

Challenges in Controlling a Predefined Project Budget

Ahmed Saleh

Abstract: *This paper presents a practical approach for controlling a predefined construction budget during the design stages of a consultancy project. A case study of an administrative building is used to demonstrate how the client budget is converted into an internal target cost after allowing for identified risks. Historical project data are then used to allocate the target cost among major disciplines, while design-stage estimates are periodically compared with these limits. Cost checklists, interdisciplinary coordination, preliminary quantity takeoffs, benchmarking, and design adjustments are applied when estimated costs exceed the established targets. These actions reduced the design-stage estimate from SAR 23.9 million, 8.6% above the SAR 22 million target cost, to SAR 22.2 million, approximately 0.9% above the target. The final BOQ-based expected cost of SAR 23.754 million remained within the client's SAR 25 million predefined budget. The proposed workflow provides a practical reference for estimators and design consultants managing projects under fixed budget constraints.*

Keywords: Predefined Budget; Target Cost; Cost Estimation; Cost Control; Construction Projects; Design Management; Historical Cost Data

1. Introduction

As a consultant, a common question asked by clients is: What is the expected project cost for a given scope? Accordingly, established estimating procedures are applied, and a preliminary cost estimate is prepared at an appropriate level of accuracy. This enables the client to allocate suitable funds for the project. However, the question becomes more difficult to answer when framed differently: How can the expected project cost be aligned in advance with a predefined budget?

Answering this question is critical. When the successful tender price is aligned with the predefined budget, it indicates that cost-management activities have been implemented effectively. Uncertainty during the early stages of a project often has the greatest influence on the estimating process, creating additional challenges for cost estimators. Significant effort is therefore required to manage and control the related activities until the project objectives are achieved.

1.1. Literature Review

(Rumane, 2017) (Del Pico, 2013) During the twentieth century, construction became a major economic sector and a core component of industrial development (Rumane, 2017b). Rapid global growth has significant implications for project management, as securing the necessary funding for projects has become more difficult and costly. Diligent management is therefore essential to ensure business continuity (Del Pico, 2013).

(Aru, 2017) Many organizations have limited sources of funding for their projects. To achieve the desired returns, organizations must forecast their expenses, receipts, and payments, while management efficiency can be assessed against predefined objectives (Aru, 2017). Budget overruns may result in investment losses. Consequently, predefined budgets are widely used in project management, and controlling such budgets is a cornerstone of project success.

(Lichtenberg, 2016) In this context, many studies have indicated that projects may be exposed to budget overruns when conventional procedures are followed (Lichtenberg,

2016). It is therefore important to develop improved procedures that reduce the risk of investment losses.

1.2. Paper Overview

Based on above introduction, this paper presents practical procedures expected to be effective in controlling client predefined budget, in terms of design consultancy contracts. So, we will start by an introduction to a case study illustrating the basic information as received from the client. Then we will move to discuss in details how to recognize the client budget features to enable further calculation of risk contingency amount and internal target cost. Then we will present the followed procedures that are necessary to allocate the target cost by disciplines and control this target through different project stages. By the end of this paper, the final expected cost will be compared with the target cost to check the effectiveness of the followed procedures. Then, the final findings of this paper will be concluded.

2. Case Study

In our case study, the client has a certain amount of investments to fund his project "predefined budget", which simply means that any overrun costs will be considered as a project failure due to insufficient funds. This will result in waste of time, profits, opportunity, and above all, loss of consultant credibility. The objective now is to tailor the project according to the scope of work and within available funds.

Before proceeding, it is important to note that the case-project information is presented in generalized form for illustration purposes, including the area, costs, and location, while no client or consultant names are mentioned.

The following summary highlights the project framework that has been followed in terms of controlling budget, which will be discussed in details respectively.

Step 1: Project introduction by presenting the basic project information as sent by the client.

Step 2: Recognition of budget features by setting a common understanding with the client regarding the predefined budget.

Step 3: Identifying the target cost by deducting the amount of money that should be reserved to cover the probable risks, from the predefined budget, then the remaining amount of the predefined budget can be considered as a target project cost for further work.

Step 4: Allocating the target cost by major disciplines using the historical database.

Step 5: Controlling the target cost through project stages, in addition, taking the necessary actions to maintain client budget.

Step 6: Calculating the final expected project cost by pricing the bill of quantities (BOQ) to get direct costs, then estimating the indirect cost and adding an appropriate overhead and profit margin.

2.1 Project Introduction

In a sample project, it is required to provide a professional engineering and design consultancy services to deliver the project with the following primary information. Table no. 1.

Table 1: Project Primary Information

-	Location	Riyadh, Saudi Arabia.
-	Project type	Admin Building
-	Built up area	4,000 M2 (for main building only).
-	Predefined budget	25,000,000 Saudi Riyals (SAR), (1 SAR equals to 0.27 \$) "Pegged to US dollar"
-	Allowed accuracy	+/- 10%
-	Scope of work	Full design disciplinary services.
-	Scope of construction	Full construction & finishing work
-	Main deliverables	Full tender documents including drawings, specifications & bill of quantities.
-	Project stages	Stage 1: Concept Design Stage. Stage 2: Schematic Design Stage. Stage 3: Detailed Design Stage. Stage 4: Preparing Construction Document.

2.2 Recognition of Budget Features

The most important objective for a project is to produce the final deliverables as defined by the client (*Russell, et al., 2018*), that means it is required to reach a common understanding for whatever is required by the client.

This shows the importance of the preliminary meetings in the beginning of the project, especially in respect of defining the main objectives of the project and also describing the main

project elements. In fact, such meetings allow for a proper introduction among project teams and provide a clear vision for the roles of each party.

In such cases with predefined budget projects, the normal design procedures will be followed, except one significant difference, which is calculating the cost limits for major disciplines.

Now, the first step is to clarify exactly what is included or excluded from the client predefined budget. As per project documents, it turns out that the maximum funds allocated to construct the main building are SAR 25 million. The inclusions and exclusions of this amount can be summarized as following:

- Including all payments to the contractor according to the approved construction contract.
- Excluding any costs associated with new requirements by the client in construction phase.
- Excluding all design and consultancy service fees.
- Excluding all costs associated with landscape work (out of scope).

So, the total sum of payments by the client to the contractor should not exceed 25 million SAR. In order to ensure alignment with this budget, a proper study for the project cost and scope is conducted to determine what we call internally (The Target Cost).

The Target Cost can be calculated by **deducting** the contingency amount **from** client predefined budget (as discussed in the next topic), so a maximum allowance of target cost can be allocated by discipline as a cost baseline.

2.3 Identifying the Target Cost

This is a very critical step to the whole project, as this will identify the target cost for all subsequent works. The target cost amount must be less than the predefined budget by an amount equals to a contingency allowance. This is important to protect the predefined budget from overruns resulting as an impact of uncertain events.

(*Patrascu, 1988*) There are many uncertain events that may occur and can lead to an increase in the final expected cost. On the other hand, uncertain events and consequences thereof are very difficult to be identified further than understood. Therefore, the risk management team started to identify the probable risk events and the associated cost impact, in order to facilitate calculation of the proper contingency amount as per following Table no. 2.

Table 2: Amount of Probable Risk Impact

Ser.	Event Description	Probability %	Estimated Amount (SAR)	Impact Amount (SAR)
1	Design development contingency	40%	50,00,000	20,00,000
5	Unforeseen costs/ Estimate errors	15%	12,50,000	1,87,500
2	Takeoff errors	5%	25,00,000	1,25,000
3	Expected inflation in prices	5%	12,50,000	62,500
4	Probable claims during construction phase due to insufficient design data	25%	25,00,000	6,25,000
Total amount of probable risk impact (SAR)				30,00,000

The full activities of risk management have been conducted in an early phase to facilitate estimation activities. However, the calculation of contingency amount is more complex than illustrated in the previous table no.2, and it is considered as a different subject that may not be suitable to be expressed in this paper.

The target cost can be calculated by deducting the amount of probable risk impact from the predefined budget, to be (SAR 22 million), as per Table no. 1.

Table 3: Calculation of Target Cost

Client Predefined Budget	2,50,00,000	SAR
Deduction of total amount of probable risk impacts	30,00,000	SAR
The Target Cost	2,20,00,000	SAR

At the end of the design stages and before bidding, the expected project cost is estimated by pricing the completed BOQ. Although the expected cost should align with the SAR 22 million target cost, up to SAR 2 million of the design-development contingency identified in Table 2 may be used. This contingency covers cost growth arising from design development during the concept, schematic, and detailed design stages.

The 15% allowance used in the preliminary discipline estimate in Table 6 is a working estimating allowance within the design-stage estimate and forms part of the overall project contingency reserve. It is not an additional contingency and is not added again when the final project cost is compared with the predefined budget.

2.4 Allocating Target Cost by Major Disciplines

(Dagostino & Peterson, 2011) Reliable historical data are among the best sources of information available to estimators (Dagostino and Peterson, 2011).

Such data must be well classified and organized to help the estimator to use it to provide an estimate as accurate as possible.

The best practice of classifying historical database is subject to continuous development and improvement and may differ among organizations, however the most important data to be included can be summarized as following:

- Classification of projects based on type (Admin, Residential, healthcare and etc.).
- Other Sub-classifications may be applied based on region and location.
- Project scope of work (building only, infrastructure, landscape, and etc.).
- Construction scope of work (full, fit out only, core and shell and etc.).
- Project records must include the project start and end dates.
- All relevant data regarding project configuration such as (number of buildings, area by floor, total BUA, number of floors and etc.).
- Cost data (preliminary cost estimate, final cost estimate, awarded construction bid, final construction contract amount).
- The total amount of the project by major disciplines (Structure, Finishes, MEP and etc.).
- Special project characteristics (façade elements, cladding, special construction system, special requirements by the client and etc.).
- Any other data or notes may be important.

The following screenshot illustrates general historical stored data of sample projects after applying some filters to show the most important data only as per Figure no. 1.

HISTORICAL DATA BASE ADMIN BUILDINGS		PROJECT (A)				PROJECT (B)			
		Project Type	Admin	Owner	(...)	Project Type	Admin	Owner	(...)
		Location	Riyadh	Const. Scope	Full Construction	Location	Riyadh	Const. Scope	Full Construction
		Start Date	Aug. 2013	Finish Date	Feb. 2015	Start Date	Jan. 2015	Finish Date	Nov. 2016
		Building BUA (M2)	2,795	Site Area (M2)	7,500	Building BUA (M2)	8,216	Site Area (M2)	22,650
		Building Cost Rate (SAR/ M2)	6,653	Site Cost Rate (SAR/ M2)	554	Building Cost Rate (SAR/ M2)	5,082	Site Cost Rate (SAR/ M2)	612
		Building Final Amount (SAR)	18,596,163	Site Final Amount (SAR)	4,152,866	Building Final Amount (SAR)	41,752,355	Site Final Amount (SAR)	13,861,800
		Building Contract Amount (SAR)	17,164,258	Site Contract Amount (SAR)	3,945,223	Building Contract Amount (SAR)	38,453,919	Site Contract Amount (SAR)	12,337,002
Div.	Division	Amount	Cost (SR) /m ²	Percentage %		Amount	Cost (SR) /m ²	Percentage %	
				Division	Project			Division	Project
02	SITE WORK	157,200	56	-	0.85%	326,924	40	-	0.78%
03	CONCRETE	2,648,940	948	-	14.24%	6,403,730	779	-	15.34%
04	MASONRY	487,848	175	-	2.62%	1,013,078	123	-	2.43%
05	METALS	331,960	119	-	1.79%	461,042	56	-	1.10%
06	WOOD & PLASTIC	183,800	66	-	0.99%	135,330	16	-	0.32%
07	THERMAL & MOISTURE PROTECTION	348,880	125	-	1.88%	784,275	95	-	1.88%
08	DOORS & WINDOWS	1,070,955	383	-	5.76%	4,447,440	541	-	10.65%
09	FINISHES	2,547,410	911	-	13.70%	4,593,355	559	-	11.00%
10	SPECIALITES	69,940	25	-	0.38%	280,073	34	-	0.67%
11	EQUIPMENTS	74,270	27	-	0.40%	66,650	8	-	0.16%
12	FURNISHING	2,291,400	820	-	12.32%	6,737,100	820	-	16.14%
13	SPECIAL CONSTRUCTION	0	0	-	0.00%	35,000	4	-	0.08%
14	CONVEYING SYSTEM	490,000	175	-	2.63%	400,000	49	-	0.96%
15 - A	Mechanical - Plumbing	692,014	248	-	3.72%	2,047,953	249	-	4.90%
15 - B	Mechanical - HVAC	1,302,745	466	-	7.01%	5,246,833	639	-	12.57%
16	Electrical Work	5,698,781	2,110	-	31.72%	8,773,572	1,068	-	21.01%
	TOTAL BUILDING	18,596,163	6,653	-	100%	41,752,355	5,082	-	100%

Figure 1: General Historical Database Sample

Extracting the information from the historical database is a very essential matter, and needs to be handled by an expert estimator, as this database can't be used directly as is.

In general, the basis of characteristics of any database is not usually identical to the project that is under study, (Hollmann, 1997), for example, the construction benchmarking rate for admin building located in a business district in the capital will be higher than admin building located in a rural town.

Therefore, this requires further analysis and normalization processing to take place before using these databases. Otherwise, misleading figures will affect the accuracy range of the estimate significantly.

In addition, to allow for proper adjustments, the following basis of characteristics shall be included with the database to be more understood (Hollmann, 1997):

- Time
- General specifications
- Physical context.
- Other non-physical conditions.

After applying the appropriate adjustments through normalization process to three sample projects, it is possible now to use the average percentage of each discipline as a benchmarking or reference in allocating the target cost by discipline of our project. As illustrated in the following Table no. 2

Table 4: Amount by Discipline of Sample Projects

Ser.	Description	Amount by Discipline (SAR)	Percentage (%)	Total Amount (SAR)
A	Sample Project (A)			4,26,75,212
1	Skeleton	68,28,034	16%	
2	Finishes	1,92,03,845	45%	
3	Electromechanical	1,66,43,333	39%	
B	Sample Project (B)			1,91,41,236
1	Skeleton	28,71,185	15%	
2	Finishes	95,70,618	50%	
3	Electromechanical	66,99,433	35%	
C	Sample Project (C)			2,78,96,355
1	Skeleton	47,42,380	17%	
2	Finishes	1,25,53,360	45%	
3	Electromechanical	1,06,00,615	38%	

The percentage of Skeleton work ranges from (15% to 17%). For Finishes work, the percentage ranges from (45% to 50%). For Electromechanical work, the percentage ranges from (35% to 39%). So, the average percentage of the three sample projects by discipline can be calculated as follows:

- Skeleton average percentage
 $(16\%+17\%+15\%)/3 = 16\%$.
- Finishes average percentage
 $(45\%+50\%+45\%)/3 = 47\%$.
- Electromechanical average percentage
 $(39\%+35\%+38\%)/3 = 37\%$.

The next step is to use the above listed average of benchmarking percentages, in order to allocate the allowed amount of target cost by discipline, as per the following Table no. 3.

Table 5: Allocating of Target Cost by Discipline

Ser.	Description	Target Project Cost (SAR)	Average Percentage (%)	Target Cost Allocation by Disciplines (SAR)
Proposed Project (Admin Building)				
1	Skeleton	2,20,00,000	16%	35,20,000
2	Finishes	2,20,00,000	47%	1,03,40,000
3	MEP	2,20,00,000	37%	81,40,000

2.5 Controlling the Target Cost Through Project Stages

Keeping the scope of work controlled over the project phases is the keystone of successful projects. Practically, it has been noticed that the client emphasizes on the importance of adhering to his predefined budget while the meetings with cost team, but unfortunately during client meetings with

designers, the budget limit is usually forgotten. Practically, this is a common behavior by most clients, and this is one of the important causes of scope creep. Preventing such scope creep is very difficult or may often be impossible (Russell, et al., 2018), and can significantly affect the target cost.

While scope control is one of project manager vital roles, it is more suitable herein to focus on the necessary activities of the cost team to control the target cost. The following topics present some proactive procedures that shall be considered to enhance the abilities of cost team to control the target cost in the concept design stage as an example:

- Preparing a cost checklist then distributing it among the concerned disciplines to address related cost data.
 - Cooperating with other disciplines to facilitate the evaluation of primary alternatives.
 - Estimating the expected cost of major discipline outputs.
 - Comparing the expected cost against target cost, and taking necessary action to maintain cost aligned to budget.
- Moreover, the same procedures can be applied to both schematic and detailed design stages using suitable tools and techniques according to the level of project definitions and other available data.

2.5.1. Preparing cost checklist

At early design stages, it was important to ensure that target cost is well addressed and respected. Therefore, a cost checklist was created and distributed among design teams in relevant disciplines. Refer to Figure no 2.

The cost checklist is intended to support the design team in making appropriate design decisions. It also supports the preparation of the outline specification in accordance with the target cost.

COST ESTIMATE TECHNICAL CHECKLIST (CD / SD DESIGN STAGE)				
PROJECT	...	NO.	...	DATE
PROJECT TYPE	☐ UNDEFINED BUDGET ☒ PREDEFINED BUDGET		SAR	22,000,000
ITEM		Target Cost	REMARKS	
DIV. 03	CONCRETE WORK	3,520,000		
	Normal Footing	☒		
	Normal Structure	☒		
	Long Span System (Double Tee)	☐	Not Allowed	
DIV. 09	FINISHES	10,340,000		
	Marble / Granite Flooring	☒	Maximum 10% of floors area	
	Porcelain / Ceramic Flooring	☒		
	Wooden Flooring	☐		
	Carpet Flooring	☐	For offices floors only	
	Electromechanical	8,140,000		
DIV. 15 A	Mechanical Work, Plumbing			
	Sanitary Fixtuers	☒	Local manufactured	
	Drainage System	☒		
	Water Supply Sytem	☒		
DIV. 15 B	Mechanical Work, HVAC			
	Chiller System	☐		
	Package Unite System	☒		
DIV. 16	Electrical Work			
	Transformer	☒		
	Generator	☒		
	Fire Alarm System	☒		
	Integrated Scurity System	☒		

Figure 2: Project Cost Estimate Checklist

The listed information in the cost checklist may include but not limited to the following:

- Total internal budget limit of the project.
- Partial allocated budget by major discipline.
- List of suggested components or systems with check marks for each discipline.
- Further clarification notes are mentioned to draw designer attention for any special conditions such as limitation of using expensive flooring materials or selection of all sanitary fixtures from local manufacturers only.

The designers now have enough information, so they can start the design process including preparing the outline specification report.

2.5.2. Cooperating with other disciplines

(Whyte, 2015)The cost estimator should interact with the other discipline teams. This helps ensure that all relevant information regarding the target cost is addressed efficiently. Proactive estimator involvement also supports the evaluation of the relative costs of design alternatives (Whyte, 2015).

2.5.3. Estimating the expected cost of major discipline

In many cases while developing designs, extra features or systems may be added just to satisfy the client, which means exceeding the allowed target costs. So, the associated costs related to discipline outputs are needed to be compared against target costs to check for any deviation.

(Whyte, 2015)Therefore, establishing a preliminary takeoff for main division elements such as (Concrete, Finishes and

MEP systems) will allow for initial estimation of the expected cost.

In this context, the output of major items is collected from disciplines. Then quantity survey team starts to do a rough takeoff to facilitate cost activities.

(Rumane, 2017)A parametric technique is used to estimate the expected cost of discipline outputs. Historical databases and preliminary quantity takeoffs provide a basis for deriving the mathematical relationships used for this purpose (Rumane, 2017a).

The following example demonstrates how the expected costs of skeleton are estimated. Refer to Table no. 4. The same steps are applied to all the remaining disciplines as per follows;

1) Quantified Items

- The expected costs were estimated by multiplying the generated quantities by appropriated benchmarking rates.

2) Un-Quantified Items

- In this early stage, some items might be immeasurable, so rough quantities can be estimated using an auxiliary factor (*generated from historical database*) which links the occupied gross area with the approximated quantity of those items. Then, the expected costs can be estimated as per the pervious step.

3) Unforeseen Items

- Represented by 10% of quantified and unquantified items, based on historical database and expert judgment.

Table 6: Estimating the Expected Cost of Skeleton

Table 6: Estimating the Expected Cost of Skeleton					
1. Quantified Items Cost					
Item	Unit	Quantity	Rate (SAR)	Amount (SAR)	
Structure Steel Ceiling	Ton	15	12,000	1,80,000	
Double Tee Slab	M2	500	900	4,50,000	
Total			SAR	6,30,000	
2. Unquantified Items – Rough Calculation					
Item	Gross Area (M2)	Auxiliary Factor	Rough Quantity (M3)	Rate (SAR)	Amount (SAR)
Substructure	1,240	0.19	235.6	1,000	2,35,600
Superstructure	3,500	0.35	1,225	1,650	20,21,250
Total				SAR	22,56,850
3. Summary of Expected Skeleton Costs					
Description	Percentage	Basis	Amount (SAR)		
Quantified Items			6,30,000		
Unquantified Items			22,56,850		
Other Unforeseen Items	10%	Of above	2,88,685		
Sub Total			31,75,535		
Contingency	15%	Of above	4,76,330		
Grand Total			36,51,865		
Grand Total (Rounded)			36,50,000		

2.5.4. Checking the expected cost against target cost

By applying the previous steps to all major disciplines, the result is the total expected cost of those disciplines. There is one more critical step prior getting the client approval on current phase, which is checking the total expected cost against target cost, as illustrated in the following Table no. 5.

Table 7: Expected Cost Vs. Target Cost Comparison

Ser.	Description	Target Cost (SAR)	Expected Cost by Major Discipline (SAR)	Variance (%)
1	Skelton	35,20,000	36,50,000	3.70%
2	Finishes	1,03,40,000	1,13,50,000	9.80%
3	MEP	81,40,000	89,00,000	9.30%
	TOTAL	2,20,00,000	2,39,00,000	8.60%

As shown, the expected cost by discipline is more than the target cost by 8.6%. So, the cost team started to take the following necessary actions to bring the expected cost down to be aligned with the target cost:

- 1) Checking the outline specifications of each discipline against the cost check list.
- 2) Identifying the elements that caused the increase of the cost, especially the items that were not allowed to be used in the cost checklist, such as (**Div.02 - Concrete - Double Tee Slabs**).
- 3) Requesting from relevant disciplines to review their designs and assumptions again to determine the items that can be eliminated or finding other suitable alternatives within the allowed limits.
- 4) Conducting necessary meetings with related disciplines, to evaluate the relative costs of the redesigned items and the new alternatives.

Finally, after receiving the final output from all disciplines again, the expected cost can be estimated using the same approach as discussed previously in Table no. 6.

The final expected cost is compared against target cost as follows in Table no. 6, which shows that the expected cost is now aligned with target cost, with acceptable variance of only 1%.

Table 8: Final Expected Cost Vs. Target Cost Comparison

Ser.	Description	Target Cost (SAR)	Expected Cost by Major Discipline (SAR)	Variance (%)
1	Skelton	35,20,000	36,00,000	2.30%
2	Finishes	1,03,40,000	1,04,00,000	0.60%
3	MEP	81,40,000	82,00,000	0.70%
	TOTAL	2,20,00,000	2,22,00,000	0.90%

After the client approved the concept design stage, the schematic and detailed design stages proceeded sequentially. The estimating procedures described in Sections 2.5.1 to 2.5.4 were repeated. As the level of project definition increased, more detailed quantity takeoffs and supplier quotations, particularly for high-value electromechanical items, were used to improve estimate accuracy.

2.6 Calculating the Final Expected Project Cost

At the final project stage, pricing the BOQ is considered the final expected cost of the project. Generally, there are multiple sources for pricing depending on project type, complexity level and nature of priced items, while the best source is the organization database and current prices in market. The final expected cost of the project is prepared as follows, refer to Table no. 9:

- Calculating all direct costs related to labor, material and the rest of all BOQ items.
- Estimating proper allowance of expected indirect costs.
- Determine appropriate overhead and profit margin according to classification of proposed invited contractors.

Table 9: Final Project Expected Cost

Div	Description	%	Amount
Div. 02	Site Work		2,77,500
Div. 03	Concrete		30,71,000
Div. 04	Masonry		4,62,500
Div. 05	Metal / Steelstructure		7,03,000
Div. 06	Wood & Plastic		4,81,000
Div. 07	Thermal & Moisture Protection		6,47,500
Div. 08	Doors & Windows		17,57,500
Div. 09	Finishes		24,97,500
Div. 10	Specialties		4,25,500

Div. 11	Equipments		2,59,000
Div. 12	Furnishing		N/A
Div. 13	Special Construction		5,92,000
Div. 14	Conveying System		4,07,000
Div. 15a	Mechanical - Plumbing		14,43,000
Div. 15b	Mechanical - HVAC		20,35,000
Div. 16	Electrical Work		34,41,000
	Total Direct Cost		1,85,00,000
	Indirect Cost	7%	12,95,000
	Sub Total		1,97,95,000
	Over Head & Profit	20%	39,59,000
	Total Expected Project Cost		2,37,54,000

As shown in Table 9, the final expected project cost is SAR 23.754 million. Although this exceeds the SAR 22 million target cost, it remains below the SAR 24 million target cost plus design-development contingency and below the client's SAR 25 million predefined budget. The result is therefore considered acceptable at this stage.

Upon client request, further value engineering sessions can be held to add more values and enhance the overall project quality.

3. Conclusion

Because the findings are derived from a single practical case, the numerical allocations and procedures should not be applied universally without adjustment. Future studies should test the framework across different project types, scales, locations, and organizational cost-control systems. Overall, disciplined cost monitoring from the earliest design stage can materially improve the likelihood of maintaining the expected project cost within the client's predefined budget.

The case also identifies opportunities for further improvement. More detailed cost data at the subsystem level would strengthen the quality of historical benchmarks, while enhanced risk analysis would improve the reliability of contingency allowances and final cost estimates. Cost-estimating capability should therefore be treated as a cumulative organizational process supported by systematic documentation, continuous learning, and periodic improvement of estimating tools and procedures.

Several practical lessons arise from the case. First, establishing a common understanding with the client regarding the scope and budget boundaries can reduce the risk of future disputes. Second, a detailed review of the project scope, constraints, and risk exposure supports the determination of an appropriate contingency reserve. Third, a reliable organizational cost database is a valuable asset and should be continuously updated with project closeout data and lessons learned to support benchmarking and the pricing of future projects. Fourth, cost checklists provide an effective means of communicating discipline-level target costs and design constraints, including limitations on expensive materials and requirements for locally manufactured products. Finally, proactive involvement of cost estimators during the early design stages supports the evaluation of alternatives and the timely implementation of value-engineering measures.

The case study demonstrates a practical framework for controlling construction design within a predefined client budget. Establishing clear budget boundaries, allowing for identified risks, allocating target costs by discipline, and continuously monitoring design development against those limits were central to the process. Historical cost data and structured cost checklists supported early decision-making, while continuous coordination between estimators and designers enabled corrective action when expected costs exceeded target values. In the case study, these actions reduced the design-stage estimate from SAR 23.9 million, which was 8.6% above the SAR 22 million target cost, to SAR 22.2 million, approximately 0.9% above the target. The final BOQ-based expected cost of SAR 23.754 million remained within the client's SAR 25 million predefined budget.

List of Tables

- Table 1 - Project Primary Information
- Table 2 - Amount of Probable Risk Impact
- Table 3 - Calculation of Target Cost
- Table 4 - Amount by Discipline of Sample Projects
- Table 5 - Allocating Target Cost by Discipline
- Table 6 - Estimating the Expected Cost of Skeleton
- Table 7 - Expected Cost Vs. Target Cost Comparison
- Table 8 - Final Expected Cost Vs. Target Cost Comparison
- Table 9 - Final Project Expected Cost

List of Figures

- Figure 1 - General Historical Database Sample
- Figure 2 - Project Cost Estimate Checklist

References

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