

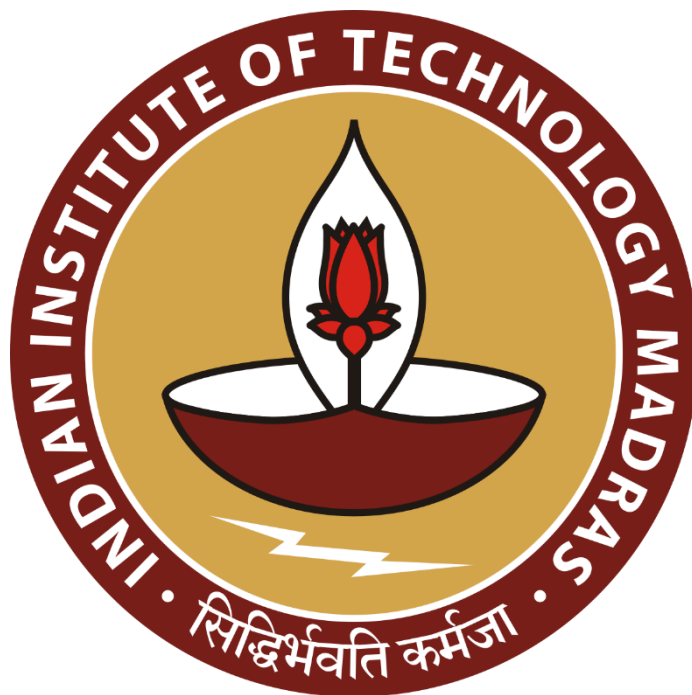
# **Streamlining Project Deadlines and Resource Allocation in a Competitive Construction Market**

**A Mid-term report for the BDM capstone Project**

Submitted by

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# 1. Executive Summary

Mohra Construction Company, based in Riyadh, specializes in residential and commercial projects, aiming for high-quality, timely delivery. This report addresses challenges related to project delays, resource optimization, and client retention, with a focus on improving operational efficiency and market competitiveness.

The analysis utilized key metadata, including project durations, revenue, and client data, collected and structured into a comprehensive dataset. Descriptive statistics highlighted trends and anomalies, such as variability in project durations and uneven client profitability. Predictive modeling, through regression analysis, was applied to estimate project timelines and resource utilization. Key formulas, such as Critical Path Method (CPM) and Customer Lifetime Value (CLV), were incorporated to identify areas for improvement.

Findings revealed that resource allocation inefficiencies and delays significantly impacted profitability. High-value repeat clients were identified through segmentation and profitability analysis, suggesting strategic targeting opportunities. Recommendations include streamlined scheduling, improved client management, and prioritization of profitable client segments to enhance retention and growth.

This mid-term report analyzes the primary challenges and opportunities facing Mohra Construction Company and provides targeted recommendations to improve project management, client relations, and market competitiveness. The report's objectives focus on reducing project delays, enhancing competitiveness, and strengthening client retention. Quantitative analysis was performed using Python and Power BI to visualize trends, while interviews provided qualitative insights on client expectations and resource challenges. By addressing inefficiencies in project execution and resource allocation, Mohra can improve operational efficiency, secure larger projects, and retain high-value clients. A comprehensive approach can ensure that Mohra is positioned to enhance both profitability and market share in the competitive construction industry.

## 2. Proof of Originality of the Data

Mohra Limited Company is a construction firm specializing in residential and commercial projects, including new builds, renovations, and remodeling. The business owner utilizes invoice collection as the primary method for recording data.

The proof of data can be accessed through the following Drive link: [📁 Proof of Originality](#)

1. Letter from organization

**Mohrah Company Limited**

C.R. 1131025603

VAT No. 311176412100003



**شركة مهرة المحدودة**

س.ت. ١١٣١٠٢٥٦٠٣

الرقم الضريبي: ٣١١١٧٦٤١٢١٠٠٠٠٣

MOHRA COMPANY LIMITED

Date:08-10-2024

Riyadh, Saudi Arabia

To Whom It May Concern,

This letter confirms that Mohra Company Limited has agreed to collaborate with Eram Nishat on a business data management project. After discussions and reviewing the project scope, we have provided Eram access to our business data to assist in conducting a thorough analysis.

The project will involve data analysis aimed at delivering actionable insights and recommendations that could enhance our operational efficiency. We are confident in Eram's professional approach and look forward to hearing your findings.

Sincerely,



Abdullah Ibrahim Al Sallal  
General Manager  
Mohra Company Limited

ص.ب ٤٨٦٣ - الرمز البريدي ١٢٨٦٥ - شارع عبدالله بن محمود - حي الفاروق - الرياض - المملكة العربية السعودية - جوال: ٠٥٠٨٢٩٧٩٣٧  
P.O. Box 4863, Postal Code 12865 - Abdullah Bin Mahmoud Street - Al-Farouq District - Riyadh - Kingdom of Saudi Arabia - Mobile: 0508297937

Figure 1: Letter of Collaboration from Mohra Company Limited

2. Images of the firm/servicescape
3. A short video interacting with the general manager

### 3. Metadata

**Disclaimer:** Due to the nature of the construction industry, the data obtained contains a limited number of records, as fewer high-value projects contribute to invoice revenues. Consequently, the quantitative analysis was performed on limited data, supplemented by qualitative insights from interviews conducted to enhance the completeness of the analysis.

#### 3.1 File: mohra\_invoice

- Description: Contains a collection of invoices issued to clients for projects with Mohra.
- Data Length: 7 months
- Date Range: 22 March 2024 - 25 September 2024
- Number of Records: 15

*Table 1: Metadata for the mohra\_invoice dataset, detailing invoice-specific information such as client names, project descriptions, billing amounts, and related order details. This data aids in tracking client invoicing, payment timelines, and revenue sources.*

Column Name	Data Type	Description	Example Value
Invoice #	String	Unique identifier for each invoice issued to clients.	INV-000001
Client Name	String	Name of the client associated with the invoice.	Saudi Plastic Factory Co.
Invoice Date	Date	Date when the invoice was issued.	22-Mar-24
Total Amount (SAR)	Float	Total amount billed to the client in SAR (Saudi Riyals) for the invoice.	103,097.50
Item & Description	String	Description or type of project (e.g., renovation, installation) for which the invoice was issued.	Villa fitout renovation

#### 3.2 File: mohra\_month

- Description: Includes monthly revenue data.
- Data Length: 7 months
- Date Range: 22 March 2024 - 25 September 2024
- Number of Records: 6

Table 2: Metadata for the mohra\_month dataset, summarizing monthly financial and project performance metrics. This data supports monthly performance analysis and helps identify trends in profitability and project efficiency.

Column Name	Data Type	Description	Example Value
Month	Date	The month and year the data refers to, typically represented by the first day of the month.	Apr-24
Total Revenue (SAR)	Float	Total revenue generated in the respective month in SAR.	140,806.00

### 3.3 File: mohra\_profit

- Description: Contains profit records derived from invoice data and cost records obtained through verbal interviews.
- Data Length: 7 months
- Date Range: 22 March 2024 - 25 September 2024
- Number of Records: 9

Table 3: Metadata for the mohra\_profit dataset, capturing project-specific financials such as revenue, costs, profit margins, and project durations. This data is essential for understanding client profitability, project timelines, and resource allocation efficiency.

Column Name	Data Type	Description	Example Value
Client Name	String	Name of the client associated with the project or profit record.	New Rabwa Real Estate Company
Total Revenue (SAR)	Float	Total revenue generated from the project in SAR.	698916.62
No. of Orders	Integer	Number of individual orders included in the invoice from a client.	2

Column Name	Data Type	Description	Example Value
Total Cost (SAR)	Float	Total cost incurred for the project in SAR.	18033.84
Profit (SAR)	Float	Total profit generated from the project, calculated as revenue minus cost.	25146.68
Gross Profit Margin (%)	Integer	Profit margin for the project, calculated as (Profit / Total Revenue) * 100.	12
Duration of Work (Days)	Integer	Total duration in days taken to complete the project.	45

## 4. Descriptive Statistics

### 3.1 File: mohra\_invoice

Table 4: Descriptive Statistics for Total Amount (SAR) in mohra\_invoice Dataset

This table summarizes key statistics for the "Total Amount (SAR)" column in the mohra\_invoice dataset. It provides insights into the count, mean, standard deviation, minimum, maximum, and quartile values (25th, 50th, and 75th percentiles), highlighting the distribution and variability of invoiced amounts.

Statistics	Total Amount (SAR)
Count	15
Mean	120,365.7
Standard Deviation	182831.07
Minimum	10,350
Maximum	625,416
25th Percentile (Q1)	20539
Median (Q2)	58,500.62
75th Percentile (Q3)	100570.37

### Categorical Summary:

- Count of unique clients: 9
- Most frequent client: United National Electromechanical Co

### 3.2 File: mohra\_month

Table 5: Descriptive Statistics for Total Revenue (SAR) in mohra\_month Dataset

This table presents descriptive statistics for the "Total Revenue (SAR)" column in the mohra\_month dataset, showcasing the count, mean, standard deviation, minimum, maximum, and quartile values (25th, 50th, and 75th percentiles). These metrics provide insights into monthly revenue variability and distribution.

Statistics	Total Revenue (SAR)
Count	6
Mean	296,889.25
Standard Deviation	462868.59
Minimum	20,585
Maximum	1,217,805.73
25th Percentile (Q1)	40122
Median (Q2)	105,765.5
75th Percentile (Q3)	261,321.06

### 3.3 File: mohra\_profit

Table 6: Descriptive Statistics for Financial and Project Metrics in mohra\_profit Dataset

This table provides a statistical summary of key metrics in the mohra\_profit dataset, including Total Revenue, No. of Orders, Total Cost, Profit, Gross Profit Margin, and Duration of Work. The table shows the count, mean, standard deviation, minimum, maximum, and quartile values, offering insights into project profitability and timeline variability.

Statistics	Total Revenue (SAR)	No. of Orders	Total Cost (SAR)	Profit (SAR)	Gross Profit Margin (%)	Duration of Work (Days)
Mean	200,609.5	2	174921.5	25687.99	12.33	31
Standard Deviation	233752.16	1	203402	30394.98	1.5	29



Statistics	Total Revenue (SAR)	No. of Orders	Total Cost (SAR)	Profit (SAR)	Gross Profit Margin (%)	Duration of Work (Days)
Minimum	20,493	1	18033.84	2459.16	9	4
Maximum	698,916.62	4	607190.76	91725.86	14	90
25th Percentile (Q1)	60375	1	52500	7875	12	14
Median (Q2)	103,097.5	1	91187.61	11909.89	12	22
75th Percentile (Q3)	180,357.13	2	155210.45	25146.68	13	30

## 5. Detailed Explanation of Analysis Process/Method

The analysis process for Mohra's data relies on a combination of quantitative analysis (focused on revenue, cost, and profit records) and qualitative analysis (through interviews) to build a comprehensive understanding of project performance and client profitability. This dual approach is particularly suitable for the construction domain, where project-specific insights and financial outcomes vary significantly due to the nature and scale of work.

Quantitative analysis was conducted on available **invoice data** to track monthly revenue, profit margins, and cost factors. The dataset includes a seven-month period of invoice and profit data, which is compact yet substantial enough to capture key financial metrics and client interactions. This data was collected from the business in alignment with the problem statement. The limited dataset length emphasizes the necessity of using Python, as it can handle smaller datasets effectively while applying complex analyses like regression.

Due to the limited number of records, qualitative analysis through **interviews** with stakeholders was integrated to address data gaps and provide additional insights. Interviews allowed for a better understanding of operational challenges, client expectations, and project-specific cost drivers that are not fully captured in quantitative data. This method enriched the quantitative findings, creating a holistic view of performance and helping justify certain costs or delays associated with large projects.

## Details on the analysis and methods used aligned with the problem statement and objectives:

To analyze **market competition**, a quantitative approach using client segmentation and profitability analysis based on the invoice data was employed. This involved calculating revenue and profit margins for each client type and project category. Additionally, using frequency distribution of high-value vs. low-value clients helped in identifying client clusters that were more profitable.

$$\text{Profit} = \text{Total Revenue} - \text{Total Cost}$$

$$\text{Gross Profit Margin (\%)} = \left( \frac{\text{Revenue} - \text{Cost of Goods Sold (COGS)}}{\text{Revenue}} \right) \times 100$$

Gross profit margins in the construction sector can vary based on factors such as project type, size, and market conditions. According to industry data, the average gross profit margin for construction companies is approximately **20%**.

To enhance market competitiveness by identifying high-value, repeat clients and optimizing resource allocation, client profitability was analyzed using profit margins, while repeat client frequency assessed loyalty. Metrics like resource costs and revenue trends by client segments were examined, alongside Client Lifetime Value (CLV), to prioritize valuable clients effectively.

$$\text{CLV} = (\text{Avg. Project Value} \times \text{Avg. No. of Projects per Client}) \times \text{Avg. Client Lifespan}$$

Average Project Value refers to the typical revenue earned from a single client project. Average Number of Projects per Client indicates how many projects a client undertakes with your company over a specific period. Average Client Lifespan measures the duration, in years, that a client continues to engage your services.

To strengthen client relationships and improve customer retention, retention rates were calculated to assess loyalty, while average revenue per client measured the financial value of relationships. Profit margin analysis identified whether repeat clients were also high-margin, guiding strategies to prioritize and retain the most valuable customers.

For the **project deadline** issue, analysis of project durations was applied, which included calculating average project durations and deviations. Regression analysis was employed to predict project completion timelines based on past data. Python libraries such as Pandas and Scikit-learn were used for these tasks, enabling efficient calculations and visualization of project scheduling data. Mathematical models assist in project scheduling, helping to allocate resources efficiently and adhere to timelines. Techniques like the Critical Path Method (CPM) were utilized to identify the sequence of crucial tasks that determine the project duration.

The analysis aimed to reduce project delays and improve deadline management. Average project duration and its standard deviation were calculated to assess baseline timelines and variability. High variability may indicate inconsistent scheduling or resource challenges. Resource allocation efficiency was analyzed using metrics like "No. of Orders" and "Total Cost (SAR)" to identify correlations between resource usage, costs, and delays. Construction

costs include Direct Costs (materials, labor, equipment), Indirect Costs (overheads, permits), Contingency Allowances for unforeseen expenses, and a Profit Margin added as a percentage to ensure project profitability.

$$Total\ Cost = (Direct\ Costs + Indirect\ Costs) \times (1 + Contingency\ \%) + Profit\ Margin$$

6. Results and Findings

Top 10 Profitable Projects by Gross Profit Margin (%) and Total Revenue

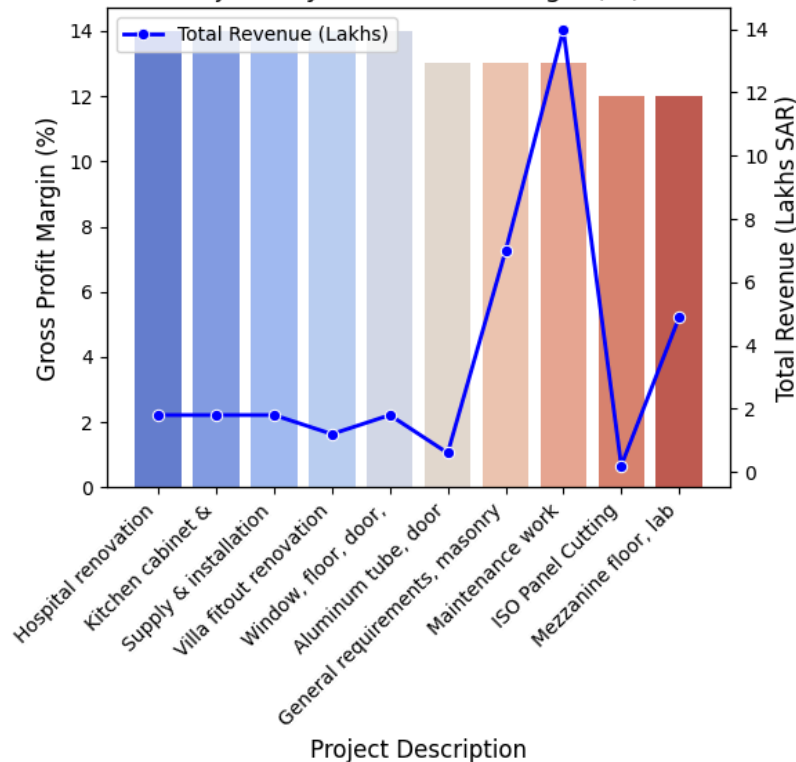


Figure 2: Top 10 Profitable Projects

Hospital renovation and villa fit-outs seem to be strong areas for Mohra to expand in, as they offer high returns while addressing more specialized, high-growth needs in the construction industry.

This chart highlights

projects like Maintenance Work which bring in high revenue but may not always correspond with the highest profit margins. Meanwhile, projects such as Hospital Renovation or Villa Fitout Renovation have more consistent profit margins, even if they generate lower overall revenue.

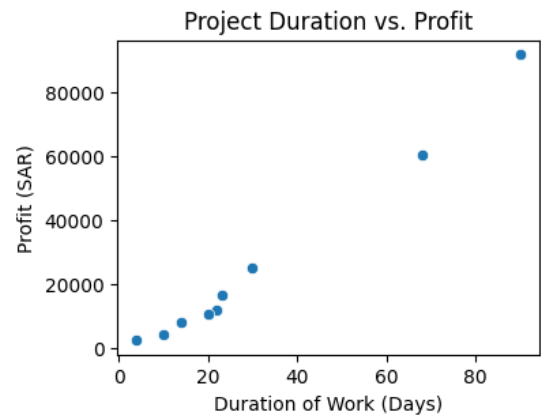


Figure 3: Project Duration vs. Profit

There is a clear correlation between the duration of a project and the profit generated, with longer-duration projects yielding higher profit.

This suggests that larger-scale, long-term projects are more profitable for Mohra. However, the complexity of these projects makes them prone to delays and resource inefficiencies.

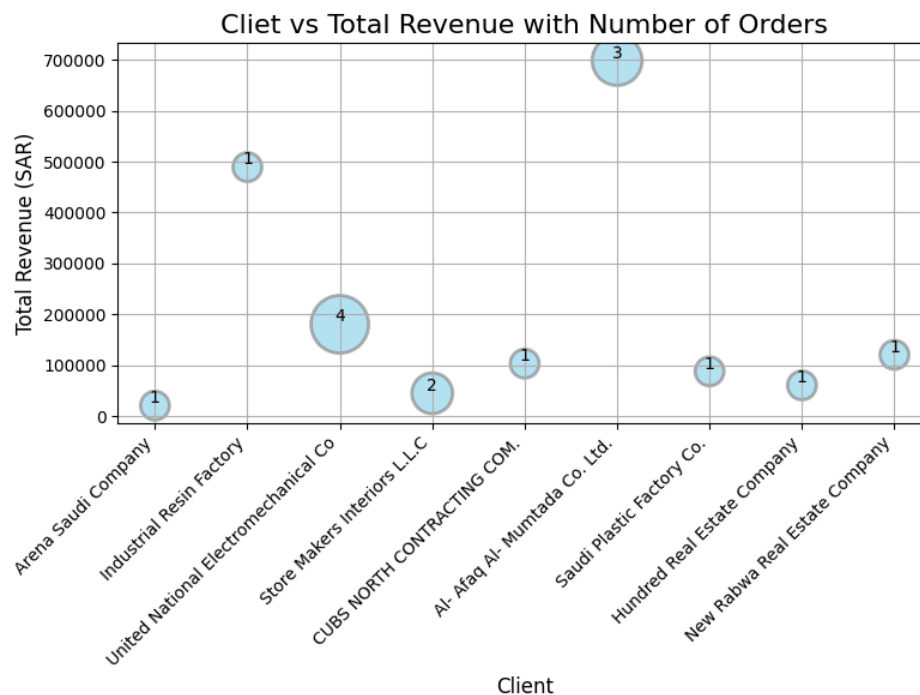


Figure 4: Client vs. Total Revenue with Number of Orders

Around 50% of revenue comes from repeat clients like United National

Electromechanical Co. and Al-Afaq Al-Mumtada Co. Ltd.

Clients like Industrial Resin Factory and New Rabwa Real Estate Company generate substantial revenue with very few orders (e.g., a single large project). While these clients can bring in high-value contracts, relying solely on them may lead to long gaps between projects.

In cases like United National Electromechanical Co. and Store Makers Interiors L.L.C., which have a higher number of orders but relatively lower total revenue compared to the top clients, it may indicate that the projects are frequent but smaller in scope. These clients might need smaller-scale but recurring services, which could strain resources without delivering high profits.