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Optimizing Project Management: Planning, Scheduling, and Cost Estimation Using Microsoft Project

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Abstract

Event or activity management is done with computer-based software built especially for planning and secluding, such Primavera, Microsoft Excel, and Microsoft Project. The MS project's scheduling and organization are the goals of this study. Software of this type is easier to use and more efficient than manual methods. Although this program is based on manual approaches, it is more accurate and takes less time. Scheduling should be created for this investigation. The project case study focuses on the planning and scheduling of residential construction. In this instance, a two-story, 200-square-meter residential building in Baghdad/Abi Ghraib, Iraq, was selected. A work schedule should be created in the Microsoft project from excavation to completion, alerting the crucial path. Every task and piece of material should have its resources allocated. The MS project should include a calculation of the material and labor costs. According to this study, the scheduling and Planning benefits should be clarified. This study aims to investigate and inform the appropriate planning and selection for project management using Microsoft Project. It will also inform the budget, material, time, and deadline.

Keywords: cost management; Microsoft Project 2021; project planning; scheduling techniques.

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1. Introduction

To meet project requirements, project management entails applying knowledge, skills, and operational methodologies to project activities (Al-Zwainy and Al-Marsomi, 2016). The ability of companies to achieve something successfully, allowing them to align project outputs with organizational goals and improve their market competitiveness, is linked to a goal-achieving strategy (Othman, 2006) (Jaber et al, 2020). Additionally, it can be described as organizing, planning, and managing important resources, procedures, and standards of conduct to (achieve or attain with effort) certain goals in scientific or everyday situations (Anantatmula, 2010). A project is a short-term endeavor that aims to create a unique product, service, or outcome with a defined beginning and end (usually time-held back) and frequently involves withholding funds or providing funds (to) or other items that may be used to achieve odd goals, which are typically intended to bring about complete change or significant value (Project Management Institute, 2021). In contrast to business as usual (or operations), which are recurring, permanent, or semi-permanent functional activities to create goods or services, projects are only temporary in nature (Hoang & Shrestha, 2014) (Jasim et al, 2021). It has always been practiced (revealing a small corner in a casual manner), but in the middle of the 20th century, it began to evolve (and improve) as a popular career path. In reality, these two systems' management is frequently rather distinct and clear,

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necessitating the formation of both management (success plan/methods of achieving goals) and various branching out into diverse abilities to perform specific job-related tasks (Prajna & Geena, 2022) (Hameed and Al-Zwainy, 2022).

2. Research Methods

In this study, a multi-story residential building that was constructed utilizing traditional techniques was taken into consideration. The study focuses on the resources, time, and cost management used to carry out the project. The data extracted from the construction site is called Plan A: Conventional Execution Approach.

This section (Plan A) presents the actual data collected from the construction site before the implementation of Microsoft Project planning (Plan A). The construction of the two-story, 200-square-meter residential building in Baghdad, Abi Ghraib was originally carried out using traditional planning methods based on manual scheduling and tracking. The total duration was approximately 210 days, due to multiple unplanned delays in material supply and labor availability. Project costs reached an estimated $78,500, which included penalties for delayed tasks and inefficient resource utilization. Manual tracking caused overlapping of several activities and inefficient workforce allocation. The absence of a centralized planning tool led to difficulties in visualizing the timeline and dependencies among tasks.

The same multi-story building was the subject of another planning and scheduling analysis using project management methods and skills and M. S. Project software. To compare this to plan A, which is the conventional execution strategy, it was done. Plan B-Project Management was the title of the resulting analysis.

2.1. Case study

The project case study focuses on the scheduling and planning of a residential building. In this instance, a two-story, 200-square-meter residential building in Baghdad, Abi Ghraib, Iraq, was selected. Plans, drawings, site information, and other materials were used to accomplish the project's goals. Type of structure: residential building with a ground structure made of Reinforced Cement Concrete (RCC).

2.2. Data Collection

A house construction project has a project plan that outlines the primary and supporting tasks as follows: Stage One: Foundation (Excavation-Construction), then, Completing Stage (Plumbing, Electrical, Flooring, Painting), finally, Stage of Interior Furnishing (Furniture Purchasing and Selection). A project plan has been developed for a house construction project, as shown in Figure 1.

2.3. Resource Allocation

The overall project's resource demand curve will be calculated using the resources utilized for each task, the percentage of resources used for each task, the schedule, cost, and effort, the resources in the table by each individual work unit, and automatic resource balancing (Szwarcfiter et al., 2023). As a result, it is simple to compute the objective and subtask flow working strength, change the time frame in "resources use situations," and configure people and costs autonomously according to mission (Aldhamad et al, 2024). The resources refer to the supplies, labor, or consumables required to complete the project's obligations (Jaber et al, 2019). They also outline how much money will be spent on project materials (Pheng, 2018). Resources can be useful in the following ways:

1) Resources can assist in the following ways. It helps to increase the precision of a project. MSP 2021 will take into account the project schedule, task dependencies, and length if "Automatic Scheduling" is selected, and an exact project model will be created. After allocating resources to the project, MSP 2021 adds working time and resource availability to the anticipated timeline (Al-Marsomi, and Al-Zwainy, 2023).
2) It also alerts us well in advance of any under-allocated tasks or instances of resource overloading during the project. Later on, as work is completed, information regarding task progress can be generated, and it will be feasible to assess whether any new under- or over-allocation is required (Devana et al., 2019).
3) It can also assist in monitoring the project's advancement based on resource utilization. Additionally, it can show how much time a resource has already spent or will require; this information will be useful for making any necessary adjustments to keep the project on track. Real progress data that can be utilized as historical data for upcoming projects will also be usefully captured (Harshavardhan et al., 2023).
4) It facilitates the documentation of project expenses, material consumption, and utilization (Jasim et al, 2020).
5) This will help guarantee that budget performance is regularly tracked and record supplies are ordered in advance (Rana et al, 2013).
6) It will ensure that proper resources are allocated and nothing is ignored (Hameed and Al-Zwainy, 2022).

7) It is great for tracking some of the most significant project expenses, such as labor, material, equipment, and transportation costs (Raheem and Al-Zwainy, 2020).

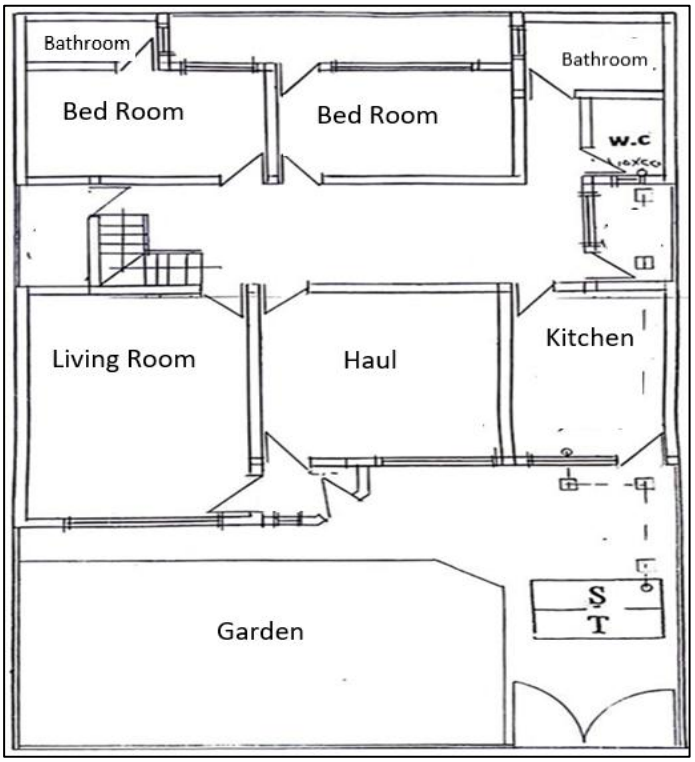


Fig. 1. House Outline

The jobs can be given the following kinds of resources (Muthusamy et al., 2021):

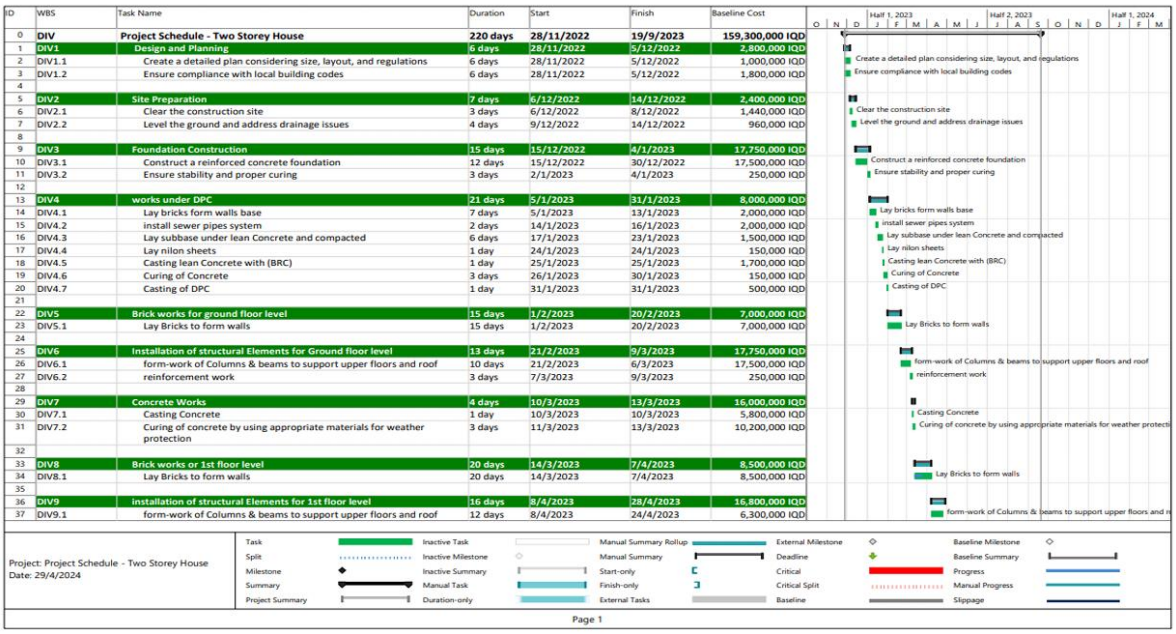
1) Work Resources: these comprise personnel or equipment.
2) Material Resources: consumable materials are included in this category.
3) Cost Resources: these comprise the price of the supplies or consumables needed to complete a task.

2.4. Project Gantt Chart

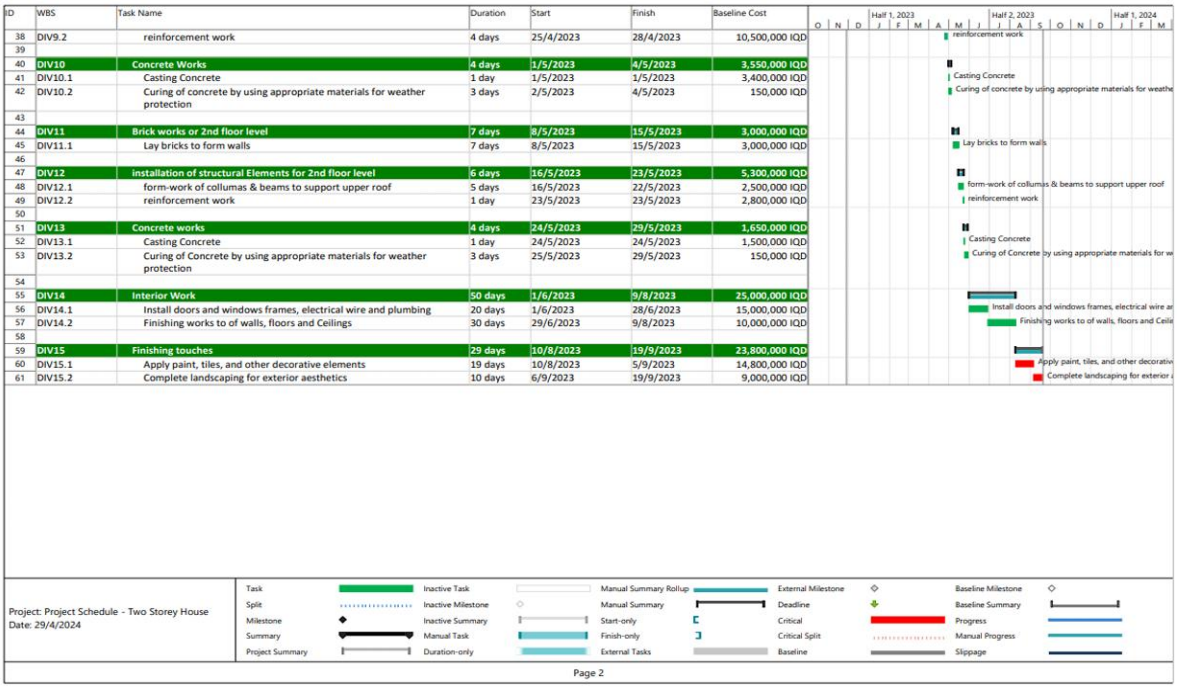
A bar chart that displays the tasks planned for a project across time is called a Gantt chart (Aldhamad et al, 2025). A Gantt chart is a useful tool for project planning since it shows the tasks that are anticipated to be finished on specific days (Al-Zwainy et al, 2018). It helps team members and project managers view the beginning, ending, and milestone dates of a project timeline in a simple stacked bar chart (Danijela & Davorin, 2013). Figure 2 shows scheduling using the Gannt chart.

2.5. Critical Path and Critical Tasks

To optimize the project plan, the critical path must be identified. It is commonly understood that any modifications to the critical path may have an impact on the project's budget, scope, and resources, as well as its completion timetable (Alazawy et al, 2024). As a result, it is critical to employ appropriate and relevant approaches for determining each project's essential path and important activities. Table 1 and Figure 3 show how we calculated the critical path for this project using the CPM and PERT techniques.



ID	WBS	Task Name	Duration	Start	Finish	Baseline Cost
0	DIV	Project Schedule - Two Storey House	220 days	28/11/2022	19/9/2023	159,300,000 IQD
1	DIV1	Design and Planning	6 days	28/11/2022	5/12/2022	2,800,000 IQD
2	DIV1.1	Create a detailed plan considering size, layout, and regulations	6 days	28/11/2022	5/12/2022	1,000,000 IQD
3	DIV1.2	Ensure compliance with local building codes	6 days	28/11/2022	5/12/2022	1,800,000 IQD
4						
5	DIV2	Site Preparation	7 days	6/12/2022	14/12/2022	2,400,000 IQD
6	DIV2.1	Clear the construction site	3 days	6/12/2022	8/12/2022	1,440,000 IQD
7	DIV2.2	Level the ground and address drainage issues	4 days	9/12/2022	14/12/2022	960,000 IQD
8						
9	DIV3	Foundation Construction	15 days	15/12/2022	4/1/2023	17,750,000 IQD
10	DIV3.1	Construct a reinforced concrete foundation	12 days	15/12/2022	30/12/2022	17,500,000 IQD
11	DIV3.2	Ensure stability and proper curing	3 days	2/1/2023	4/1/2023	250,000 IQD
12						
13	DIV4	works under DPC	21 days	5/1/2023	31/1/2023	8,000,000 IQD
14	DIV4.1	Lay bricks form walls base	7 days	5/1/2023	13/1/2023	2,000,000 IQD
15	DIV4.2	install sewer pipes system	2 days	14/1/2023	16/1/2023	2,000,000 IQD
16	DIV4.3	Lay subbase under lean Concrete and compacted	6 days	17/1/2023	23/1/2023	1,500,000 IQD
17	DIV4.4	Lay nilon sheets	1 day	24/1/2023	24/1/2023	150,000 IQD
18	DIV4.5	Casting lean Concrete with (BRC)	1 day	25/1/2023	25/1/2023	1,700,000 IQD
19	DIV4.6	Curing of Concrete	3 days	26/1/2023	30/1/2023	150,000 IQD
20	DIV4.7	Casting of DPC	1 day	31/1/2023	31/1/2023	500,000 IQD
21						
22	DIV5	Brick works for ground floor level	15 days	1/2/2023	20/2/2023	7,000,000 IQD
23	DIV5.1	Lay Bricks to form walls	15 days	1/2/2023	20/2/2023	7,000,000 IQD
24						
25	DIV6	Installation of structural Elements for Ground floor level	13 days	21/2/2023	9/3/2023	17,750,000 IQD
26	DIV6.1	form-work of Columns & beams to support upper floors and roof	10 days	21/2/2023	6/3/2023	17,500,000 IQD
27	DIV6.2	reinforcement work	3 days	7/3/2023	9/3/2023	250,000 IQD
28						
29	DIV7	Concrete Works	4 days	10/3/2023	13/3/2023	16,000,000 IQD
30	DIV7.1	Casting Concrete	1 day	10/3/2023	10/3/2023	5,800,000 IQD
31	DIV7.2	Curing of concrete by using appropriate materials for weather protection	3 days	11/3/2023	13/3/2023	10,200,000 IQD
32						
33	DIV8	Brick works or 1st floor level	20 days	14/3/2023	7/4/2023	8,500,000 IQD
34	DIV8.1	Lay Bricks to form walls	20 days	14/3/2023	7/4/2023	8,500,000 IQD
35						
36	DIV9	installation of structural Elements for 1st floor level	16 days	8/4/2023	28/4/2023	16,800,000 IQD
37	DIV9.1	form-work of Columns & beams to support upper floors and roof	12 days	8/4/2023	24/4/2023	6,300,000 IQD



ID	WBS	Task Name	Duration	Start	Finish	Baseline Cost
38	DIV9.2	reinforcement work	4 days	25/4/2023	28/4/2023	10,500,000 IQD
39						
40	DIV10	Concrete Works	4 days	1/5/2023	4/5/2023	3,550,000 IQD
41	DIV10.1	Casting Concrete	1 day	1/5/2023	1/5/2023	3,400,000 IQD
42	DIV10.2	Curing of concrete by using appropriate materials for weather protection	3 days	2/5/2023	4/5/2023	150,000 IQD
43						
44	DIV11	Brick works or 2nd floor level	7 days	8/5/2023	15/5/2023	3,000,000 IQD
45	DIV11.1	Lay bricks to form walls	7 days	8/5/2023	15/5/2023	3,000,000 IQD
46						
47	DIV12	installation of structural Elements for 2nd floor level	6 days	16/5/2023	23/5/2023	5,300,000 IQD
48	DIV12.1	form-work of collumas & beams to support upper roof	5 days	16/5/2023	22/5/2023	2,500,000 IQD
49	DIV12.2	reinforcement work	1 day	23/5/2023	23/5/2023	2,800,000 IQD
50						
51	DIV13	Concrete works	4 days	24/5/2023	29/5/2023	1,650,000 IQD
52	DIV13.1	Casting Concrete	1 day	24/5/2023	24/5/2023	1,500,000 IQD
53	DIV13.2	Curing of Concrete by using appropriate materials for weather protection	3 days	25/5/2023	29/5/2023	150,000 IQD
54						
55	DIV14	Interior Work	50 days	1/6/2023	9/8/2023	25,000,000 IQD
56	DIV14.1	Install doors and windows frames, electrical wire and plumbing	20 days	1/6/2023	28/6/2023	15,000,000 IQD
57	DIV14.2	Finishing works to of walls, floors and Ceilings	30 days	29/6/2023	9/8/2023	10,000,000 IQD
58						
59	DIV15	Finishing touches	29 days	10/8/2023	19/9/2023	23,800,000 IQD
60	DIV15.1	Apply paint, tiles, and other decorative elements	19 days	10/8/2023	5/9/2023	14,800,000 IQD
61	DIV15.2	Complete landscaping for exterior aesthetics	10 days	6/9/2023	19/9/2023	9,000,000 IQD

Fig. 2. Gannt Chart by MS Projects

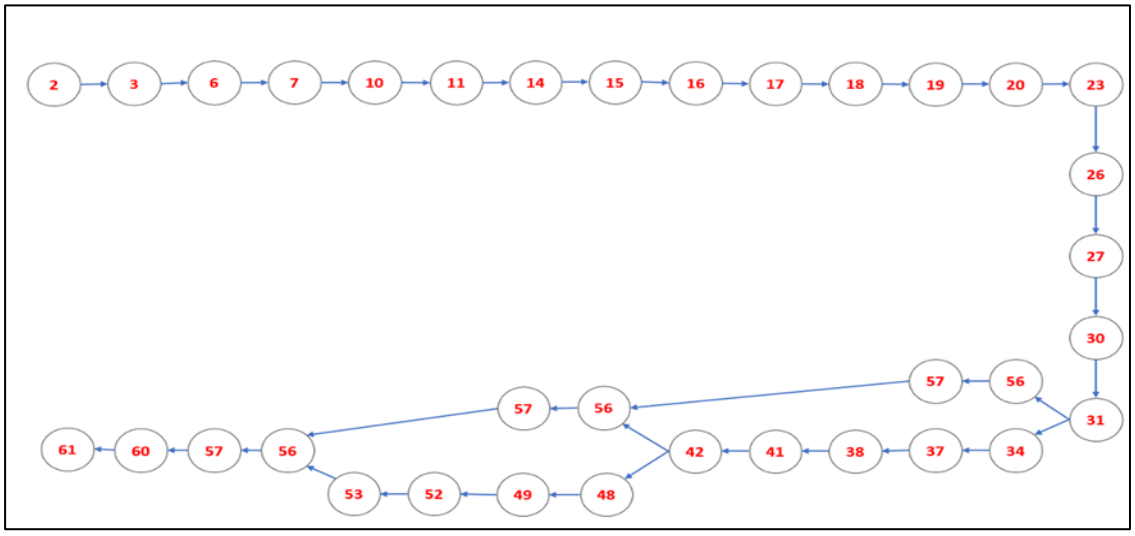


Fig. 3. PERT Chart steps

Table 1. PERT Method Calculations

No.	Activity	To	Tp	Tm	Te	Variance
1	Create a detailed plan considering size, layout, and regulations	5	6	7	6.5	0.02777
2	Ensure compliance with local building codes	5	6	7	6.5	0.02777
3	Clear the construction site	2	3	4	3.5	0.02777
4	Level the ground and address drainage issues	3	4	5	4.5	0.02777
5	Construct a reinforced concrete foundation	11	12	13	12.5	0.02777
6	Ensure stability and proper curing	2	3	4	3.5	0.02777
7	Lay bricks form walls base	6	7	8	7.5	0.02777
8	Install sewer pipes system	1	2	3	2.5	0.02777
9	Lay subbase under lean concrete and compacted	5	6	7	6.5	0.02777
10	Lay nylon sheets	0	1	2	1.5	0.02777
11	Casting lean concrete with (BRC)	0	1	2	1.5	0.02777
12	Curing of concrete	2	3	4	3.5	0.02777
13	Casting of DPC	0	1	2	1.5	0.02777
14	Lay bricks to form walls	14	15	16	15.5	0.02777
15	Formwork of columns & beams to support upper floors and roof	9	10	11	10.5	0.02777
16	Reinforcement work	2	3	4	3.5	0.02777
17	Casting concrete	0	1	2	1.5	0.02777
18	Curing of concrete by using appropriate materials for weather protection	2	3	4	3.5	0.02777
19	Lay bricks to form walls	19	20	21	20.5	0.02777
20	Formwork of columns & beams to support upper floors and roof	11	12	13	12.5	0.02777
21	Reinforcement work	3	4	5	4.5	0.02777
22	Casting concrete	0	1	2	1.5	0.02777
23	Curing of concrete by using appropriate materials for weather protection	2	3	4	3.5	0.02777
24	Lay bricks to form walls	6	7	8	7.5	0.02777
25	Formwork of columns & beams to support upper roof	4	5	6	5.5	0.02777
26	Reinforcement work	0	1	2	1.5	0.02777
27	Casting concrete	0	1	2	1.5	0.02777
28	Curing of concrete by using appropriate materials for weather protection	2	3	4	3.5	0.02777

No.	Activity	To	Tp	Tm	Te	Variance
29	Install doors and windows frames, electrical wire and plumbing	19	20	21	20.5	0.02777
30	Finishing works of walls, floors and ceilings	29	30	31	30.5	0.02777
31	Apply paint, tiles, and other decorative elements	18	19	20	19.5	0.02777
32	Complete landscaping for exterior aesthetics	9	10	11	10.5	0.02777
	Sum	191	223	246	239	0.88864

3. Results and Discussion

These findings demonstrate that Microsoft Project not only reduces project duration but also improves cost efficiency and planning clarity.

1) Tracking Accuracy: Plan A lacked real-time tracking, while Plan B benefited from visual dashboards and Gantt charts provided by MS Project.
2) Delay Impact: Plan A experienced multiple delays due to poor visibility of dependencies and resource conflicts. In contrast, Plan B used CPM and resource leveling to avoid such conflicts.
3) Estimated Total Cost: Plan A cost around $78,500, while Plan B was reduced to $72,000 due to better planning and resource allocation.
4) Total Duration: Plan A took approximately 210 days, while Plan B completed in 188 days.

Key comparative findings include: Plan A relied entirely on manual tracking methods, which resulted in a longer project duration and inefficient resource utilization. To enhance the study's practical relevance, a comparison was drawn between the traditional execution plan (Plan A) and the project management approach using Microsoft Project (Plan B).

In project management, experience is crucial, but it is only one component of the resources needed. Time is particularly limited in large-scale scientific research initiatives, which frequently involve a lot of senate grinds (Abbas and Al-Zwainy, 2024). It will typically take a lot of time and be difficult to accomplish goals if the strategy and repeated calculations are done solely based on personal experience. When managing a project, use project management technology to perform comprehensive management (QaraMohammed and Al-Zwainy, 2021). Additionally, it includes features like timeliness, speed, accuracy, and convenience. In any case, manual labor alone simply cannot compete with it. Project must will, therefore, be widely utilized due to its important function in project management and its features of being easy to track and modify and simple to operate (Varouqa et al, 2025). For material and labor planning and scheduling, we used Microsoft software, which provides us with a concise overview of the construction project's operations, including their start and end times, material and manpower requirements, and project duration (Al-Zwainy, 2018)). It has done CPM and PERT analysis for planning.

- From the PERT chart, Tp=188 days
- X=√Variance = √0.88864 =0.943
- Te=191 days (The probability of completion of the project in 191 days)
- Z=(Te-Tp)/σ = (191-188)/0.943 = 3.18
- from Table , x=0.4993
- *Probability = 0.4993+0.5 = 99.9%,
  - If the probability is 90%, the project duration;
- Z=(Te-Tp)/σ 1.3=(Te-188)/0.943
- Te=189 days

The outcome of our planning indicates that this project will be completed in about six months and 27 days; it also highlights the essential activities and critical route duration needed to complete some activities, which are longer than the software result. Which suggests that certain activities are postponed. After allocating resources for the personnel, materials, and activities that are causing the project to be delayed, we used software to determine how long it would take to finish. After that, the results from the software and the real site were compared.

4. Conclusion

The study aims to determine how much easier and more effective this kind of software is than manual techniques for the planning and scheduling of the MS project. Though it is less accurate and time-consuming than manual approaches, this program is essentially based on them, the following points are concluded:

- MS Project is an effective tool for project planning and scheduling.
- MS Project increases workplace efficiency and streamlines the decision-making process.
- Microsoft Project is easy to use and manage.
- A project can be finished on schedule and within the allocated budget with the aid of Microsoft Project.
- It can employ several easily comprehensible graphical representations, charts, and perspectives.
- With MS Project, can be managed the project's budget and timeline

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