Phase 1: Problem Definition and Design Thinking

Problem Definition:

- The problem is to develop a machine learning model that can predict product demand based on historical sales data and external factors.
- This model will help businesses optimize their inventory management and production planning to meet customer needs efficiently.
- The project will involve data collection, data preprocessing, feature engineering, model selection, training, and evaluation.

Design Thinking:

- Empathize: Understand the needs and pain points of businesses in managing inventory and production planning. Gather information about the challenges they face in meeting customer demand and optimizing their operations.

- Define: Define the problem statement and project goals. The goal is to create a machine learning model that can accurately predict product demand based on historical sales data and external factors. The model should help businesses optimize their inventory management and production planning to meet customer needs efficiently.

- Ideate: Brainstorm potential solutions and approaches to predicting product demand. Consider different regression algorithms, feature engineering techniques, and evaluation metrics.

- Prototype: Develop a prototype model using historical sales data and external factors. Use this model to test different algorithms and feature engineering techniques.

- Test: Test the model's accuracy and effectiveness in predicting product demand. Evaluate the model's performance using appropriate regression metrics such as Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE).

Phase 2: Data Collection and Preprocessing

- Collect historical sales data and external factors such as seasonality, promotions, and economic indicators. This data can be obtained from various sources such as CRM systems, sales reports, and external databases.

- Clean and preprocess the data by removing duplicates, missing values, and outliers. This step is critical to ensure that the data is accurate and suitable for machine learning algorithms.

- Transform the data into a suitable format for machine learning algorithms. This may involve converting categorical features into numerical representations or scaling the data to ensure that all features are on the same scale.

Phase 3: Feature Engineering

- Identify relevant features that may impact product demand. These features may include seasonality, promotions, economic indicators, and historical sales data.

- Create new features based on domain knowledge and intuition. For example, we may

create a feature that captures the effect of holidays on product demand.

- Use feature selection techniques to select the most significant features for the model. This step is critical to ensure that the model is not overfitting or underfitting the data.

Phase 4: Model Selection and Training

- Select appropriate machine learning algorithms for the problem, such as linear regression, time series analysis, or neural networks. Consider the strengths and weaknesses of each algorithm and choose the one that best fits the problem.

- Split the data into training and testing sets. The training set will be used to train the model, while the testing set will be used to evaluate its performance.

- Train the model on the training set using appropriate hyperparameters. Hyperparameters are parameters that are not learned from the data but are set by the user. They can significantly impact the performance of the model.

Phase 5: Model Evaluation and Deployment

- Evaluate the model's accuracy and performance on the testing set. Use appropriate regression metrics such as MAE and RMSE to evaluate the model's performance.

- Fine-tune the model based on evaluation results. If the model's performance is not satisfactory, we may need to adjust hyperparameters or try different algorithms or feature engineering techniques.

- Deploy the model in a production environment for businesses to use in optimizing inventory management and production planning. This step involves integrating the model into existing systems and ensuring that it is scalable and re

- Continuously monitor and update the model to ensure its effectiveness in predicting product demand. As new data becomes available, we may need to retrain the model or adjust its parameters to ensure that it remains accurate and effective.

Conclusion:

- In conclusion, the project aims to create a machine learning model that can forecast product demand based on historical sales data and external factors.
- This will help businesses optimize their inventory management and production planning to meet customer needs efficiently. The project involves various steps, including data collection, data preprocessing, feature engineering, model selection, training, and evaluation.
- By following the design thinking approach, we can ensure that we are addressing the problem effectively and efficiently. With this project, businesses can make informed decisions about inventory management and production planning, leading to better customer satisfaction and increased profitability.