**Project Charter Document**



**Project Name :** Forecasting Inventory of pallet

**Department :** Optimization Supply Chain Management

**Focus Area :** Inventory Management

**Product/Process :** Steel Rods Inventory Management



**Prepared By**

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| --- | --- |
| **Document Owner(s)** | **Project/Organization Role** |
| Venkata Sai Daggupati | innodatatics – Internship |
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**Project Charter Version Control**

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| --- | --- | --- | --- |
| **Version** | **Date** | **Author** | **Change Description** |
| 1.0 | 26/03/2023 | Venkata Sai Daggupati | Document created |
| 2.0 | 29/03/2023 | Venkata Sai Daggupati | Updated Business Understand, overview of the project, and research on relevant projects. |
| 3.0 | 01/04/2023 | Venkata Sai Daggupati | Reference updated |
| 4.0 | 03/04/2023 | Venkata Sai Daggupati | Updated Project Architecture. Currently, working on Data Collection. Shared two articles with our team to get access. |
| 5.0 | 05/04/2023 | Venkata Sai Daggupati | Paid Articles request sent to our team. Researching for other sources to get the dataset. Updated a few features that can be considered related to the project in "Research Tracker" |
| 6.0 | 07/04/2023 | Venkata Sai Daggupati | Understanding and analyzing the features in the Data Dictionary like Type of Data Type, Relationship between the variables, Level of Measurements, Quantitative or Qualitative and Continuous or Discrete. |
| 7.0 | 09/04/2023 | Venkata Sai Daggupati | Received Dataset, Updated Python code till EDA and Auto EDA using SweetViz and D-Tale. Working on Data-Preprocessing steps |
| 8.0 | 11/04/2023 | Venkata Sai Daggupati | Done with preprocessing using forecasting Techniques, and researching different Time Series Models. |
| 9.0 | 13/04/2023 | Venkata Sai Daggupati | Building Models like Auto-TS and a few of Manual models like ARIMA, SARIMA, and SARIMAX |
| 10.0 | 15/04/2023 | Venkata Sai Daggupati | Built models of ARIMA, and SARIMA Facing errors while executing Auto-TS model |
| 11.0 | 17/04/2023 | Venkata Sai Daggupati | SARIMAX, Auto ARIMA, and SES are done |
| 12.0 | 19/04/2023 | Venkata Sai Daggupati | Working on MA, AES models and few other models that are listed by guide |
| 13.0 | 21/04/2023 | Venkata Sai Daggupati | Evaluating Time series Metrics like RSME on all the build models. Models built: ARIMA, SARIMA, SARIMAX, AES, SES, and MA. Observed for ARIMA it is giving us best performance with RMSE of 3.40 |
| 14.0 | 23/04/2023 | Mahesh Babu Pedagadi | Working on Model Deployment using Streamlit |
| 15.0 | 25/04/2023 | Mahesh Babu Pedagadi | Done with Model deployment using Streamlit |

**TABLE OF CONTENTS**

[1 PROJECT CHARTER PURPOSE 3](#_Toc30423757)

[2 PROJECT EXECUTIVE SUMMARY 3](#_Toc30423758)

[3 PROJECT OVERVIEW 3](#_Toc30423759)

[4 PROJECT SCOPE 3](#_Toc30423760)

[4.1 Goals and Objectives 3](#_Toc30423761)

[4.2 Project Deliverables 4](#_Toc30423762)

[4.3 Deliverables Out of Scope 4](#_Toc30423763)

[4.4 Project Duration 4](#_Toc30423764)

[5 PROJECT CONDITIONS 5](#_Toc30423765)

[5.1 Project Assumptions 5](#_Toc30423766)

[5.2 Project Issues 5](#_Toc30423767)

[5.3 Project Risks 5](#_Toc30423768)

[5.4 Project Constraints 6](#_Toc30423769)

[6 Project Structure Approach 6](#_Toc30423770)

[7 Project Team Organization Plans 6](#_Toc30423771)

[8 PROJECT REFERENCES 6](#_Toc30423772)

[9 APPROVALS 7](#_Toc30423773)

[10 APPENDICES 8](#_Toc30423774)

[10.1 Document Guidelines 8](#_Toc30423775)

[10.2 Project Charter Document Sections Omitted 8](#_Toc30423776)

# PROJECT CHARTER PURPOSE

The project charter defines the scope, objectives, and overall approach for the work to be completed. It is a critical element for initiating, planning, executing, controlling, and assessing the project. It should be the single point of reference on the project for project goals and objectives, scope, organization, estimates, work plan, and budget. In addition, it serves as a contract between the Project Team and the Project Sponsors, stating what will be delivered according to the budget, time constraints, risks, resources, and standards agreed upon for the project.



# PROJECT EXECUTIVE SUMMARY

* **Project goals**

1. Develop a demand forecasting model that predicts the demand for pallets with a minimum accuracy of 90% to minimize excess inventory while ensuring adequate supply to meet demand.
2. Implement an inventory management system that minimizes excess inventory while ensuring adequate supply to meet demand, with a focus on maximizing production efficiency to meet the business constraint of maximizing production efficiency.
3. Reduce excess pallet inventory by at least 15% to improve profitability while maintaining production efficiency.
4. Improve customer satisfaction by ensuring timely delivery of pallets to customers by accurately forecasting demand and maintaining adequate inventory levels.
5. Analyze and optimize the production process to minimize waste and improve efficiency, while ensuring that the business constraint of maximizing production efficiency is met.
6. Establish regular reporting and monitoring of inventory levels, demand forecasting accuracy, production efficiency, and customer satisfaction to identify trends and opportunities for improvement.

* **Objectives**
  + Minimize excess steel inventory to improve profitability.(The company can reduce holding costs and free up resources for other investments.)
* **Data prepossessing**

1. Collect and clean historical data on pallet inventory levels, orders, sales, and production.
2. Apply time-series analysis techniques to identify trends, seasonality, and other patterns in the data.
3. Use machine learning algorithms to forecast future demand for steel pallets.

* **Scope**

1. Analyzing historical data of pallets demand and inventory levels
2. Developing a demand forecasting model for pallets inventory
3. Optimizing inventory management policies to minimize off-cut waste and maximize inventory management
4. Evaluating facility planning strategies to ensure efficient inventory management
5. Implementing the forecasting model

* **Assumptions**

1. The demand for pallets is assumed to follow a certain pattern and can be predicted accurately.
2. The production process for pallets is assumed to be stable, with minimal variation in quality and quantity.
3. The data used for forecasting is assumed to be accurate and reliable.
4. The ordering policies and facility planning are assumed to remain constant during the forecasting period.
5. The cost of raw materials, labor, and other production inputs are assumed to remain stable during the forecasting period.
6. The market demand for pallets is assumed to remain stable, with no major changes in the competitive landscape or economic conditions.
7. The company has access to the necessary technology and resources to implement the forecasting system and optimize inventory management accordingly.

* Risks
* Costs
* Timeline

Start Date: 01/03/2023

End Date: 07/04/2023

* Approach

Forecasting Steps:

1. Define Goal - Daily sales prediction (365 days)
2. Data Collection & Data Understanding
3. Exploring & Visualize Series - Time plot, Lag plot, ACF/Correlogram
4. Data Pre-processing - Stationary/Non-stationary
5. Partitioning the series- Train & Test Data
6. Apply Forecasting Methods - Data-drive & Model-based
7. Evaluate & Compare Performance
8. Implemented Forecasts/Systems

* Organization



# PROJECT OVERVIEW

The project overview is to minimize excess steel inventory and maximize inventory efficiency to reduce waste and increase profitability. The project will involve developing a demand forecasting model that accurately predicts steel demand, enabling the company to optimize inventory levels and reduce overstocking. The model will be trained on historical sales data, and evaluated for accuracy using appropriate metrics.

# PROJECT SCOPE:

1. The project will focus on forecasting the demand for pallets in the inventory management system.
2. The data for the project will be collected from historical sales records and other relevant sources.
3. The project will develop a machine learning model to predict the demand for steel rods based on historical sales data and other relevant factors.
4. The project will evaluate the performance of the machine learning model in terms of prediction accuracy and make recommendations for improvements.

## Goals and Objectives

|  |  |
| --- | --- |
| **Goals** | **Objectives** |
| * The goal is to Minimize excess steel inventory to improve profitability | * Analyze historical data of Company’s clients, identify trends and patterns, and build a forecasting model that predicts the number of pallets of different sizes needed based on historical data and demand trends. | |

## Project Deliverables

|  |  |
| --- | --- |
| **Milestone** | **Deliverable** |
| * Identifying Constraints and design the project architecture, explore various public forums to collect relevant data, Data Preparation. | * Deliverable 1.1—Identifying Constraints and design the project architecture. * Deliverable 1.2—Explore various public forums to collect relevant data. * Deliverable 1.3— Data Preparation |
| * EDA and Descriptive Analytics, Model Building for Association (Fuzzy Algorithm) and Recommendation | * Deliverable 2.1— EDA and Descriptive Analytics * Deliverable 2.2— Model Building for Association (Fuzzy Algorithm) and Recommendation |
| * Model Evaluation, tuning and insights, Deployment | * Deliverable 3.1— Model Evaluation, tuning and insights. * Deliverable 3. 2— Deployment |
| * Show case and review, Final Presentation and documentation, Handover and KT. | * Deliverable4.1 – show case and review * Deliverable4.2 – Final Presentation and documentation * Deliverable4.3 – Handover and KT |

## Deliverables Out of Scope

* Mobile Application

## Project Duration (start date: 01/03/2023 End date: 30/03/2023)

|  |  |  |  |
| --- | --- | --- | --- |
| **Project Milestone** | **Date Estimate** | **Deliverable(s) Included** | **Confidence Level** |
| * Identifying Constraints and design the project architecture, explore various public forums to collect relevant data, Data Preparation. | [05/03/2023]  -  [12/03/2023] | * Deliverable 1.1—Identifying Constraints and design the project architecture. * Deliverable 1.2—Explore various public forums to collect relevant data. * Deliverable 1.3— Data Preparation | [High] |
| * EDA and Descriptive Analytics, Model Building for forecasting | [12/03/2023]  -  [24/03/2023] | * Deliverable 2.1— EDA and Descriptive Analytics * Deliverable 2.2— Forecasting Model Building, both data-driven and model based. | [High] |
| * Model Evaluation, tuning and insights, Deployment | [24/03/2023]  -  [28/03/2023] | * Deliverable 3.1— Model Evaluation, tuning and insights. * Deliverable 3. 2— Deployment | [High] |
| * Show case and review, Final Presentation and documentation, Handover and KT. | [28/03/2023]  -  [05/04/2023] | * Deliverable4.1 – show case and review * Deliverable4.2 – Final Presentation and documentation * Deliverable4.3 – Handover and KT | [Medium] |



# PROJECT CONDITIONS

## Project Assumptions

* Work on data received from the client.
* Can create a web API by using flask or streamlit.
* Robust Tested: Application should be tested for noise data also..

## Project Issues

**Priority Criteria**

1 − High-priority/critical-path issue; requires immediate follow-up and resolution.

2 − Medium-priority issue; requires follow-up before completion of next project milestone.

3 − Low-priority issue; to be resolved prior to project completion.

4 − Closed issue.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **#** | **Date** | **Priority** | **Owner** | **Description** | **Status & Resolution** |
| 1 |  | High |  |  |  |
| 2 |  | High |  |  |  |

## Project Risks

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Risk Area** | **Likelihood** | **Risk Owner** | **Project Impact-Mitigation Plan** |
| 1 | [Project Risk] | [High/Medium/Low] |  |  |
| 2 | [Project Risk] | [High/Medium/Low] |  |  |

## Project Constraints

* Historical trend limitations: Historical trend of client demand may not accurately reflect future demand, especially if new clients or projects are added to the mix.
* Production constraints: Limitations in production capacity or lead time for steel rods can constrain the ability to respond to changes in demand, even if accurately forecasted.
* Cost constraints: Additional costs associated with processing, transportation, and storage of leftover steel rods.

# Project Structure Approach

* Project Initiation: The project will be initiated with a kick-off meeting, where the project team will be introduced and the project goals and objectives will be defined.
* Requirements Gathering: The project team will work with stakeholders to gather and document the requirements for the ML model, including data sources, accuracy goals, and performance requirements.
* Model Development: The project team will develop a machine learning model using a combination of off-the-shelf ML libraries and custom code, and will test and validate the model using real-world data.
* Model Deployment: The project team will deploy the model as a web-based application, making it accessible to maintenance teams via a web browser.
* User Training: The project team will provide training to maintenance teams to help them understand how to use the model and make the most of its predictions.
* Project Monitoring and Evaluation: The project team will monitor and evaluate the performance of the model and the deployment, and will make any necessary adjustments to improve its accuracy and functionality
* Project Closure: The project will be closed with a final review, where the project team will assess the project outcomes and make recommendations for future work



# Project Team Organization Plans

|  |
| --- |
| * Deliverable 1.1— Data Information & Data Dictionary * Deliverable 1.2— Project Overview & Scope * Deliverable 1.3— Business Insights |
| * Deliverable 2.1— ML Model Custom Code * Deliverable 2.2— ML Model Validation Report |
| * Deliverable 3.1— Deployed Model * Deliverable 3. 2— Deployed Model Test Report |
| * Deliverable 4.1 – Project Charter Document * Deliverable 4.2 – CRISP-ML(Q) Document * Deliverable 4.3 – Project Presentation & Demonstration |

# PROJECT REFERENCES

|  |  |
| --- | --- |
| **Milestone** | **Deliverable** |
| Data Collection | <https://www.researchgate.net/profile/Ahmad-Chehab/publication/348714394_Inventory_Management_at_Foz_Trading_Demand_Forecasting_Ordering_Policies_and_Facility_Planning/links/600c44baa6fdccdcb87700e3/Inventory-Management-at-Foz-Trading-Demand-Forecasting-Ordering-Policies-and-Facility-Planning.pdf>  <http://lib.buet.ac.bd:8080/xmlui/bitstream/handle/123456789/3639/Full%20Thesis.pdf?sequence=1&isAllowed=y>  <https://www.iaeng.org/publication/WCE2015/WCE2015_pp791-795.pdf> |
| Data Understanding | The 12 most important metrics to measure in manufacturing  Cycle Time, Lead Time, & Takt Time - Key Production Metrics Explained |
| Model Tuning | Different types of Time-series Forecasting Models |

# APPROVALS

**Prepared by** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Project Manager

**Approved by** Sharat Chandra M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Project Sponsor

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Executive Sponsor

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Client Sponsor



# APPENDICES

## Document Guidelines

## Project Charter Document Sections Omitted

