Low-Cost Options for Remodeling a Residential Structure in Puerto Rico

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Abstract *— This project is based on the remodeling and rehabilitation of a concrete house in the town of Guánica, Puerto Rico. The remodeling and rehabilitation of this house needed construction management and effective cost management. For this, a cost analysis was carried out on the main components of the remodeling and rehabilitation of this house and a category system was developed to establish the allocation of the budget for each necessity. It was found that by developing a detailed cost analysis with enough information, it would help economic and financial decision-making. The researched data for the cost of each material included three of the largest construction material distribution chains in Puerto Rico: Home Depot, ACE Hardware and National Lumber and Hardware. A minimum of two option packages were directly compared with the allocated budget and an objective decision was made towards the best financial and economic option.*

Key Terms *— Budget Control, Cost Analysis, Roofing Materials, Structural Components.*

INTRODUCTION

The focus of this project is the remodeling and rehabilitation of a concrete house in the town of Guánica, Puerto Rico. As part of the project, different categories were generated to classify the type of effort, work, materials, tools, and processes that must be present in the execution of each different task. Multiple project management tools were used during the development of the project, some that can be mentioned are cost management, cost analysis, quality control and risk analysis. An initial budget was established, but the costs exceeded this budget, for this reason a cost analysis was carried out on each material and component needed in each category. Because costs were exceeded, the budget was balanced and allocated based on need for each category of the remodeling.

The following categories were generated to generalize the budget allocation:

- Furniture
- Structure
- Electrical
- Kitchen
- Yard

The objectives of the project were to reduce the costs of remodeling and rehabilitating the house. As part of the cost reduction efforts a cost analysis was carried out, so that a direct comparison of cost per material could be analyzed and each supplier could be considered per category of necessity. Within the analysis it was established that a minimum of two option packages would be presented. By having different options, an evaluation was completed, so it helped to determine the best option based on the approved budget and the high-quality materials needed. The option package included three of the largest construction material distribution chains in Puerto Rico: Home Depot, ACE Hardware and National Lumber and Hardware. But were not limited to considering other suppliers such as: Sherwin-Williams for paint, “La Electrica” from Ponce for electrical materials, Rooms To Go for high end quality furniture, Global Mattress and Sams Club for home essential appliances.

LITERATURE REVIEW

Remodeling and Rehabilitation Concept

Construction Materials are considered the raw materials that a contractor or subcontractor uses in a workspace, where a structure such as a building is produced [1]. A variety of components can be found to be part of construction materials, such as metal rods, cement, and cement blocks.

The Environmental, Health and Safety is usually developed to help ensure that construction efforts comply with life safety codes, as well as that all efforts are following state, municipal and federal laws [2]. Since construction materials have been purchased from registered and certified suppliers, each material used in the remodeling process was used following manufacturer directions and disposal instructions.

Quality Assurance is the most important activity in any project is to implement quality standards in all phases of the project, starting with planning all the way to delivery of the final product. The involvement of quality assurance by monitoring a construction project can be vital to the life cycle of the building. If the work was performed applying high quality standards, future maintenance costs are much less. There is always room for continuous improvement and no process is ever perfect [3]. Activities where quality must be constantly involved include and are not limited to construction materials, equipment, processes, print development, training, skills development, and certifications.

Cost Analysis

Financial and Budgeting Control are important to be included when managing construction projects, attention must be implemented in all phases of the project and consideration must be given to how each task can affect the budget, is recommended to get to know the budget limits. In construction, the acquisition of materials must be controlled and organized, otherwise it will be negligent, and the money will be misused or poorly spent [4]. Once the budget is established, it can be balanced to offset any miscalculations. But it must be monitored continuously, as it is the life of the project.

A Cost Benefits Analysis is the process by which the benefit of an incurred cost is analyzed. It helps in decision making, as it provides data in a monetary way, even in intangible things. Basically, the total cost is subtracted from the estimated rewards and what is left over is recognized as benefit [5]. The more costs are limited, and the more savings are generated, the greater the final value of the benefits is going to be. In construction project it helps in the analysis of choosing the best cost options presented.

Data collection is important for risk and historical records; it helps create an information structure that can help predict and predefine certain trends. The importance of knowing this information is that it provides the security of mitigating risks in the progress of a project. Risk will always exist and may not be controllable, for example the volatility in the market with construction materials cannot be controlled, but it can be measured and with this information, management can plan budgets that counteract risks [6].

METHODOLOGY

Kaizen

By brainstorming a list of ideas was generated when interviewing the client, Table 1 presents the brainstormed ideas and the relation they have with each category.

Table 1
Initial Ideas Brainstorming

Item	Ideas	Relation Category
1	Roof Reconditioning	Structure
2	Wall cracks fix	Structure
3	Paint Work	Structure
4	Patio cleanup	Yard
5	Electrical Safety	Electrical
6	Kitchen Modernization	Kitchen
7	Guest Rooms	Furniture

To complete the task, it was necessary to collect information of what was expected as the final product of the structure and for this the list of ideas establish a baseline of the focus areas. Because so many ideas were presented, a category system was created, and each idea was paired with their respective category. Table 2 presents the Cost Allocation Categories that were defined and the budget per development area.

Table 2
Cost Allocation Category

Item	Category	Budget
1	Furniture	$18,000.00
2	Structure	$17,000.00
3	Kitchen	$7,000.00
4	Electrical	$4,000.00
5	Yard	$4,000.00

Roof Measurements

The roof material estimated was performed by measuring the length and width of the roof, basic mathematics was implemented and used coating material formula for product estimation, Figure 1 presents a top view of the roof measurements. Equation (1) performs the mathematical expression for the area estimation. Roof measurements were L= 66'and W=26', for a total area of 1,716 square feet.

$$A = LxW \quad (1)$$

Figure 1
Roof Top

Research Cost Data

Data research in cost material for structural work was performed, the research recollected the cost of each material from the three principal suppliers: Home Depot, ACE Hardware, National Lumber and Hardware and included a proposal by Private Contractor. The materials were analyzed, and the considered parameters were cost and quality.

Organize and Compare Cost Data

Using Microsoft Excel program Table 3 was developed to present the overall data comparison from each mayor supplier and the description of the structural areas worked.

Table 3
Compare Cost Data

Item	Area of Work	Home Depot	ACE	National	Contr.
1	Roof	$1,691	$1,514.	$1,611	$1,480
2	Windows and Doors	$8,685	$8,893	$7,029	$8,360
3	Paint	$2,228	$2,036	$1,753	$2,304
4	Walls	$2,000	$2,000	$2,000	$2,519
5	A/C Patching	$931	$921	$933	$921

Option Package Selection

The research of all construction materials has been completed, the option package determined the best cost reduction option and provided the best highest benefit provider.

Costs Tiers Organization

A three-level tier analysis was developed, group A is the high importance and need strict management, group B are significant but need moderate control, and the third level are less significant may be less controlled or neglected based on functionality, Table 4 presents the ABC Tier level distribution.

Table 4
ABC Tier Level Distribution

Item	Category	Tier
1	Furniture	A
2	Structure	A
3	Kitchen	B
4	Electrical	A
5	Yard	C

Budget Review

Budget analysis for the incurred cost versus the balanced budget was performed. Each option was evaluated against the estimated and the expected

values for each category. Man, hours labor was accounted into fixed cost were the weekly rates weas provided by the contractor and only the constructions materials, furniture, tools and home appliances were the variable component. Materials were dependent on the supplier and or available sales.

Analysis of Overhead

Any cost that was not consider at the beginning of the project was reviewed, construction materials were identified by the task or area of work, Tier B and Tier C materials, were address as the implementation of Tier A was in process, this way over head was not impacting Tier A materials. Risk analysis supported the overhead mitigation and elimination.

RESULTS

Cost Analysis Tables and Graphs Discussion

Figure 2 provides a direct comparison for each option package. Budget was limited to $50,000 and at least a 5% of saving was targeted in the project planification, meaning that the minimum desire saving cannot be less than $2,500, while Figure 3 provides the graph comparison of the total savings per Option Package. All four options complied with the minimum savings of 5%.

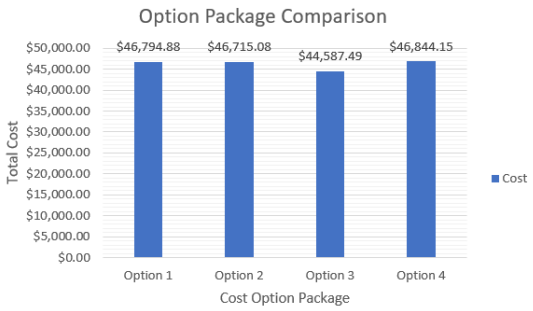

Figure 2
Option Package Comparison Graph

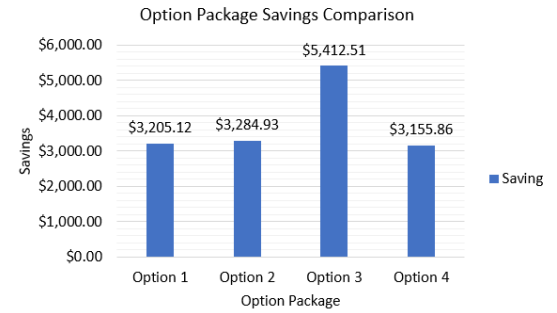

Figure 3
Option Package Savings Comparison

CONCLUSION

The cost analysis turned out to be successful, the data collected allowed a direct comparison between four options. The options presented were a combination of materials and components that could be purchased from Home Depot, ACE Hardware, National Lumber and Hardware suppliers. Within the analysis, the best possible economic option and the best possible quality option were taken into consideration. As established in the plan, the two best options were presented, these were Option Number 3 and option Number 4. Option Number 3 presents the best results in terms of economic savings and with the minimum cost that impacts the budget. While Option Number 4, although it is not the option with the best economic savings in materials, is part of a proposal from a private contractor, who agreed to purchase the materials established by the project cost analysis. The final decision made was to accept Option Number 4 offered by the private contractor who provided the complete service and bought all the materials needed per task. The contractor offered a warranty for his job and guaranteed the best practices with high fidelity to his service.

REFERENCES

[1] Law Insider. Definition Material Construction. [Dictionary]. Available https://www.lawinsider.com/dictionary/construction-material

[2] EHS University of Michigan. Definition of EHS in Construction. (Dictionary). Available https://ehs.umich.edu/construction-projects/

[3] PlanRadar. (2021, 03, 25). Quality assurance in construction: 5 golden rules. [Article]. Available https://www.planradar.com/us/quality-assurance-in-construction-5-golden-rules-saving-money/#:~:text=Quality%20assurance%20is%20a%20method,all%20decisions%20meet%20these%20standards.

[4] Akhilesh Ganti. (2024, 04, 26). What is a Budget? Plus 11 Budgeting Myth Holdings You Back. [Article]. Available https://www.investopedia.com/terms/b/budget.asp

[5] Adam Hayes. (2024, 02, 26). What Is Cost-Benefit Analysis, How Is it Used, What Are its Pros and Cons? [Article]. Available https://www.investopedia.com/terms/c/cost-benefitanalysis.asp

[6] CFI Team. Risk Management. [Article]. Available https://corporatefinanceinstitute.com/resources/career-map/sell-side/risk-management/risk-management/