 2 .

4.1 Fuzzy logic controller

The procedure involved in utilizing MATLAB's Fuzzy Inference System (FIS) to create a model is shown in figure 3. A fuzzy logic system (FLS) is described as numerical output data from an input data set. The four components of FLS are the fuzzifier, rules, inference engine, and defuzzification. First, a crisp set of input and convert it into a fuzzy set using linguistic, Variable fuzzy linguistic terms and membership functions. This process is called fuzzification, it is then inferred depending on a set of rules. Finally, the resulting fuzzy outputs are defuzzified using membership functions to produce crisp results.

4.2 Fuzzy Sets and Membership Functions:

Through the use of membership functions, non-fuzzy input values are translated into fuzzy linguistic concepts and vice versa during the fuzzification and defuzzification phases of FLS [32]. The membership function is used to find the degree of membership of the factors to the fuzzy set, and this set is defined by the full set (X) as a function corresponding to the characteristic function and symbolized by (μ(*X*)), which is called the membership function, and each element x in the complete set X has a certain value within the closed period [0,1] and this can be expressed by the following formula:

$$A = \{(X \text{ Ç } A(x) / x \in X)\}$$

set A; A (x) signifies the grade or degree of membership of any element x in A in the fuzzy collection A. Each factor x in A is combined with A (x) in the interval [0, 1] which is allocated to x in definition. Higher degrees of membership are indicated by larger A (x) values. There are several forms of membership functions, including those with a triangular, angular, and trapezoidal shape.

4.3 Fuzzy Rules of factors:

IF-Then Rules base is constructed to control the output variable and the tools that make fuzzy logic useful, to clarify our concept of condition and consequence rules. the following hypothesis: We assume that (A) represents a condition rule and one fuzzy result for any model, if (x) is (A (so) y) is (B) since (A,B) are the linguistic principles defined by the fuzzy sets On corresponding ranges (x, y) , if the part of the base (x) is (A), then it is called the element The conditional or hypothesis (If) but if the part of the base (y) is (B), it is called the result or The conclusion (Then) that the interpretation of the rules of the condition and the outcome (IF-Then Rules**)**

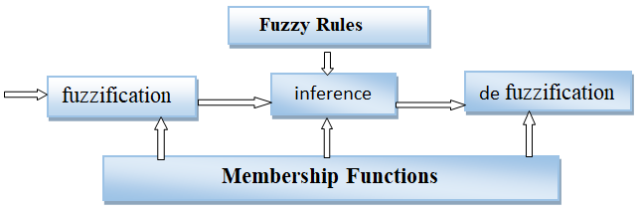

Fig 3: A Fuzzy Logic System

5. MODEL DEVELOPMENT:

5.1 Application Model Stage in Fuzzy Logic

In a fuzzy application, five factors are defined as input, each with a corresponding weight, and only one output is defined as (time schedule). Table 2 shows the model's input with weight and membership function. The following analysis processes are done on the fuzzy logic toolbox of MATLAB software to generate a model.

5.1.1 The System of Fuzzy Inference (FIS)

1. operations are completed on the MATLAB fuzzy logic toolbox to create the model.
2. The first step of the fuzzy inference system is Create the five-input; one-output system depicted in Table 3 in the FIS editor
3. The "time schedule" and the selected positive factors are entered as input and output members, respectively. The five input and one output fuzzy-based positive factors are discussed. then, the fuzzy controller makes use of the Mamdani inference system as shown in figure 4.

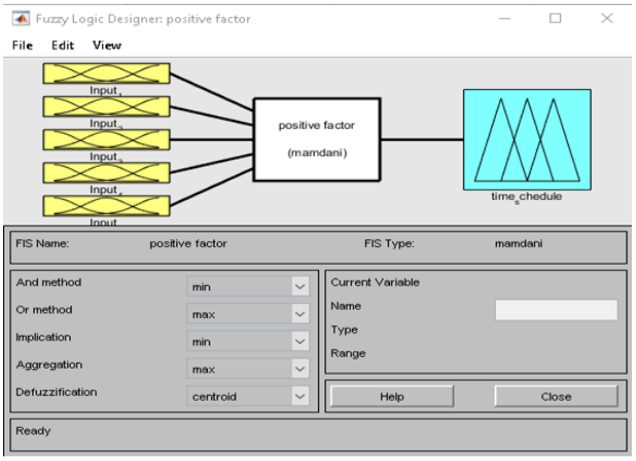

Fig 4: Fuzzy Inference of five Selective Input and One Output (FIS)

TABLE 1: RII and ranking of Positive factor by covid-19

Groups of factors	Positive causes of covid 19	Amount of responders who scored						
		1:Very low impact	2:Low impact	3:mediu m impact	4:High impact	5:Very high impact	**RII**	**Rank**
Internal factor	Take advantage of the ban period in the transportation and composition of materials, especially in bridge facilities	8	19	46	39	20	0.667	**4**
	Adding work shifts on the site to decrease the number of workers and reduce the risk of infection with Covid 19	6	28	40	34	24	0.664	**5**
	Adhere to the rules of social distancing and limited gatherings and develop a backup plan	8	19	56	39	10	0.636	**7**
	Adopt safety measures for the site, including routine temperature checks for employees, sterilization of equipment, and provision of personal protective equipment to employees.	38	46	23	17	8	0.465	**12**
	Making attempts to decrease the number of workers and dividing the site into areas to minimize employment in each area	46	56	14	10	6	0.409	**15**
	Create flexible work schedules by arranging times for various project groups and break periods, limiting the amount of employees working in each area.	52	40	28	10	2	0.403	**16**
	Develop a strategy to facilitate regular communication between management and employees as well as between employees.	8	18	60	40	6	0.627	**9**
	Not permitting people to gather in the main area and posting signs reminding everyone of the rules.	14	32	42	29	15	0.598	**11**
	Not having more than one employee in each office for engineers.	9	13	48	38	24	0.683	**2**
	Identifying reserve workers who can can work on the project if the "necessary site" worker is unable to come to the site due to a possible quarantine or because they were exposed to the virus away from work.	49	38	20	16	8	0.438	**13**
	Maintaining crew separation from subsequent shift workers during breaks requires different rest periods and venues for reasons of safety.	44	30	24	16	8	0.424	**14**
	Flexible redistribution of the work team to cover the various activities in the project	2	8	38	44	18	0.603	**10**
	Use digital technology and create open lines of communication between the project team and subcontractors.	16	21	30	47	28	0.721	**1**
	Determine which employees are on-site and whose job duties can be performed off-site.	10	26	44	32	20	0.639	**6**
	Some project team made working from home as much as possible to reduce the number of people on site	58	46	18	10	0	0.370	**18**
	Constant contact with suppliers of equipment and materials to ensure that delivery times are not affected	2	26	46	40	18	0.670	**3**
External factor	Reducing bank interest to encourage the contractor to facilitate the work of his project and finish it is better than waiting in the period of Covid 19	59	42	19	8	4	0.382	**17**
	Dealing with many contractual issues whether it is related to force majeure, time extension or cost through communication and cooperation	8	24	50	38	12	0.633	**8**

TABLE 2.: Five Top most Positive Factors Affecting of Construction by covid-19

Sl. No	Positive Factors Affecting of Construction	RANK	RII
1	Use digital technology and create open lines of communication between the project team and subcontractors.	1	0.721
2	Not having more than one employee in each office for engineers.	2	0.683
3	Constant contact with suppliers of equipment and materials to ensure that delivery times are not affected	3	0.670
4	Take advantage of the ban period in the transportation and composition of materials, especially in bridge facilities	4	0.667
5	Adding work shifts on the site to decrease the number of workers and reduce the risk of infection with Covid -19	5	0.664

TABLE 3: Modeling linguistic variables and their membership functions

Variables	**Range**	**MFs**	**No of MFs**	**Names of the variables**
Use digital technology and create open lines of communication between the project team and subcontractors. (Input 1)	[0 -1]	trimf	5	(1)very low (2)low (3)medium (4)high (5)very high
Not having more than one employee in each office for engineers. (Input 2)	[0 -1]	trimf	5	(1)very low (2)low (3)medium (4)high (5)very high
Constant contact with suppliers of equipment and materials to ensure that delivery times are not affected (Input 3)	[0 -1]	trimf	5	(1)very low (2)low (3)medium (4)high (5)very high
Take advantage of the ban period in the transportation and composition of materials, especially in bridge facilities (Input 4)	[0 -1]	trimf	5	(1)very low (2)low (3)medium (4)high (5)very high
Adding work shifts on the site to decrease the number of workers and reduce the risk of infection with Covid 19 (Input 5)	[0 -1]	trimf	5	(1)very low (2)low (3)medium (4)high (5)very high

5.1.2 Membership Functions Simulation (MF)

In the membership function editor, membership functions are specified for each input and output variable and its membership degree between 0 and 1. All membership functions in the fuzzy logic controller are regarded as triangle membership functions with five segments. Low (L), Medium (M), High (H), Very High (VH), and Very Low are the fuzzy subsets as shown in figure 5. Triangular membership functions have been selected in this research because fuzzy set have three values according to experts' opinions. Triangular membership functions are used in this study as they are widely used. According to previous literature, Triangular membership functions are the most used function in the investigation of changes in project time.

5.1.3 Establishment of If-Then Rules (Rule Editor)

1. Rules that connect input variables to output variables are defined to do fuzzy inference. A total of 230 rules are created for the current model using all five input

variable components and one output variable. Five of them are given below.

- Rule1: if the probability of Use digital technology and create open lines of communication between the project team and subcontractors is very low time schedule is very low.
- Rule 2: if the probability of Use digital technology and create open lines of communication between the project team and subcontractors is low time schedule is low
- Rule 3: if the probability of Use digital technology and create open lines of communication between the project team and subcontractors is medium time schedule is medium
- Rule 4: if the probability of Use digital technology and create open lines of communication between the project team and subcontractors is high time schedule is high
- Rule 5: if the probability Use digital technology and create open lines of communication between the project team and subcontractors is very high time schedule is very high
- Rule 6: if the probability of Not having more than one employee in each office for engineers is very low time schedule is very low.
- Rule 7: if the probability of Use digital technology and create open lines of communication between the project team and subcontractors, and not having more than one employee in each office for engineers are very low time schedule is very low as shown in figure 6.

2. In order to build the assessment model to estimate the likelihood, fuzzy rules are given weights based on the relative significance indices (RIIs) of positive factors. These rules were made through the experience of project managers.
3. Since the weights of the fuzzy rules will vary as a result of the RII's factors having various values, each if-then rule will have a varied weight, demonstrating the relative relevance of fuzzy rules.

5.1.4 Rule Viewer

By defining the system by IF-Then Rules into the fuzzy inference system (FIS) by running the Rule Editor from the View menu, IF-Then Rules are entered in the rules editor by formulating the most important effects at the time of project completion. Through the rule viewer, the influence of factors in projects can be controlled by moving the indicator within the first and second column to the right to indicate the significant effect and to the left to indicate the weak effect. We assume here that the impact of factors on the project is strong, and this means that the duration of the project's completion is an optimistic estimate of achievement in the least time. in figure 7 shows that all five input factors with weights value and fuzzy output value into a crisp value=0.66

5.1.5 Surface Viewer and Defuzzification

The surface of the output can be seen for the entire system by running the surface viewer Form figure 8 of a display list which is the last five of the fuzzy logic tools in (GUI), after running the surface viewer shows a three-dimensional surface which expresses the input and outputs well because it generates a three-dimensional object that can program (MATLAB) handled efficiently, through Rule Viewer.

(VI) After applying all the steps mentioned above to address the problem of fuzzy logic tools in MATLAB program for all inputs obtained the final data representing the values (Crisp Value) after Defuzzification was obtained by the Centroid of Area (COA) method. And through the control models, it can be converted from the form of fuzzy numbers to accurate output numbers equal to 59.4% as an output ratio to influence the project schedule. To ensure delivery time in the normal state of the project and preventing delays in the time schedule.

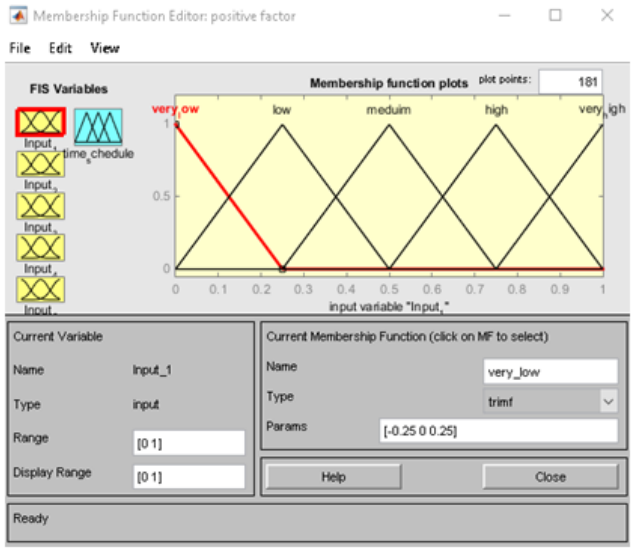

Fig 5: Triangular Membership Function Editor of Input and Output (MF)

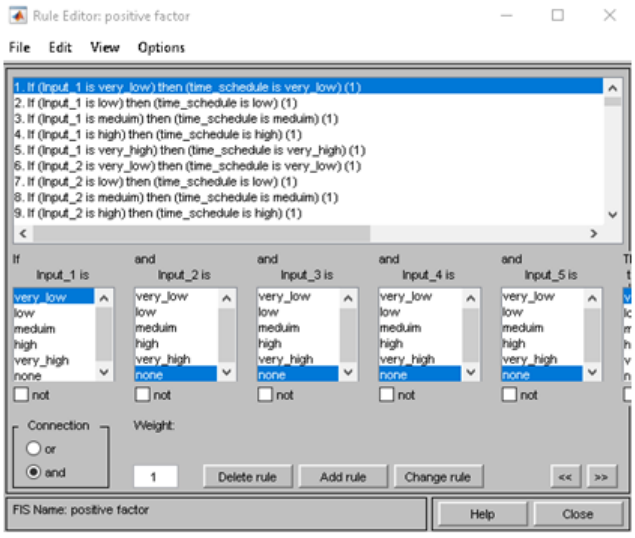

Fig 6: Rule Editor with corresponding Weight

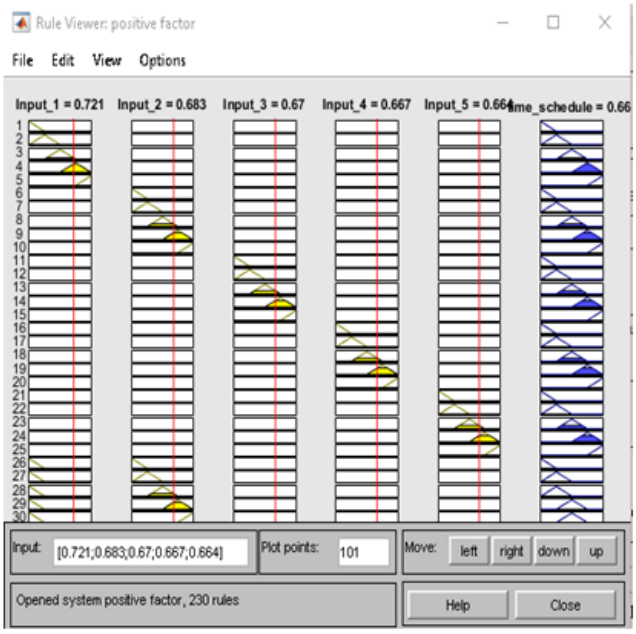

Fig 7: Rule and Result Viewer

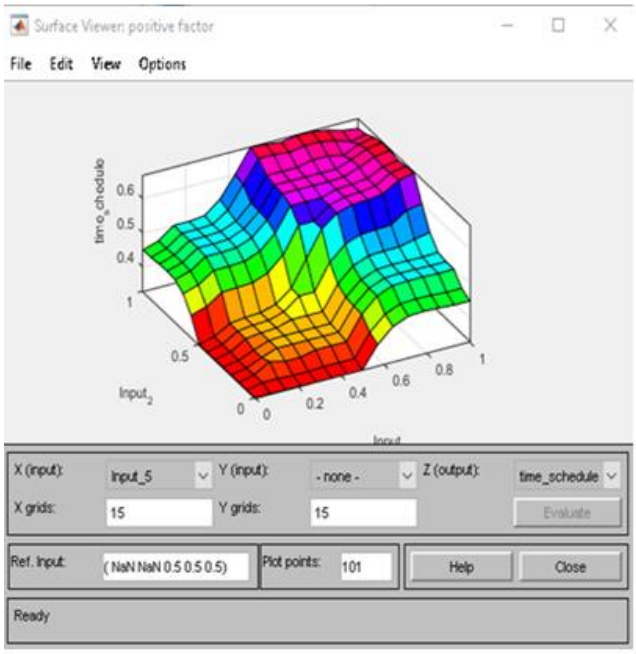

Fig 8: surface viewer variation of input 1, and input 2 with respect of output percentage of impacted time schedule 59.4%.

6. CONCLUSIONS AND RECOMMENATIONS:

The research's key contribution is the Framework, which suggests a tool to use fuzzy logic and the relative importance index approach to enhance schedules and ensure no delays for projects during the COVID-19 period. Model has been developed to address the problems of fuzzy logic in construction projects during the COVID-19 period. The applicability of fuzzy theory has been demonstrated to identify positive factors to prevent deviation in the construction project and the absence of schedule overruns. A questionnaire was prepared and distributed to 132 by experienced construction professionals including engineers, contractors, and owners. It includes all the positive factors that can be used to improve the project schedule, and its results were analyzed with a factor of relative importance index were assigned as the fuzzy rule weights. The five most important positive factors in the project were selected. A fuzzy logical model and these membership function values are presented by expert judgment in the field. Five Functions of membership are defined for all language variables in the program. All functions are represented by a triangular-shaped combination of fuzzy numbers These verbal variables are translated into mathematical scales by fuzzy set theory. The ambiguous Mamdani-Style rules (if-then rules) were established using basic forms after a thorough literature study procedure. The "Max" (maximum) collecting method and the "center of gravity" defuzzification method were both chosen (COG). The MATLAB program's fuzzy logic toolbox was used to implement the computations for aggregation and defuzzification as well as the assessment model and The fuzzy model was developed to estimate the percentage of project implementation according to the schedule and to avoid any delays during implementation.The reason why fuzzy group theory was chosen as a reliable method of analysis is that it may deal with the subjectivity that underlies the risk assessment of international construction industry. Furthermore, it can readily manage various inputs and define problem analysis in a more realistic manner than traditional methods. Various charts can be generated to show the variance in a different set of positive factors with respect to the project schedule. Further research is needed to the research initiated by this study:

1. Establish a method to the impact of cost on construction projects under the influence of Covid-19 .
2. Study the impact of risks and safety factors that negative or positive impact on construction projects.

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