International Journal of Structural Civil Engineering and Management
Volume 1, Issue 01, 2025

INNOVATIVE FINANCIAL CRISIS MANAGEMENT IN CONSTRUCTION PROJECTS

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Research Article
Received: 28-04-2025 ***Revised:05-05-2025*** ***Accepted:29-05-2025*** ***Published:10-07-2025***

ABSTRACT

This study offers a novel method for managing financial crises in building projects, emphasizing the best use of resources during recessions, such as the COVID-19 pandemic. The research gives decision-makers a structured tool to strategically reduce the financial consequences on project profitability by using a mathematical model based on MATLAB. In order to maximize profit margins and facilitate effective unit building across projects, the model incorporates key economic characteristics, including project and annual budgets, construction costs, projected returns, and interest rates. The search finds important projects and deadlines via thorough sensitivity analysis, which makes it possible to create worst-case scenarios that evaluate and reduce financial risks in unstable times. The model is validated by a case study of large-scale building projects in Jordan, which shows great potential for cost savings and improvements in strategic resilience. The results provide a framework for proactive financial planning in construction management and highlight the value of adaptive financial measures in enhancing crisis resilience.

1. OVERVIEW

A lot of scientific study aims to assess the impact of a financial crisis, but regrettably, only a small number of academics have developed a tool to forecast a crisis or even provide decision-makers the best resources to reduce the crisis's negative effects. Ajayakuma and Jose (2019). In order to improve the plans to develop management capabilities, skills, and knowledge using actual feedback for more improved plans that might be a privilege to avoid any unforeseen conditions in the future, this study attempts to provide a sufficient, optimal solution to overcome the financial crisis's affect on the construction industry. The MATLAB software would be used to create a mathematical model that would reflect the best financial answer. This model would be based on a variety of economic criteria, including budgets, project budgets, expenses, projected and predicted profits, the number of units created, and interest rates. However, using previously provided data, polynomial fitting was used to predict certain profit numbers. examining a case study of massive building projects during the COVID-19 pandemic and providing the best possible financial solution. Two distinct views were subjected to sensitivity analysis: the project perspective and the annual perspective. To calculate the impact of certain factors on one another, such as the year and project that are most and least impacted, as well as the worst-case scenario—which is regarded as a risk scenario—in order to assess the impact on profit margins and the overall number of units built. A crisis is described as a unique and

unexpected issue encountered by individuals, groups, organizations,andgovernments Anderson et al. (2007), Roux & Vidaillet, B. (2003). It cannot be resolved using standard, routine processes; by its very nature, a crisis might make the decision-maker more anxious. Furthermore, a crisis is described as a sequence of abrupt, uncontrollable activities in the life of an organization. There are no well-defined emergency preparations in place to deal with the crisis, which might jeopardize future growth and development goals and impact current stability grounds. Furthermore, a crisis is a time of abrupt change brought on by unforeseen events, danger, uncertainty, threat, conflict, and instability; but, it is also a time of opportunity. A crisis may have a lower likelihood occurrence but a larger uncontrolled consequence, according to Loosemore (2000). The definition of crisis management is a procedure and management model used in an unforeseen circumstance. Samra and colleagues (2019). It includes precise, well-defined steps including identifying crisis indicators to reduce adverse impacts on sectors, sustaining minimum losses, and implementing and managing all preoperational measures for recovery. Laufer, D., and W. T. Coombs (2018). Additionally, crisis management is a dynamic process that includes both proactive and reactive measures. Froese and Liu (2020). which seek to identify appropriate strategies, manage, resolve, and record during the crisis period. Identifying and assessing both direct and indirect crisis indicators is part of crisis management. Pearson & Mitroff (2019), followed by taking all necessary safety measures.

II. REVIEW OF LITERATURE

A building project is a valuable timetable with constrained resources and expenses. Walker, A. (2015). According to Vrchota and Rehor (2016), a project is a series of connected actions having a beginning and an end that are intended to achieve a certain goal. It is possible to see uncertainty as a prevalent and unpredictable occurrence. The project's objective is to build a suitable building facility or service with the least amount of money and time, taking into account its intended objectives, quality, completion date, and other restrictions or limits. Construction projects may be impacted by the enormous risk associated with a financial crisis. specifically during the implementation phase (Shibani et al., 2022). Financial problems have been becoming worse recently, particularly as a result of the COVID-19 epidemic. The two most important elements that may adequately describe the success of a building project are cost and completion time, both of which can be significantly impacted by the crisis. Other factors that are thought to be less impacted than others include scope, quality, and resources. The impact of crises on construction projects throughout the planning, implementation, and maintenance stages has been the subject of several scientific studies recently. Hällgren,M.,&Wilson, T.L.(2008),especiallyfinancialcrisismanagement. A system that identifies any element or piece of information that triggers a crisis is required to notify decision-makers so they may make measures to mitigate or even prevent the consequences of the crisis. A crisis is a unique occurrence that profoundly impacts the fundamental frameworks of any business, creating a great deal of anxiety. Booth, S.A. (2015). The most effective global acceleration forces building firms to fortify their plans for unforeseen circumstances (Hällgren & Wilson, 2008). In order to enhance and develop its present tactics to fit such scenarios, the long-term building project nature, which will maximize the terms of crisis, uncertainty, and unanticipated conditions, focuses on optimum crisis management. S. Sahin and associates (2015). Four stages of crisis management are identified in this study: An early warning system to identify warning signs and records to predict a catastrophe are part of the preventative phase. The preparation phase include adapting existing tactics and getting the plant ready for the impending catastrophe. In order to regulate the entire situation and lessen its harmful effects both immediately

and over time, the crisis phase entails functioning under crisis circumstances. Rebuilding management techniques and plans to prevent unplanned or unexpected situations is part of the post-crisis phase.

III. MODEL FOR MATH As previously stated, the primary goal of building projects during the implementation phase is to maximize overall profit, which may be described as
max{= (1+)

x1+

12(1+)

2x2+⋯+

(1+)

x ◆

where the entire profit is represented by = 1, 2… (1). $x$is The predicted net profit for each built unit for each project in the year is the interest rate, and the number of constructed units in the year $th$is the number of units. The year number is represented by . The project budget, the annual budget, and the number of created units are the three constraint categories for this profit function. As previously said, x indicate net profit for each produced unit for each project in a given year, thus it's critical to compare current profit figures. As will be covered later in a case study, an example of the information that is now accessible for a large-scale building project is provided. The megaproject is made up of many separate construction projects that will be finished in various years, each of which will build multiple units. Three tables are required in order to provide the necessary data for modeling the issue of building projects. The first table includes the detailed profit for each built unit/year :{x}, and the second table includes the cost for each constructed unit/year for each project :{x}. In order to determine a third table : {x}, these tables were arranged. The coefficients of the linear objective function that has to be minimized are shown in third table C. Max {∑∑xx} (2) x=1=1 where x refers to the quantity of units built for the jth project using all or a portion of the ith annual budget while x x = x ,,=1,2… Table 1 lists these profit/cost ratios for building a unit. The programming methods that will be utilized to find the best solution are defined by matrices that are equal to these three tables. The number of construction projects (rows) and implementation years (columns) determine the matrices' size; square and non-square matrices may be taken into consideration. The situation of a square matrix of dimension (×) is shown in Table 1. As can be seen, and stand for the annual budget and project budget for the ith year, respectively. A balanced linear programming model, similar to a balanced transportation model, is produced by assuming that the total budget allotted for the years under consideration is equal to the budget allotted for all projects to be completed.

Table1Coefficientof profit/cost

Project	1	2	3	….		yearly budget
Year1	11	12	13	….	1	1
Year2	21	22	23	….	2	2
Year3	31	32	33	….	3	3
….	….	….	….	….	….	….
Yearn	1	2	3	….		
project	1	2	3	5		

budget						

Either a balanced or imbalanced situation might exist. The overall budget allotted for the years under consideration is the same as the budget allotted for all completed projects in a balanced problem. A balanced issue may be expressed mathematically as follows, where represents the budget for the ith project and represents the budget for the ith year: The formula is ∑=∑ =1 The source and total year budgets of a transportation problem's requests are represented by the annual particularized budget. The extra restrictions on the number of construction units that must be imposed for the specific project in every year, however, distinguish these two issues from one another. Thus, the mixed constraints of the model will be as follows: ∑≤, =1,2… (3) =1 The equation ∑=, =1,2...(4) =1

1 ∑=, =1,2… (5) =1<��� where x is the total number of units built for the jth project over the course of all years. The technique first proposes to solve without the third set of limitations. If the corporation requires a total of five built units in all projects, then the best solution (highest overall profit) is approved. Otherwise, the best solution that fulfills the needed number of building units is obtained by including the pre-determined total construction units restrictions (5). It is crucial to remember that adding the third set of restrictions might make the solution impractical; thus, another set of $x$values should be taken into account.

II. CRISIS AND SENSITIVITY ANALYSIS

Generally speaking Sensitivity analysis is a technique that assesses the effectiveness of an independent variable with a specific dependent variable under predefined assumptions for each change. Research indicates that several sources of uncertainty may add to the total uncertainty of a mathematical model. The sensitivity analysis may include the crisis analysis. Sensitivity analysis is a tool that has many uses in fields like biology, engineering, commerce, economics, and industry. Sensitivity analysis for the situation at hand consists of: Examining crucial years in order to contrast them with other years—that is, years when a crisis may transpire as the worst- case scenario.

2. Examining significant projects to compare them to other projects and conducting worst-case scenarios based on the facts obtained. 3. Determining the maximum and minimum profit losses by examining the impact of a decline in total profit from (1–20)% each project.

4. Calculating the maximum and minimum profit losses by examining the impact of declining total profit for each year. 5. Examining how raising the price of building supplies by 1–20% affects each project in order to calculate the maximum and minimum profit losses. 6. Analyzing the impact of annual increases in building material costs to ascertain the maximum and minimum profit losses.

7. Analyzing how rising costs and falling profits affect the most risky implementation year and calculating the impact on the overall number of units built for all projects. 8. Analyzing the impact of rising costs and falling profits for the riskiest implementation year and figuring out how it affects the overall number of units built for all projects.

III. CASESTUDY

One of the Jordanian engineering construction businesses that carried out massive building projects in several Jordanian regions between 2017 and 2027 (within ten years) was the subject of a case study in this section. Every project has a certain number of units that must be completed within a ten-year timetable. Table 2 displays the cost and total budget for each project. For instance, the second project has 35 completed units since their plan will be executed in 7 years, which translates to 5 units every year over 7 years. The project's constructed cost is 1,114,988 JD. Each

project's budget is shown in Table 2. For instance, the first project's budget of 7,078,896JD will be utilized to build 40 units throughout the first five years. Take note that the Multiplying the total number of built units by the cost per constructed unit yields the overall project budget. Without favoring higher profit units or disregarding low profit units without taking the impact of construction costs into account, using the ratio that represents profit value divided by cost gives us more accurate findings. In this case, the best tools are stronger proof to back up any suggested strategy. Add to what has already been mentioned by utilizing a ratio rather than actual sales statistics that would show a genuine impact (actual measuring tools) for either raising or lowering profit or cost.

Table2Detailedfinancialcostforeachproject

No	Project	No.of units	Cost/constructed unit	Total Project Budget (JD)
1	Project1	40	176,972	7,078,896
2	Project2	35	1,114,988	39,024,580
3	Project3	50	1,712,466	85,623,340
4	Project4	30	26,465,666	793,969,981
5	Project5	25	3,953,246	98,831,163
6	Project6	30	128,269	3,848,082
7	Project7	40	273,771	10,950,862
8	Project8	40	178,677	7,147,103
9	Project9	40	237,925	9,517,009
10	Project 10	50	179,395	8,969,783

Since this construction project money is a loan from an international financial institution, it is limited to this amount. The appropriate allocation of this amount to each project in order to optimize the overall profit in both normal and emergency situations will be covered later. In order to achieve a balanced problem, each project budget has to be established at the same time as the annual budget.

2. OPTIMIZATION OF PROFIT

As previously stated, a variety of methods, including genetic algorithms, neural networks, and basic linear programming in our case study, may be used to determine the best assignment. Three tables were required in order to solve this issue; table 3 shows the profit value for each unit or project independently. Given that this amount varies from year to year, as was determined in the previous section, table 4 includes the building cost for each unit or project, which is taken into account as a constant in our case study. The headditional variables reflect the coefficients (ratio) of the linear objective function. Every table is regarded as a matrix (10 × 10), summarizing our case study of several projects with ten years of implementation. As a result, every table and matrix will have the same size. Under typical circumstances, the first-year budget of 30,696,047 JD will be used to Table3ProfitValue implement one unit for project 4, while Table JD, or 18.59% of the second-year budget, which would cover the construction costs for 40 units of the first project. Project 2 will receive 30,986,047 JD, or 81.4% of the second-year budget, which would cover the construction costs for 28 units of project number 2. The remaining unit will be finished in the fifth year, for a total construction cost of 8,038,534 JD. The fourth year budget should be highlighted because it accounts for 16.13 percent of ten-year budgets. As a result, many projects are thought to be completed during this time, including one unit for the fourth project, 25 units for the fifth project, 30 units for the sixth project, 40 units for the seventh project, 40 units for the eighth project, 40 units for the ninth project, and finally 50 units for the tenth project, as indicated in the following solution (10 × 10) matrix.Since the fourth year will see the implementation of over 59% of all units for all projects, it makes sense to view it as a critical year, with overall profit covering all costs for the remaining units of fall projects. Sensitivity analysis would later emphasize the significance of this. Since the construction cost for one unit is the highest value (26,465,666 JD), the fourth project is advised to be completed in eight years (beginning in years 1, 3, 4, 5, 6, 7, and ending in year 9). This is the longest implantation duration when compared to the construction duration for other projects.

Year	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Y1	31,855	32,505	36,116	40,129	44,588	49,542	56,144	863,380	71,505	80,521
Y2	72,820	74,306	78,217	82,333	86,667	91,228	97,097	10,332	110,196	117,661
Y3	35,961	37,073	43,615	51,312	60,367	71,020	84,807	100,284	117,824	137,426
Y4	42,915	43,791	52,760	63,567	76,587	92,273	112,623	135,688	161,976	191,487
Y5	59,298	61,769	64,343	67,024	69,817	72,726	75,756	78,913	82,200	85,625
Y6	23,088	25,653	28,504	31,671	35,190	39,100	43,446	48,274	53,637	59,596
Y7	38,328	40,774	43,377	46,145	49,091	52,224	55,557	59,103	62,875	66,886
Y8	34,842	35,919	37,030	38,175	39,356	40,573	41,829	43,122	44,456	45,831
Y9	47,585	51,722	56,220	61,109	66,423	72,199	78,477	85,302	92,719	100,782
Y10	32,291	35,879	39,865	44,295	49,216	54,685	60,762	67,514	75,015	83,349
Total profit .	418,985	439,396	480,052	525,765	577,306	635,576	706,500	691,913	872,404	969,164

Table4Constructioncost

Year	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Y1	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y2	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y3	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y4	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y5	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y6	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y7	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y8	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y9	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395
Y10	176,972	1,114,988	1,712,466	26,465,666	3,953,246	128,269	273,771	178,677	237,925	179,395

Table5theoptimaldistributionofconstructionunitsandregulardistrubuationfor constructed units

	P1		P2		P3		P4		P5		P6		P7		P8		P9		P10	
Year	R	O	R	O	R	O	R	O	R	O	R	O	R	O	R	O	R	O	R	O
Y1	8				5			1	5								4			
Y2	8	40	5	28	5				5								4		5	
Y3	8		5		5			1	5				5				4		5	
Y4	8		5		5		5	1	5	25	30	40	5	40		40	4		5	
Y5	8		5	7	5	50	5	3	5		6		5				4		5	
Y6			5		5		5	6			6		5		8		4		5	
Y7			5		5		5	6			6		5		8		4			
Y8			5		5		5	6			6		5		8		4			
Y9					5		5	6			6		5		8		4			
Y10					5								5		8		4			

The best plan yields a profit of 4.0730 × 107JD, but the regular plan of the corporation differs by almost 20 × 106JD. For instance, the best way to allocate the precise amount of the annual budget to each project budget is to allocate 172,531,748 JD to the fifth year planned budget, which is advised for the implementation of projects 2 (8,038,534 JD) to build seven units, 3 (85,623,340 JD) to build fifty units at a time, and 4 (78,869,875 JD) to complete three units. These projects represent 16.20 percent of the total budget and approximately 15.79 percent of the total number of units built. Table 6 displays the sixth-year budget, which is 152,779,157 JD, or 14.35% of the overall budget. As a result, it was suggested that six units, or 1.58% of the total number of building units, be built as part of project number 4.

Table6 MATLB assignment results

Yearly budget	Project Budget	Cost / Project	# units	Profit.
1st	P# 4	30,696,047	1	46,544
2ed	P#1	7,078,897	40	2,912,812
2ed	P# 2	30,986,047	28	4,717,760
3rd	P# 4	39,433,801	2	60,076
4th	P# 4	32,498,128	1	94,715
4th	P# 5	98,831,163	25	763,959
4th	P# 6	3,848,083	30	2,867,629
4th	P# 7	10,950,862	40	16,222,109
4th	P# 8	7,147,103	40	29,946,079
4th	P# 9	9,517,009	40	26,845,955
4th	P# 10	8,969,783	50	42,091,655
5th	P# 2	8,038,533	7	1,800,380
5th	P# 3	85,623,340	50	1,221,070
5th	P# 4	78,869,875	3	82,301
6th	P# 4	152,779,157	6	118,271
7th	P#4	150,985,200	6	6,709
8th	P#4	150,985,200	6	15,796
9th	P# 4	145,410,260	6	16,502
10th	P# 4	12,312,313	1	15,928

SENSITIVITY EXAMINATION

Given that risk management is seen as a fundamental component of effective crisis management, sensitivity analysis would be examined in this part as a method to gauge risk level. Later, sensitivity analysis would be calculated from the project and year perspectives. The key year and important projects would be evaluated with the aid of this analysis, and a companion piece of

III. PROJECTSBASIS FOR SENSITIVITYANALYSIS

According to scientific research and some local expertise, two primary concerns will be taken into consideration as a measuring tool for sensitivity analysis based on the available construction information: profit and construction costs. Increasing the cost of materials would impact over 40% of the total construction profit, which will have a direct impact on selling costs and expected net profit. In addition to what was already mentioned, some typical treatment marketing strategies include adding a predetermined percentage of net profit (as a buffer) to account for any unforeseen future events that might delay unit sales or lower demand for this project's purchases. This percentage would be used as a remedy in real estate stagnation.

Table7 Comparingthe4thand 10thprojects results

(%)	Project4		Project 10	
	Profitdecreasing X 10^5	Profit decreasingdue to increasing cost X 10^5	Profit decreasing X 10^5	Profit decreasingdue to increasing cost X 10^5
1	0.1421	0.1406	0.9574	0.9479

2	0.2842	0.2786	1.9148	1.8773

3	0.4263	0.4138	2.8723	2.7886
4	0.5684	5.4655	3.8297	3.6824
5	0.7105	0.6766	4.7871	4.5592
6	0.8526	0.8043	5.7446	5.4194
7	0.9947	0.9296	6.702	6.2635
8	1.1368	1.0526	7.6594	7.0921
9	1.2789	1.1733	8.6169	7.9054
10	1.421	1.2918	9.5743	8.7039
11	1.5631	1.4008	10.5317	9.488
12	1.7052	1.5225	11.4892	10.2582
13	1.8473	1.6348	12.4466	11.0147
14	1.9894	1.7451	13.404	11.7579
15	2.1315	1.8535	14.3615	12.4882
16	2.2736	1.96	15.3189	13.206
17	2.4157	2.0647	16.2763	13.9114
18	2.5578	2.1676	17.2338	14.6049
19	2.6999	2.2688	18.1912	15.2867
20	2.842	2.3683	19.1486	15.9572

The link between each project's declining profit percentage (0–20%) and its impact on overall project profit is explained in Table 8. Figure 1 illustrates a project that was severely impacted. For instance, the 10th project's maximum profit loss was 1.9148 X106, while the 4th project's minimum profit loss was 2.8420 X105. Although it is evident that Project Ten is a critical project, where the greatest profit loss occurs, this project will not be completed until the fourth year due to optimal assignment distribution, meaning that the first three years are regarded as a safe period with no high-risk level completion percentage of 18.42% of all construction units. The fourth project, on the other hand, would be regarded as a safe project; nevertheless, table 8 indicates that it is executed within 8 years, which clearly depicts those years as low-risk years, which will be discussed later.

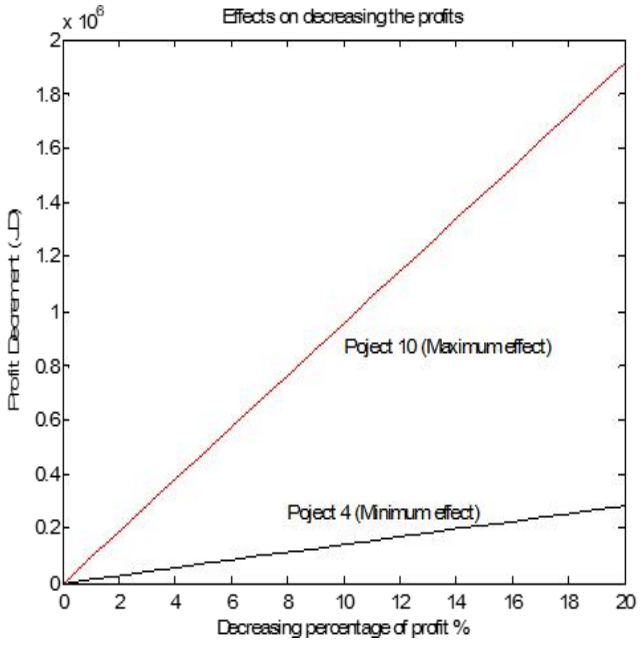


Figure1.Effectofdecreasingprojectprofitonnetprofit

The impact of rising construction costs, whether from labor or material expenses, on net profit is the second metric for assessing risk levels, and Table 9 shows the percentage of each project's net profit that increases when construction costs rise. Figure 2 illustrates a project that is severely impacted; for instance, the 10th project's maximum profit loss is 1.5957 X 105 JD, while the 4th project's minimum profit loss is 2.3683 X 105. The amazing identification of Max and Min-affected projects based on a particular viewpoint is one significant result acquired utilizing earlier analytical data, therefore further study was carried out on both the fourth and tenth projects, as shown in table 7. When the 10th project's assessment is taken into account, the losses exceed 2.7%, whilst the 4th project's losses amount to 0.42% of net profit.

Table8ProfitdecreasingX10^5

%	P 1	P 2	P3	P4	P 5	P 6	P7	P 8	P9	P 10
1	0.291	0.2510	0.3217	0.1421	0.1914	0.2768	0.4504	0.5427	0.6479	0.9574
2	0.5826	0.5021	0.6434	0.2842	0.3829	0.5536	0.9009	1.0855	1.2958	1.9148
3	0.8738	0.7531	0.9652	0.4263	0.5744	0.8304	1.3514	1.6282	1.9437	2.8723
4	1.6512	1.0041	1.2868	0.5684	0.7658	1.1072	1.8019	2.1710	2.5916	3.8297
5	1.4564	1.2551	1.6085	0.7105	0.9573	1.3841	2.2524	2.7137	3.2395	4.7871
6	1.7476	1.5062	1.9303	0.8526	1.1488	1.6609	2.7029	3.2565	3.8874	5.7446
7	2.0389	1.7572	2.2520	0.9947	1.3402	1.9377	3.1534	3.7992	4.5353	6.7020
8	2.3302	2.0080	2.5737	1.1368	1.5317	2.2145	3.6039	4.3420	5.1832	7.6594
9	2.6215	2.2593	2.8954	1.2789	1.7232	2.4913	4.0544	4.8847	5.8311	8.6169
10	2.9128	2.5103	3.2171	1.4210	1.9146	2.7682	4.5049	5.4275	6.4790	9.5743
11	3.2040	2.7613	3.5388	1.5631	2.1061	3.0450	4.9554	5.9702	7.1269	10.5317
12	3.4953	3.0124	3.8606	1.7052	2.2976	3.3218	5.4059	6.5130	7.7748	11.4892
13	3.7866	3.2634	4.1823	1.8473	2.4890	3.5986	5.8563	7.0557	8.4227	12.4466
14	4.0779	3.5144	4.5040	1.9894	2.6805	3.8754	6.3068	7.5985	9.0706	13.4040
15	4.3692	3.7655	4.8257	2.1315	2.8720	4.1523	6.7573	8.1412	9.7185	14.3615
16	4.6604	4.0165	5.1474	2.2736	3.0634	4.4291	7.2078	8.6840	10.3664	15.3189
17	4.9517	4.2675	5.4691	2.4157	3.2549	4.7059	7.6583	9.2267	11.0143	16.2763
18	5.2430	4.5186	5.7909	2.5578	3.4464	4.9827	8.1088	9.7695	11.6622	17.2338
19	5.5343	4.7696	6.1126	2.6999	3.6378	5.2595	8.5593	1.0312	12.3101	18.1912
20	5.8256	5.0206	6.4343	2.8420	3.8293	5.5364	9.0098	10.8550	12.9580	19.1486

Table9 Effecton profitduetocost increasingX 10^5

(%)	P1	P 2	P 3	P4	P 5	P 6	P7	P8	P9	P10
1	0.2883	0.2485	0.3185	0.1406	0.1895	0.2740	0.4460	0.5373	0.6414	0.9479
2	0.5711	0.4922	0.6308	0.2786	0.3754	0.5427	0.8833	1.0642	1.2704	1.8773
3	0.8483	0.7311	0.9370	0.4138	0.5576	0.8062	1.3121	1.5808	1.8870	2.7886
4	1.1203	9.6551	1.2373	5.4655	0.7364	1.0646	1.7326	2.0875	2.4919	3.6824
5	1.3970	1.1954	1.5319	0.6766	0.9117	1.3181	2.1451	2.5845	3.0852	4.5592
6	1.6487	1.4209	1.8210	0.8043	1.0837	1.5669	2.5499	3.0721	3.6673	5.4194
7	1.9055	1.6422	2.1046	0.9296	1.2525	1.8109	2.9471	3.5507	4.2386	6.2635
8	2.1576	1.8595	2.3830	1.0526	1.4182	2.0505	3.3369	4.0203	4.7992	7.0921
9	2.4050	2.0727	2.6563	1.1733	1.5809	2.2856	3.7196	4.4814	5.3496	7.9054
10	2.6480	2.2821	2.9247	1.2918	1.7406	2.5165	4.0953	4.9341	5.8900	8.7039
11	2.8865	2.4877	3.1881	1.4008	1.8974	2.7432	4.4633	5.3786	6.4206	9.4880
12	3.1208	2.6896	3.4469	1.5225	2.0514	2.9659	4.8266	5.8151	6.9418	10.2582
13	3.3510	2.8880	3.7011	1.6348	2.2027	3.1846	5.1826	6.2440	7.4537	11.0147
14	3.5771	3.0828	3.9509	1.7451	2.3513	3.3995	5.5323	6.6653	7.9567	11.7579
15	3.7993	3.2743	4.1963	1.8535	2.4974	3.6107	5.8759	7.0793	8.4509	12.4882
16	4.0176	3.4625	4.4374	1.9600	2.6409	3.8182	6.2136	7.4862	8.9366	13.2060
17	4.2322	3.6475	4.6745	2.0647	2.7820	4.0221	6.5456	7.8861	9.4139	13.9114
18	4.4432	3.8293	4.9075	2.1676	2.9206	4.2226	6.8719	8.2792	9.8832	14.6049
19	4.6507	4.0081	5.1366	2.2688	3.0570	4.4198	7.1927	8.6657	10.3446	15.2867
20	4.8546	4.1839	5.3619	2.3683	3.1911	4.6136	7.5081	9.0458	10.7984	15.9572

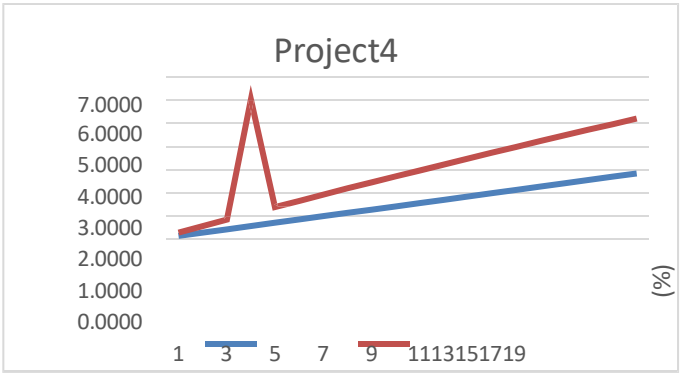


Figure3. Sensitivity analysis forthe 4thproject

Figure 4 compare two factors mentioned previously, adding to what was mentioned previously and focusing on profit values, especially for the 10th project, at the beginning both losses dsue to both conditions would be considered approximately similar until 9% then the effect of profit decreases would contribute more decreasing overall profit.

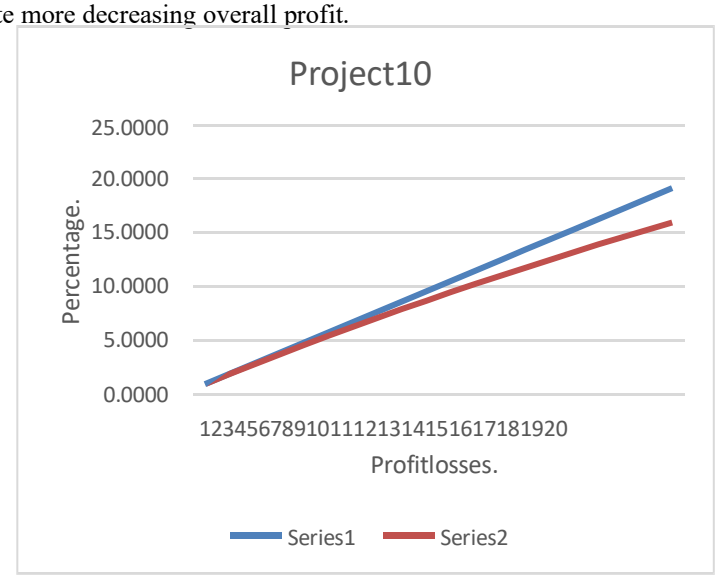


Figure4 Sensitivity analysis forthe 10thproject

II. EARLY BASIS OF SENSITIVITY ANALYSIS

This part will assess the impact of declining profit and falling net profit owing to rising construction expenses concurrently since the implementation period is ten years, which is regarded as a long length to execute building projects, so the influence of time would be visible. A more accurate and represented senior, who may be regarded as a potential crisis senior, might be completed with the use of the findings from this investigation. The

key year and the essential project, together with the annual budget cap that will be covered later, would serve as the foundation for this senior. Figure 5 shows that the fourth year is most impacted, followed by the second and fifth years, with the other years falling below it. Since more than 69% of the construction units would be completed in the fourth year, or more than half of this massive project would be completed, these findings were logically predicted. The completion of 68 units, which needed more than 38 million to finish all construction activities, also had a significant influence on the second year. Lastly, the fifth year, when more than 55 units would be completed, would require more than 93 million as the project budget for this year.

2. IMPACTOFINCREASING THE COST OF CONSTRUCTION UNITS

Since the projected net profit would be used to finish the remaining planned number of units after the fourth year, rising construction costs might have an impact on the total expected or even the total number of building units. As shown in table 10, which assesses the effects of the fourth year and the fourth project on overall net profit, any increase in this profit brought on by rising construction costs may have an impact on the total number of construction units. The cost of the project's units is rising in year four, which has a significant impact on the optimum assignment matrix, which is beginning to shift from a 2% increase. This increase results in the loss of over 8% of the total number of construction units, potentially leading to profit losses of over 11.43%. For example, lowering the profits by 1–20% has a little impact on the number of units and the optimum assignment matrix in the fourth project. For example, lowering five units while profit reducing losses is 0.58% (237.000 JD), which is regarded as an acceptable percentage for large-scale building projects.

Table10Effect ofincreasingconstruction costson thetotalnumberofconstruction units.

Year4			**Project4**		
cost %	Profit“JD”	No. of units.	cost %	Profit“JD”	No. of construction units.
0	40,730,000	380	0	40,730,000	380
1	40,426,000	380	1	40,716,000	379
2	40,127,000	375	2	40,702,000	379
3	39,840,000	375	3	40,689,000	379
4	39,579,000	371	4	40,675,000	377
5	39,322,000	371	5	40,662,000	377
6	39,071,000	370	6	40,650,000	376
7	38,824,000	366	7	40,637,000	376
8	38,582,000	365	8	40,625,000	376
9	38,344,000	365	9	40,613,000	376
10	38,111,000	361	10	40,601,000	376
11	37,881,000	361	11	40,589,000	376
12	37,656,000	360	12	40,578,000	376
13	37,443,000	358	13	40,567,000	376
14	37,236,000	358	14	40,556,000	376
15	37,032,000	357	15	40,545,000	376

16	36,832,000	354	16	40,534,000	376
17	36,635,000	354	17	40,524,000	376
18	36,444,000	353	18	40,513,000	376
19	36,257,000	353	19	40,503,000	376
20	36,073,000	350	20	40,493,000	375

II. EFFECTOFDECREASINGPROFITONTHENUMBEROFCONSTRUCTION UNITS

The buffer profit ratio hypothesis will be supported by Table 11, which shows the impact of a declining profit ratio on the total number of building units. After the profit is reduced by up to 20%, the total number of contribution units stays the same.

Table11Effectofdeacrasingprofitonnumberof construction units

ncreas e f cost	**Profi t "JD"**	**No. o f construc tion units .**	**ncreas e f cost**	**Profi t "JD"**	**#unit**
0	40,730,000	380	11	40,409,600	380
1	40,700,870	380	12	40,380,470	380
2	40,671,740	380	13	40,351,340	380
3	40,642,620	380	14	40,322,210	380
4	40,564,880	380	15	40,293,080	380
5	40,584,360	380	16	40,263,960	380
6	40,555,240	380	17	40,234,830	380
7	40,526,110	380	18	40,205,700	380
8	40,496,980	380	19	40,176,570	380
9	40,467,850	380	20	40,147,440	380
10	40,438,720				

III. RESULTS

Numerous noteworthy findings from the present study are summed up in the following points:

Why By redistributing available financial resources as efficiently as possible, an optimization model may reduce total losses during a financial crisis. This is preferable to regular plans or responsive plans. • It would be beneficial to use an optimum model to prevent any financial losses brought on by a financial crisis. Utilizing mathematical polynomial fitting to forecast missing values for financial gain. • Comparing the present value of the company's normal plan with the optimum plan, where the optimal PW doubles the PW for the other plan. • Using sensitivity analysis, the impact of declining profit is assessed on two separate bases: project-wise and year-wise. It is probable that in both situations, the overall profit was little impacted, and the overall number of building units was less affected.

• If normal circumstances govern the building environment, the effect of declining profit owing to rising construction material costs

would have a significant impact

on both overall profit and the total number of created units, which represent more than a 7% increase of their usual plan. • Determining key years and projects based on maximum losses for a year and a project—the tenth project and the fourth year—is crucial to creating financial crisis circumstances.

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