

Proposal for implementation of

'Sales Forecasting System'



ORACLE®

I successfully won a sales forecasting system development project by leading the entire stage from the RFI to Demo implementation and Proposal.

This project is currently in progress, and the entire step is to build a data platform and develop a sales prediction system for the client.

CONTENTS



1. Our understanding & Approach

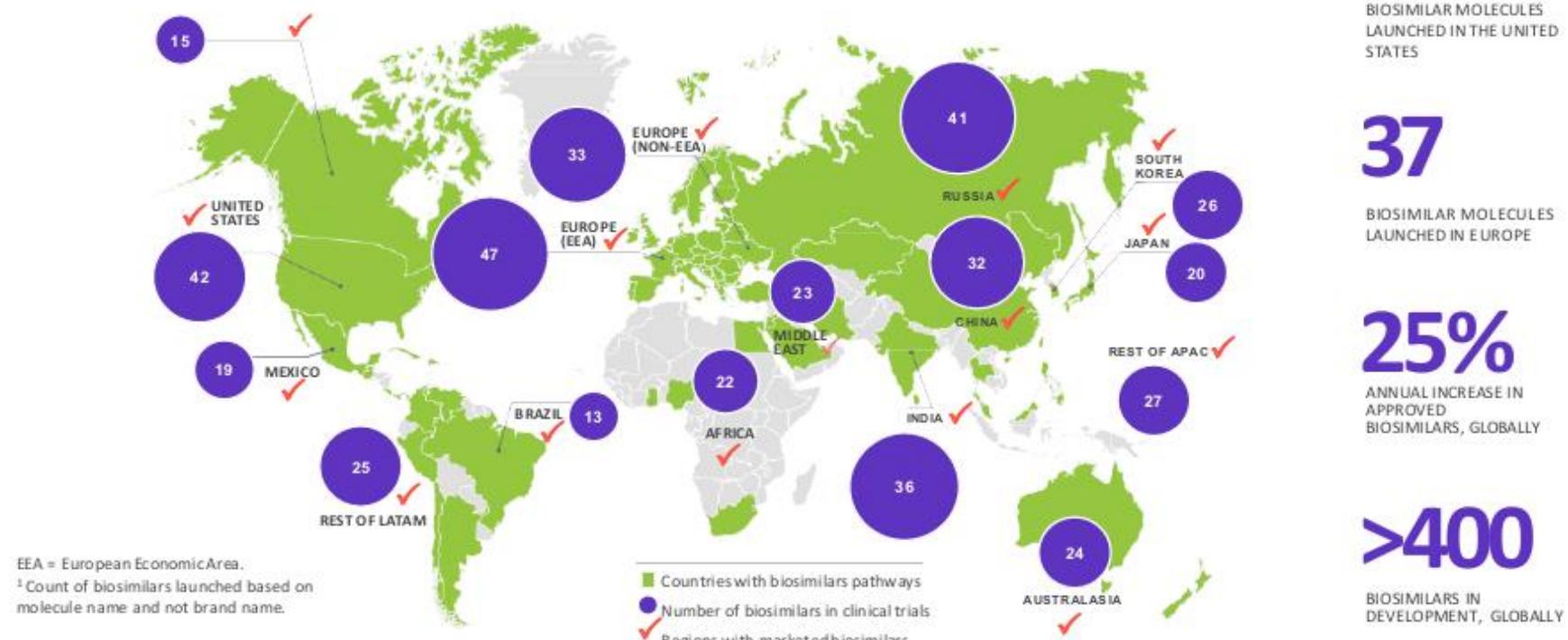
1. Project background
2. Project objectives
3. Project scope
4. Oracle's Competitive Solutions for the project
5. Oracle's Value Proposition for the project

1.1 Project Background

- ✓ Beyond US and EU5, global development activity is fairly aggressive across the world

Global biosimilars clinical development activity

Where are the biosimilar hot spots?



19

BIOSIMILAR MOLECULES LAUNCHED IN THE UNITED STATES

37

BIOSIMILAR MOLECULES LAUNCHED IN EUROPE

25%

ANNUAL INCREASE IN APPROVED BIOSIMILARS, GLOBALLY

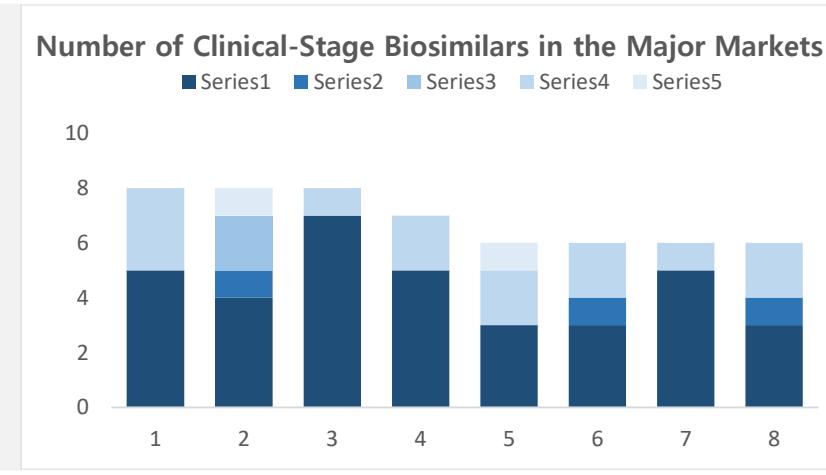
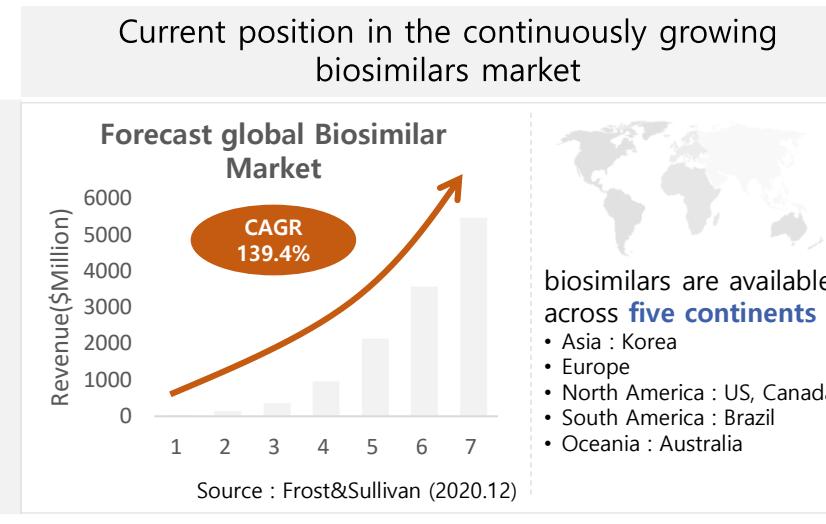
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BIOSIMILARS IN DEVELOPMENT, GLOBALLY

1.1 Project Background

- Oracle will support to grow as a leader in the global biosimilar market by implementing the analysis environment and prediction model.

- Developed one of the most expansive and rapidly advancing biosimilar medicines portfolios in the industry.



- 19 biosimilar products, 6 of which have successfully entered the global market.

"A World-leader in Biosimilar"

Strengthen global Competitive-ness

Increase market share

Implement data analytics environments & Forecasting models

Transform R&D processes through digital technologies

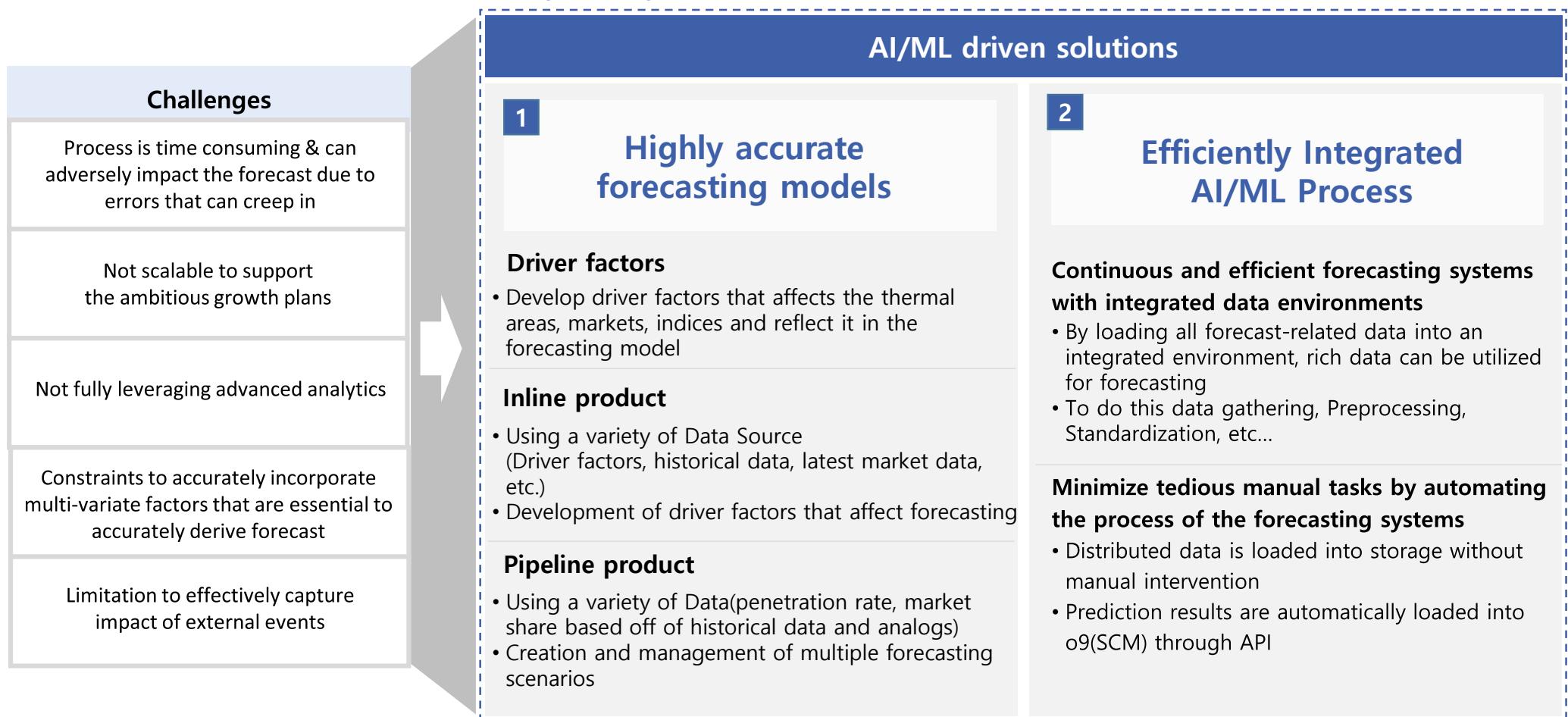
Monitor the industry landscape and prepare for change

Strengthen the foundations by enhancing the R&D operating model

1.2 Project objectives

S company will get a solution to support an accurate forecasting model in an efficient integrated process

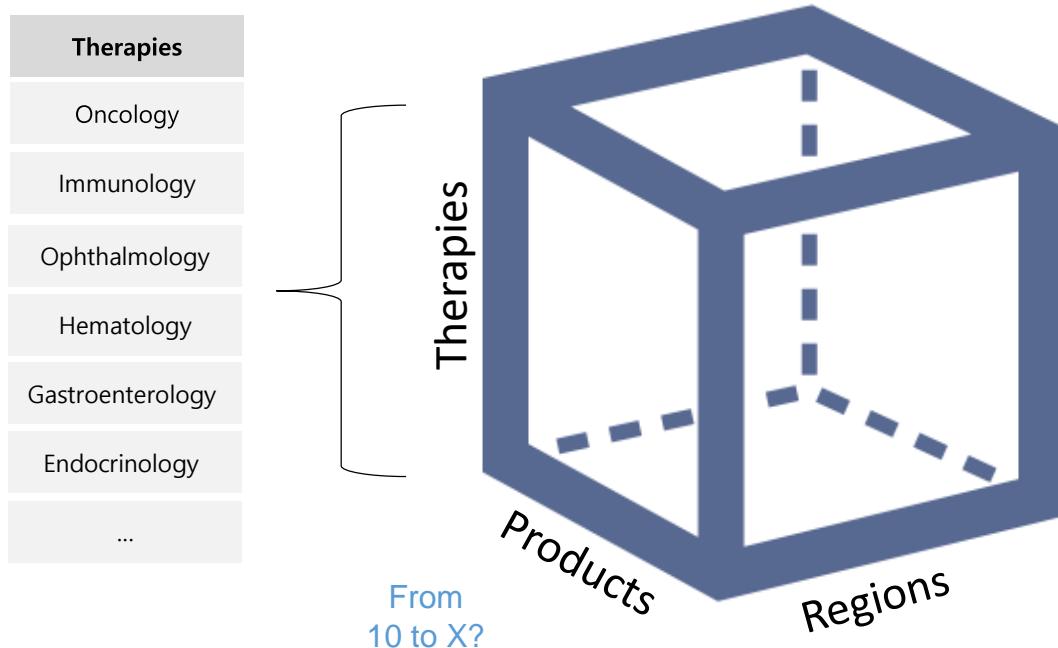
Project objectives



1.2 Project objectives > a. Highly accurate forecasting models

As S company's portfolio grows there will be increasing complexity in accurately forecasting and planning

The scale of the portfolio is increasing rapidly



Increasing access, expanding footprint, and new commercialisation partners

An accurate forecast
to remain competitive

Secure a world-class supply chain
and operational efficiency

Better target market
with the right profitability

Tactically manage shifts
among competitors or regulators.

1.2 Project objectives > b. Efficiently Integrated AI/ML Process

Through an AI/ML tool, S company will be able to drive accurate forecasts at scale

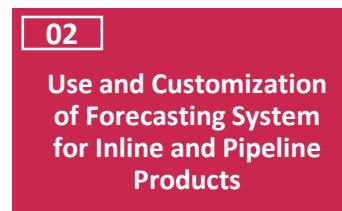
Benefits of AI/ML driven forecasting system

- 1 Ability to leverage more data sources with forward looking indicators
- 2 Ability to support S Corporate's growth plans & scale seamlessly
- 3 Greater insights into forecast drivers
- 4 Leverage a multitude of analogues & measuring the correlation between similar markets
- 5 Ability to frequently auto-refresh forecasts
- 6 Reduce time consuming manual effort without need for data scientists

“Need of the hour is a sophisticated forecasting platform that can rapidly access & analyze information, adjust results to accommodate external events and forecast trends on a real-time basis”

1.3 Project scope

Throughout the engagement, an AI/ML tool with specific driver factors for inline & pipeline products will be implemented



- ✓ Development of driver factors using various data source
- ✓ Common driver factors that would apply to all therapeutic areas and markets
- ✓ Specific driver factors for certain therapeutic areas, markets, and indices (e.g. penetration rate, market share)
- ✓ Method of manually adjusting or giving different weightage to driver factors according to the market

- ✓ Use of Oracle's proprietary forecasting system that is capable of **creating forecasts for inline products using AI/ML function**
- ✓ Use of Oracle's proprietary forecasting system that is capable of **creating scenarios of forecasts for pipeline products using various historical data source**
- ✓ Customization of Oracle's proprietary forecasting system to fit the needs of S company *

- ✓ **Integrability with S company's internal systems** such as MDM, ERP, and SCM (integration timing, integration method, management cycle, and management method including security)
- ✓ Performance of the system when integrated
- ✓ Operability of system in terms of maintenance and monitoring (Response system in case of error or disaster)
- ✓ Types of S/W and its method of maintenance

→ AI/ML Modeling based consulting service scope

→ AI/ML Modeling based consulting service scope

→ System Implementation service scope



- ✓ Timeline from developing (1) driver factors, (2) customizing system, and (3) go-live

1.4 Oracle's Competitive Solutions for the project

- To accurate and efficient 'Sales Forecasting System' Oracle provides competitive solutions, (1) best forecasting solutions (2) with strategic partnership with C company, (3) End-to-End Integration system (4) with agile approach

Oracle's competitiveness AI/ML driven solutions



- Uses statistical algorithms, machine learning and deep learning to deliver highly accurate time-series forecasts
- Contains the ability to process analogues intelligently to forecast situations with limited / no historical data (new products / markets)
- Automated preprocessing enables more accurate and robust prediction models.
- Is embedded with AutoML and Explainability features to create the best model and bring transparency

Strategic Partnership with C company:



- Oracle's strategic partnership with C company provides the Pharma / Biosimilar industry expertise essential
 - ✓ to articulate key driver factors accurately & provide data related thereto
 - ✓ to capture the market events accurately and quantify their impact to forecast
 - ✓ to develop 4-5 analogue selection criteria for pricing and share estimation
- The partnership with C company also provides Samsung with access to market specific datasets that facilitates input data automation and forecast validation

End-to-End Automation / Integration



- Our solution will seamlessly integrate, with minimum effort, the entire process from Source to Processing to Visualization (Tableau / OAC)
- There shall be minimal / no manual intervention
- ODI / MySQL with ML / are tools with minimal costs that can be leveraged upon
- Flexibility to transition to a new DW development for the future

Agile Approach



- While the overall implementation methodology follows Oracle TCM methodology, we also adopt Agile approaches specifically to develop models faster and improve continuously
- Our implementation will follow an agile approach with 2~3 sprints, which will deliver more accurate forecasting models
- Subsequent sprints will prioritize markets / TAs / Products in discussion with S company

1.5 [Back-up] OCI Forecasting Solution's Competitive Landscape

Feature	Oracle	Competitors
Service name	<ul style="list-style-type: none"> • Oracle provides OCI Forecasting Service. 	<ul style="list-style-type: none"> • AWS provides Amazon Forecast, Azure provides AutoML, and Google provides GCP AutoML.
Algorithms	<ul style="list-style-type: none"> • OCI Forecasting provides 20 algorithms, which allow to create models optimized for forecasting • Available algorithms: SMA, DMA, HWSA, HWSADAMPED, HWSM, HWSMDAMPED, SES, DES, DESDAMPED, SA, SM, UAM, UHM, ARIMA, PROPHET, EFE, APOLLONET, PROBRNN 	<ul style="list-style-type: none"> • AWS provides 6 Time-Series related algorithms(NPTS, ARIMA, ETS, Prophet, CNN-QR, DeepAR+) and Azure provides 4 Time-Series related algorithms(Traditional ML models, Prophet, Auto-ARIMA, TCNForecaster).
Automatic Preprocessing	<ul style="list-style-type: none"> • OCI Forecasting provides 4 automation features for preprocessing. <ul style="list-style-type: none"> ✓ <u>Imputes missing values based on ML based estimates</u> ✓ Transform data as required to improve data quality ✓ Aggregate data as per the need for forecasting horizon and schedule ✓ <u>Identify and replace outliers</u> : Outlier processing is a necessary task for the stable performance of the model, and automated outlier processing before modeling can save time and resources for outlier processing 	<ul style="list-style-type: none"> • AWS Provides 3 automation features for preprocessing <ul style="list-style-type: none"> ✓ Imputes missing values(not based on ML) ✓ Transform data as required to improve data quality ✓ Aggregate data as per the need for forecasting horizon and schedule • Azure provides 2 automation features for preprocessing <ul style="list-style-type: none"> ✓ Transform data as required to improve data quality ✓ Aggregate data as per the need for forecasting horizon and schedule
Model Explainability	<ul style="list-style-type: none"> • OCI Forecasting provides Global expandability details and Local expandability details to ensure the transparency of the model and to understand how each attribute impacts forecasted values <ul style="list-style-type: none"> ✓ Global explainability details ranked influencers based on overall dataset and Local explainability details ranked influencers for specific forecast in the horizon. This helps to determine if there are varying influencers within the forecast horizon 	<ul style="list-style-type: none"> • AWS provides the Global expandability details and Local expandability details features, but the Local level requires job run and charges separately. • Azure provides aggregate feature importance & individual importance with Model Explainability, but does not provide variable importance for a specific period at the local level.
Auto Best Forecast	<ul style="list-style-type: none"> • OCI Forecasting provides 5 automation features to select best models. <ul style="list-style-type: none"> ✓ A truly robust service that builds multiple models and ensembles to create the best model to maximize forecast accuracy using AutoML ✓ Automatic model selection based on a variety of ML/DL algorithms and hyper parameter optimizations. ✓ Model output includes overall accuracy along with AutoML summary ✓ Scheduling capability to include all latest data points each time it runs, to capture even a small change in business ✓ Best 2 Forecasts based on accuracy 	<ul style="list-style-type: none"> • AWS and Azure use ensemble modeling techniques to produce optimal prediction models, and provides hyper parameter optimization and automatically tracks the accuracy of model over time as new data is imported

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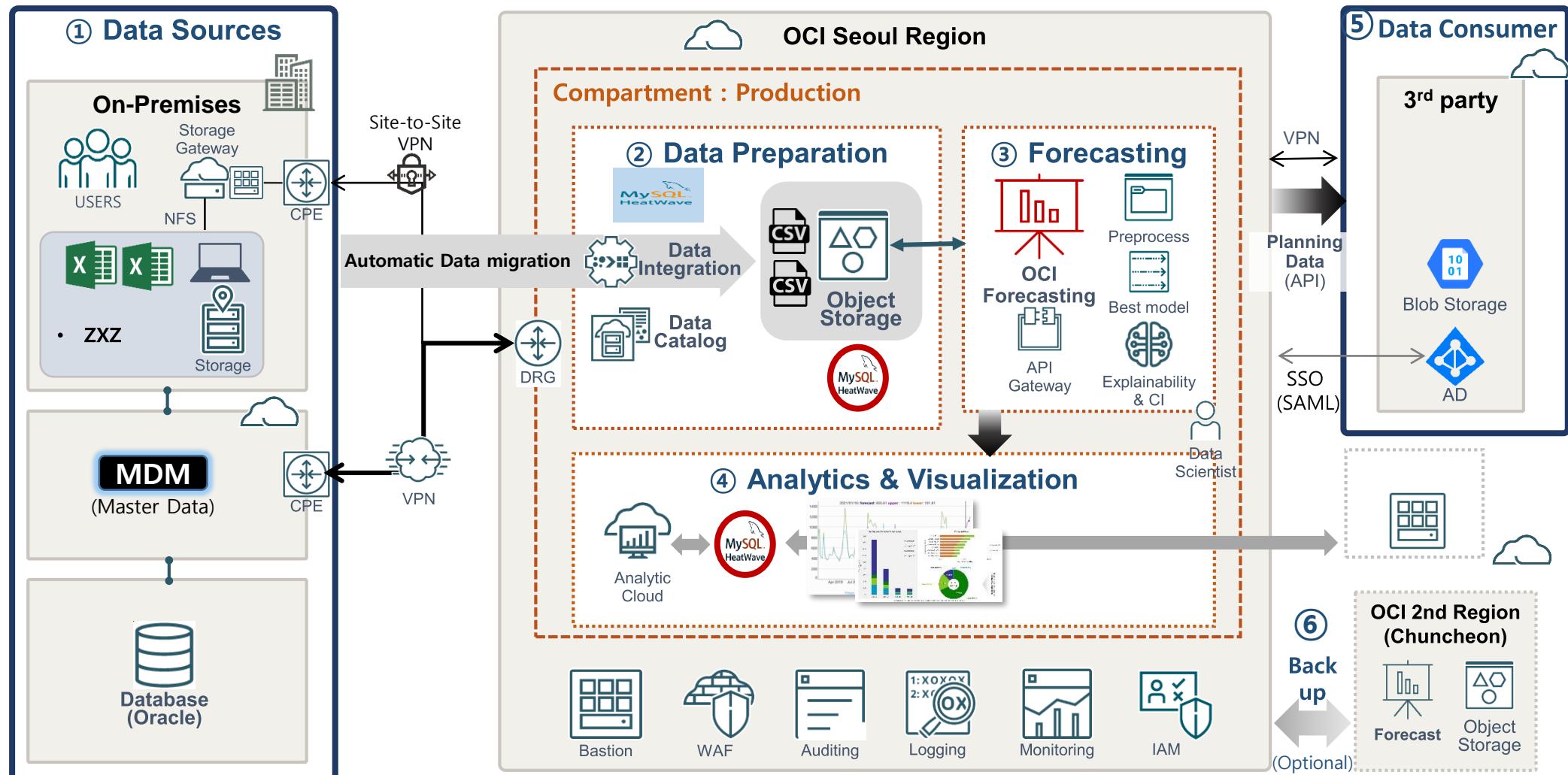


2. Architecture

1. Solution Architecture: Overall
2. Solution Architecture: Detail

2.1 Solution Architecture : Overall

- Oracle Cloud Infrastructure(OCI) Sales Forecasting System Architecture. Focus on automatic source data integration for forecasting service and managing the results to be consumed by apps and OAC



2.1 Solution Architecture : Overall > Explanation

- Using Oracle Data Integration service, various data sources are linked and used as an automated process, and the prediction results can be consumed in the supply chain management system.

① Data Sources

- To create a data set for forecast service, it is automatically transferred to object storage using data integration service and created in Oracle Machine Learning
- Fast connect improves security and performance, which is a dedicated line service and site-to-site VPN for source data can be used for transmission to object storage.

② Data Preparation

- To create a data set for forecast service, it is automatically transferred to object storage using Oracle Machine Learning and data integration service.

③ Forecasting

- Using pre-process using Data Integration Service (DIS) and AutoML Training model / Scheduling / support multiple Data sources with OML
- Publish to a private endpoint using an API gateway to seamlessly link with Oracle Analytics Cloud and other consumer systems.

④ Analytics & Visualization

- Oracle Analytics Cloud is used to visualize forecasting data, while the on-premises tableau solution or other tools can be connected with OCI, used in conjunction with OAC.

⑤ 3rd party cloud Interconnect

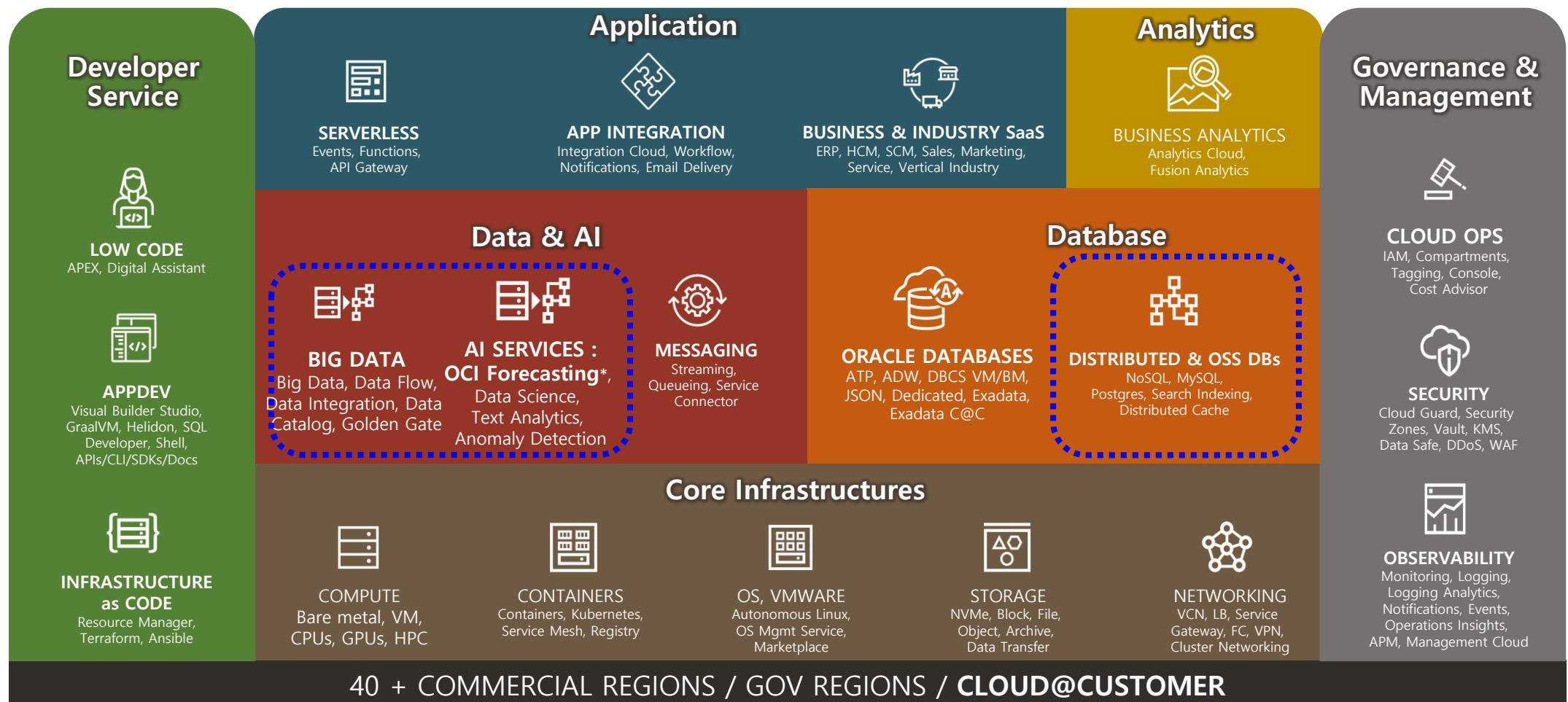
- The planning data generated by the Forecast system is transferred to the system SCM, which is operated in other clouds
- OCI supports SSO through SAML(Security Assertion Markup Language) for connection with SCM, currently operating in MS Azure.

⑥ Back up

- For business continuity and system operation excellence (system high availability and recovery in case of outages, failures, or disasters), redundant main system and data backups are established in the second cloud region

2.1 Solution Architecture : Overall > Service Overview

- S company will leverage business value by building forecasting system with Oracle's comprehensive portfolio of cloud services including OCI Forecasting, ODI, MySQL and etc.



* Proposed solutions in this project

* Currently OCI Forecasting service is not available in KR region, but it will be deployed in KR region before starting project

Note] OCI forecasting service can be deployed in a regional data center if customer shows business commitment. Usual time is 2 weeks max considering all other priorities we may have. If we expect to start by the 1st week of Jan 2023, it would be great if we are informed by 10-12th dec as we have holidays in December last week.

2.1 Solution Architecture : Detail > Forecasting

- Fully managed time-series forecast service through machine learning and statistical algorithms without the need for data science expertise

Key Features

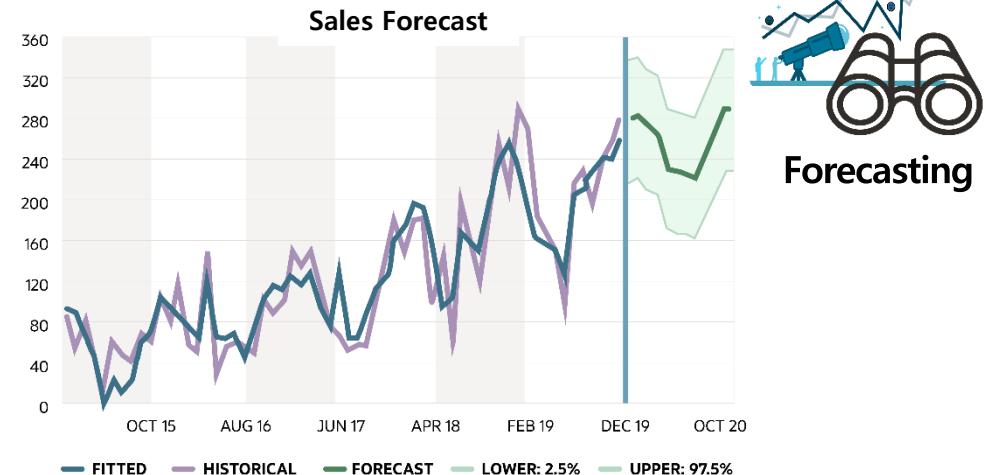
- Automatic data preprocessing : missing value imputation, outlier replacement, transform
- Automated best model selection
- AutoML summary with model accuracy report
- Explanation of ranked influencers for the model result
- Start with generic models that can be customized by domain and by customer data

Key Benefits

- Intuitive Drag & Drop time-series forecasting service with no programming (instead of advanced analytics)
- Store time series data in object storage and pull data in AI service and quickly get insight
- Identify trends and patterns in cleaned historical data
- Create Baseline forecasting to compare AI-based prediction result from your own forecast/planning

Use Case

- Demand forecasting
- Retail sales/revenue, demand, expense forecasting
- Supply chain/logistics demand, shipment forecasting
- IT server capacity, web traffic forecasting
- Healthcare, Energy, Banking forecasting cases



2.1 Solution Architecture : Detail > Forecasting

Forecasting service can be accessed through REST API call

One Simple API Call

- Train the model (Pre-process and Auto ML)
 - ✓ Data Sources – OCI Object Store
 - ✓ Supports Multiple Data sources using DIS (data integration service)
 - ✓ Supports Scheduling
- Generate Forecasts / CI / Explainability
- Input File supported – CSV, JSON

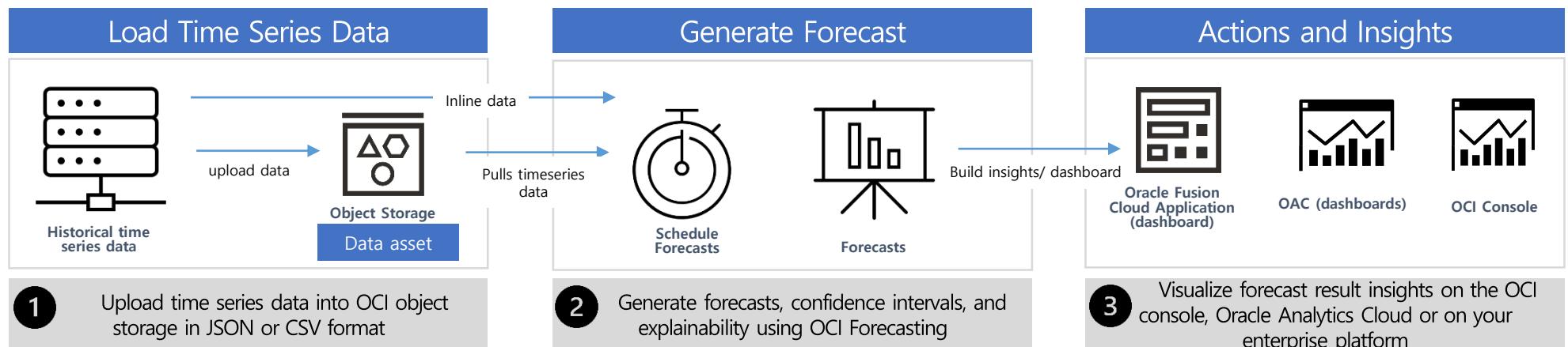


Forecasting can be accessed through

- REST APIs
- OCI Console
- SDK
- CLI



Forecasting service reference Architecture



2.1 Solution Architecture : Detail > Forecasting

More statistical algorithms are supported than Forecasting service of AWS

Statistical Algorithms of Oracle Forecasting

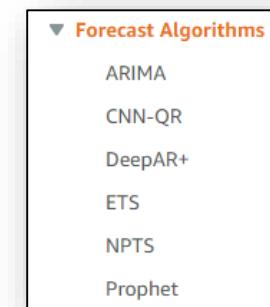
Univariate

1. **NAIVE**
2. **SNAIVE**
3. **SMA**: Single Moving Average
4. **DMA**: Double Moving Average
5. **HWSA**: Holt - Winter's Seasonal Additive
6. **HWSADAMPED**: Holt - Winter's Seasonal Additive method with a damped trend
7. **HWSM**: Holt - Winter's Seasonal Multiplicative
8. **HWSMDAMPED**: Holt - Winter's Seasonal Multiplicative method with a damped trend
9. **SES**: Simple Exponential Smoothing
10. **DES**: Double Exponential Smoothing
11. **DESDAMPED**: Double Exponential Smoothing method with a damped trend
12. **SA**: Seasonal Additive
13. **SM**: Seasonal Multiplicative
14. **UAM**: Ensemble Arithmetic Mean
15. **UHM**: Ensemble Harmonic Mean

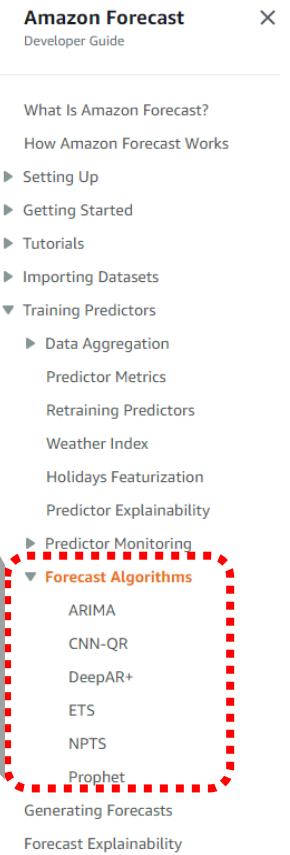
16. **ARIMA**: Autoregressive Integrated Moving Average (ARIMA) Algorithm
17. **PROPHET**: Local Bayesian structural time series model from Prophet open source
18. **APOLLONET**: A proprietary deep learning model (Exclusive Deep Learning model)
19. **PROBRNN**: Probabilistic Recurrent Neural Network model
20. **EFE**: Endogenous Feature Engineering model

Multivariate

VS.



AWS Forecasting



2.1 Solution Architecture : Detail > OAC (Oracle Analytics Cloud)

- ✓ An all-in-one Cloud BI and Analytics Platform for data connectivity, data preparation, flow, self-service visualization and collaboration

Key Features

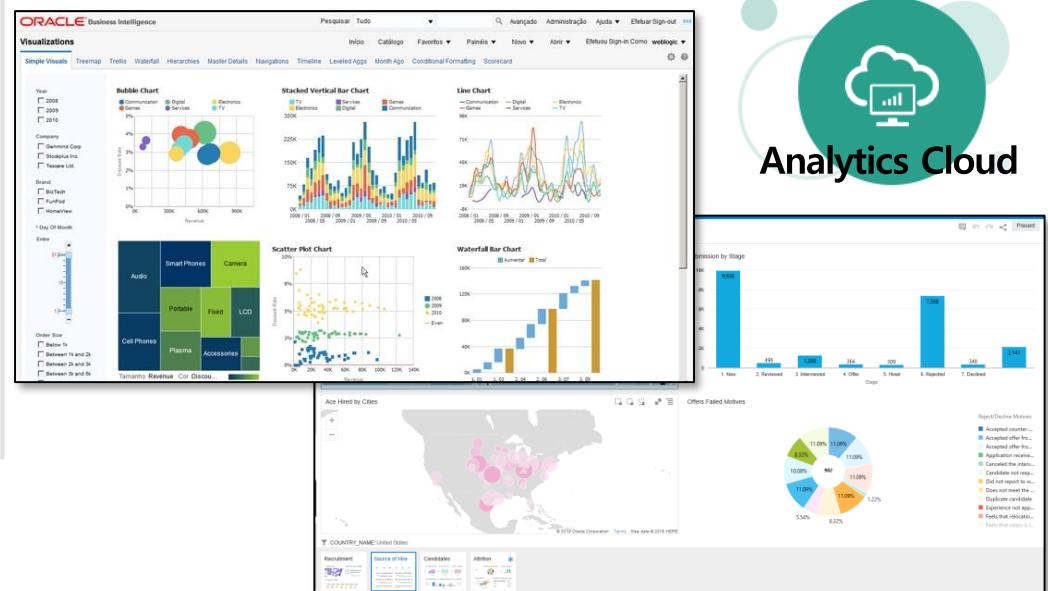
- Self-service Data visualization to make decisions
- Machine learning
- Mobile analytics app
- Collaboration via shared data outputs
- Open data source connectivity (34 native connectors, XLS/CSV formats, JDBC)
- Built-in data preparation and data flow

Key Benefits

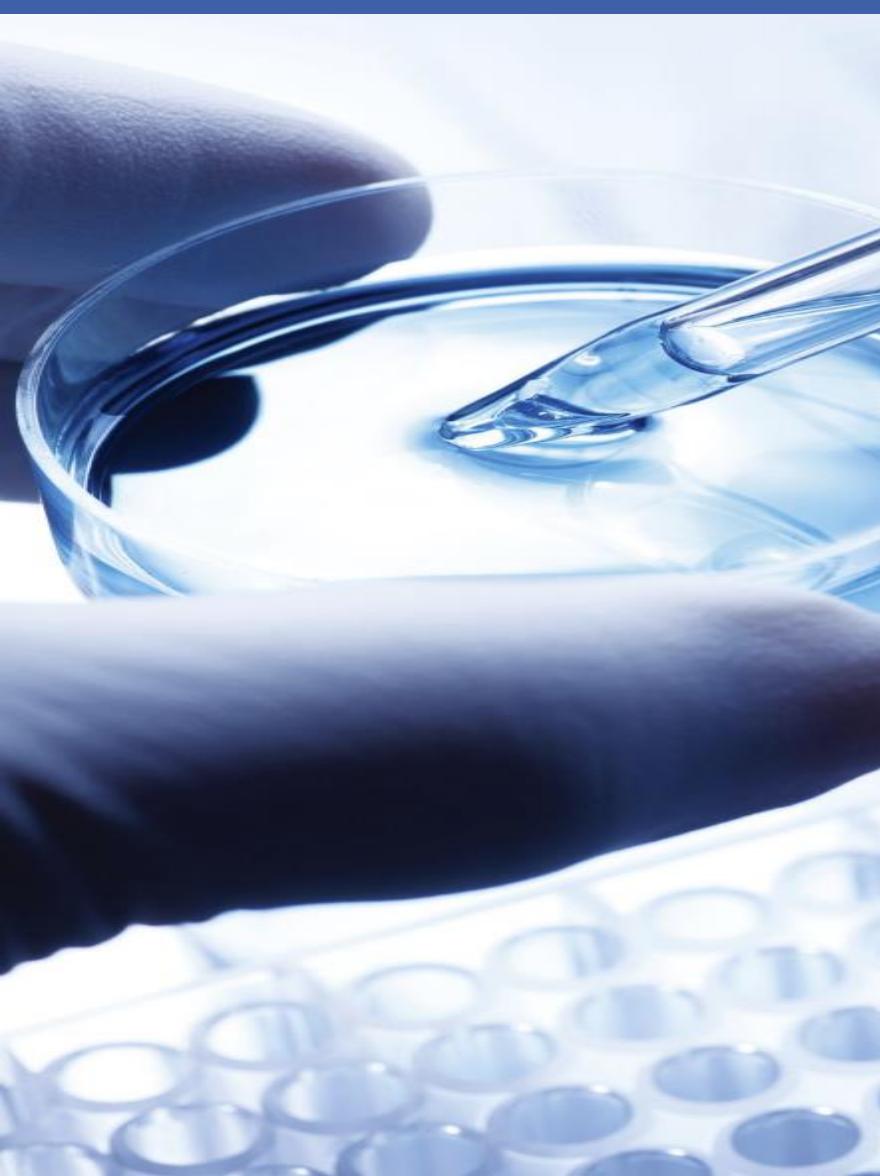
- Deploy with ease, just a few clicks to provision
- No need preparation in Excel
- Train and execute ML models (Numeric Prediction, Bi/Multi Classifier, Clustering)
- Mobile analytics with natural language query

Use Case

- Dashboards, Reports, Data Visualization
- Single-click ML (Machine Learning)
- Graph analytics, Spatial visualization
- Empower Business users, data engineers/scientist to easily access data and make decisions



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3. Implementation

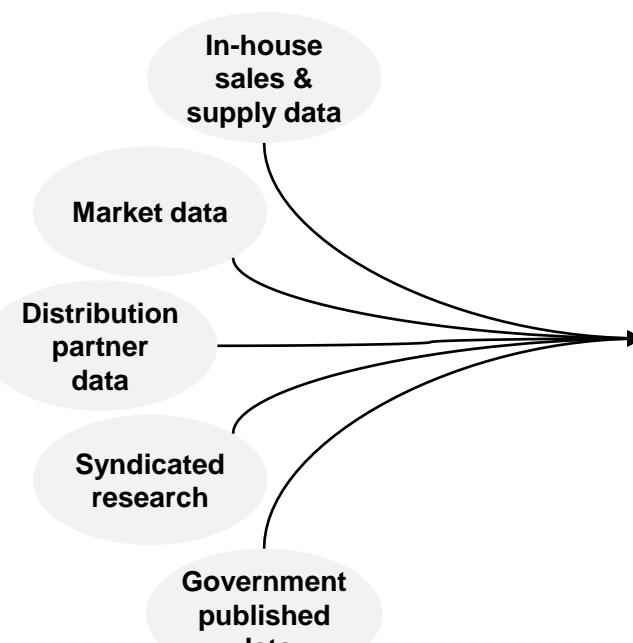
1. Development of Driver Factors for AI/ML Forecasting
2. Use and Customization of Forecasting System for Inline and Pipeline Products
3. System Integration & Maintenance
4. Timeline from Initiation to Go-live

3.1 Development of Driver Factors for AI/ML Forecasting

- For each use case, S company will be able to start small and evolve the model to leverage the right driving factors for an accurate model

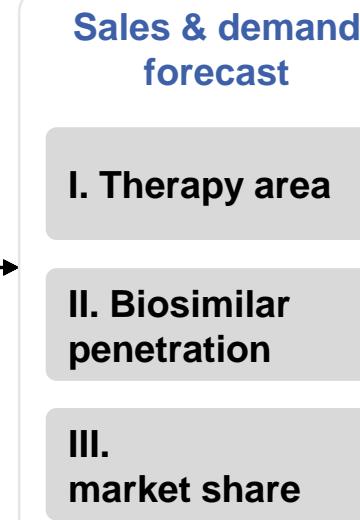
A. Identify driver factors

In the first iteration, a number of baseline and a few additional driving factors are selected



B. Enhance model

The model is built and enhanced with additional data sets, leveraging previous models as a template



C. Evaluate model

Measuring accuracy and evaluating driving factors with explainability, the model is evaluated and new driving factors can be considered

Forecast accuracy

How accurate the forecast predicts

Explainability

The relevance of driving factors to the forecast model

Re-iterate, refine model and driver factors

3.1 Development of Driver Factors for AI/ML Forecasting

S company will be able to start small and evolve the model in an agile manner

Driver factors	Example data sets	Typical sources
In-house sales & supply data	<ul style="list-style-type: none"> • Sales • CRM 	<ul style="list-style-type: none"> • Supply chain • Tenders , partners
Market data	<ul style="list-style-type: none"> • Competitor sales • Prescription 	IQVIA xPonent
Distribution partner data	<ul style="list-style-type: none"> • Stock levels • Sales 	<ul style="list-style-type: none"> • Sales forecasts Distribution & commercialisation partners
Syndicated research	<ul style="list-style-type: none"> • Access • Reimbursement • Regulatory intel 	<ul style="list-style-type: none"> • Clinical trials • Drug dev. & approvals • Patient claims data Clarivate, WHO, Globaldata Kantar health, Biomedtracker
Government published data	<ul style="list-style-type: none"> • Clinical trials • Claims data 	HIRA, WHO, Pubmed

3.1 Development of Driver Factors for AI/ML Forecasting

- Derive driver factors based on three broad categories of market driving factors to be analyzed in order to quantify expected changes in forecast result



Pricing
Changes

- **Total Number of competitors** in the market, and **timing + sequence of launch** will determine expected level of discount
- **Change in Cost of Originator** product will drive price expectation for Biosimilar
- **International reference pricing** will impact biosimilar prices at global & regional level (*will not impact MVP as it is single market*)



New
biosimilar
launches

- **Upcoming biosimilar launch schedule** by key competitors / new competitors in the next 5 years
- Indications with shorter **treatment duration** have lower **interchangeability barriers** than treatments with longer treatment duration, given targeting naïve patients vs. shifting treatment of existing patients – (*relatively fewer events, can be planned for future enhancement*)



Governing
policies and
clinical practice

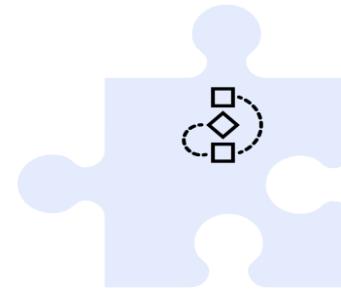
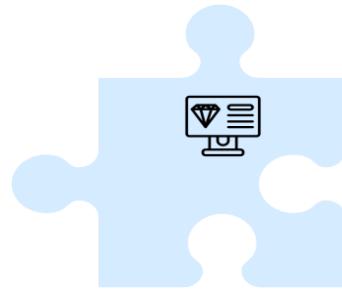
- **Regulation / Access changes** in favor of Biosimilar adoption – e.g. ease of evidence needed for approval, HTA needs
- **Clinical Guideline updates** for biosimilar adoption and **News of adverse events** reported from biosimilar usage (*Impact expected to be relatively lower, can be planned for future enhancement*)
- Prescribing physicians' familiarity with and positive experience from earlier biosimilars in the same therapeutic area

* quotation: Clarivate

Based on analogue case analysis for above events, we can ascertain impact of the above scenarios which will be built on top of historical sales and base forecast

3.1 Development of Driver Factors for AI/ML Forecasting

Develop driver factors by considering various factors such as indication area, approved countries, treatment type, entry sequence and data availability. Oracle will utilize 4-5 analogue selection criteria for pricing and share estimation



Key questions answered:

Indication area

- In which therapy area is the product used in? (*Immunology, Oncology, Metabolic etc.*)
- Is it directly competing within the same line of therapy?

Treatment type

- Is it a Chronic vs Acute condition?
- Are the proposed formulations of the same type?

Approved countries

- Which countries are the analogue available in?

Entry sequence

- How many biosimilars have entered the market prior to this?

Data availability

- Availability of at least 2 years of data post launch
- Any adverse events that signify the analogue has a lower safety and efficacy?

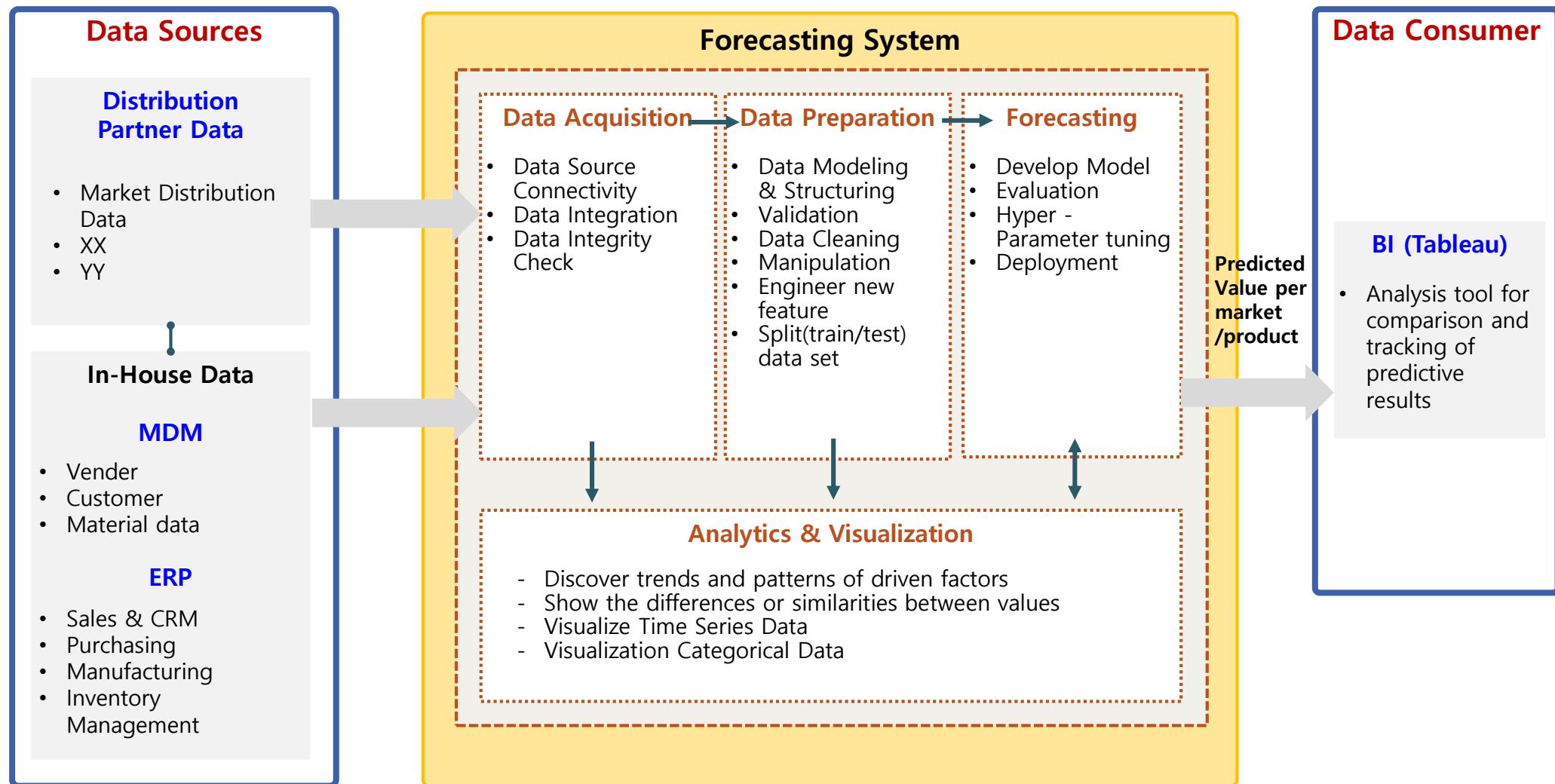
Based on above criteria, products will be selected for pricing and patient share



* quotation: Clarivate

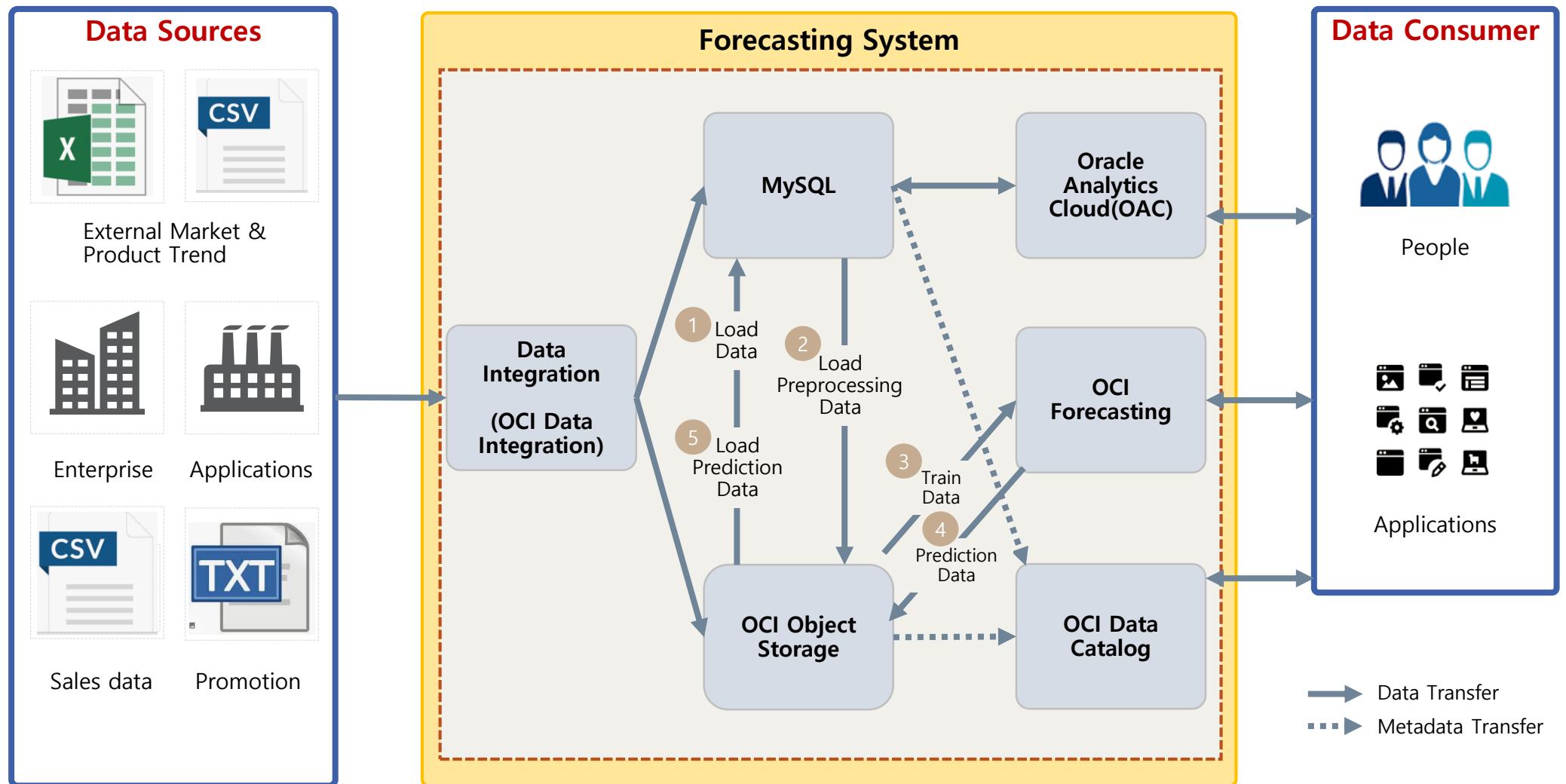
3.2.1 Conceptual view of Data Flow

Conceptual view of data flow in proposed overall architectures



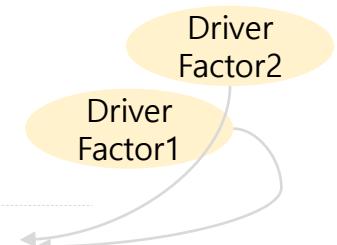
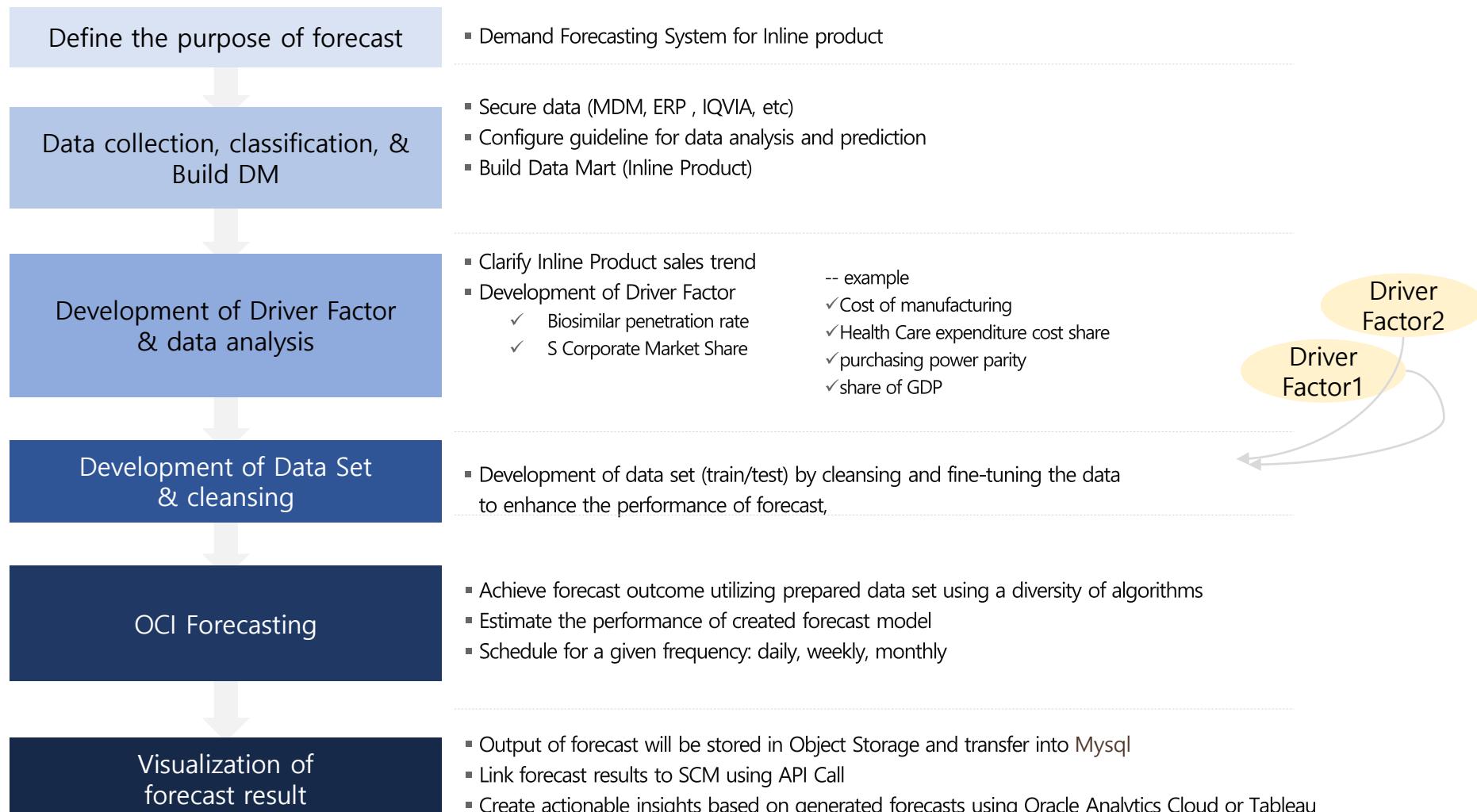
3.2.1 Forecasting System Architectures > Implementation view

Forecasting System Environment (implementation view)



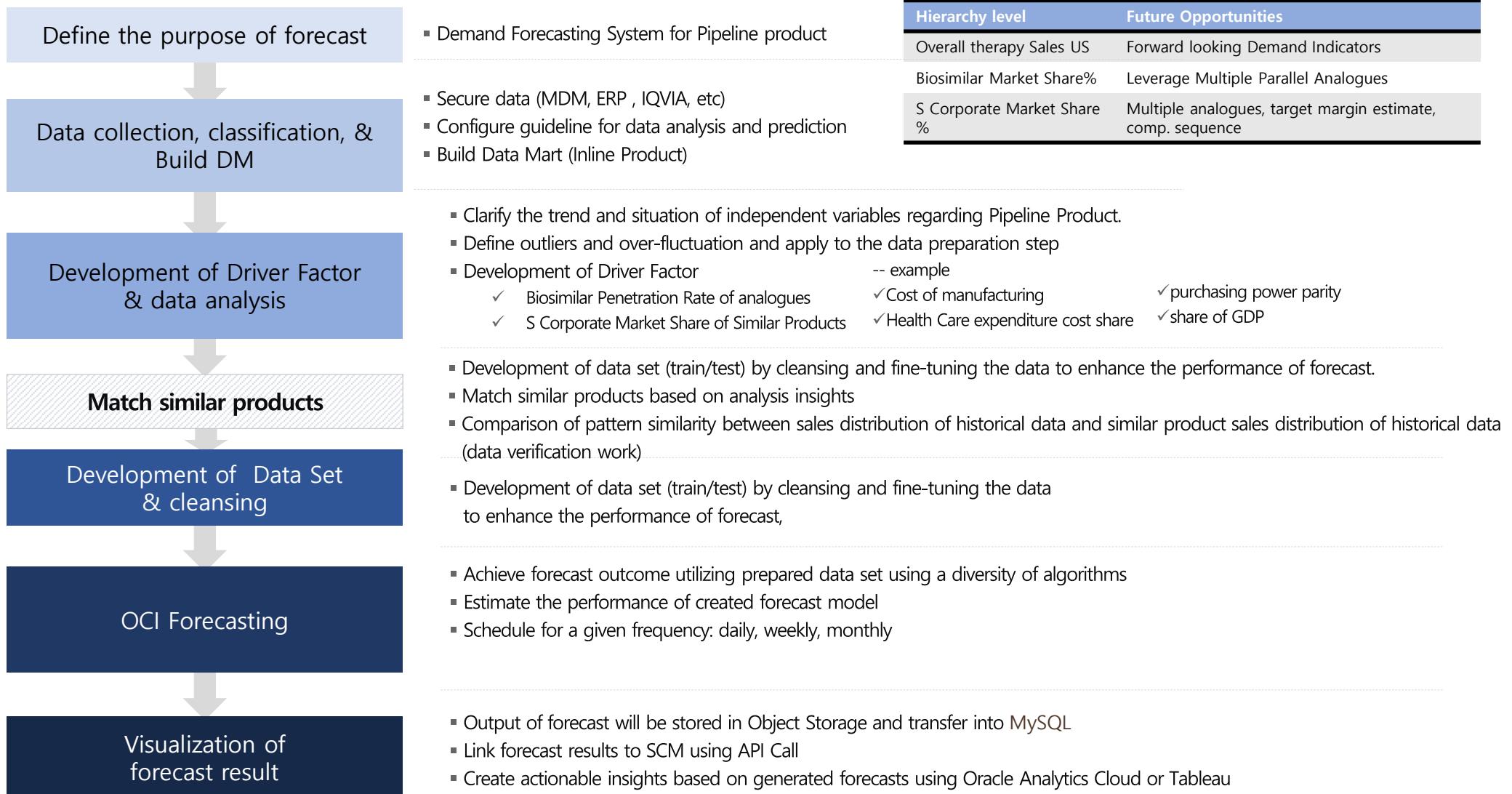
3.2.2 Forecasting System for Inline Products

Develop forecast by using various source data, inline products' historical data and invented Driver Factors



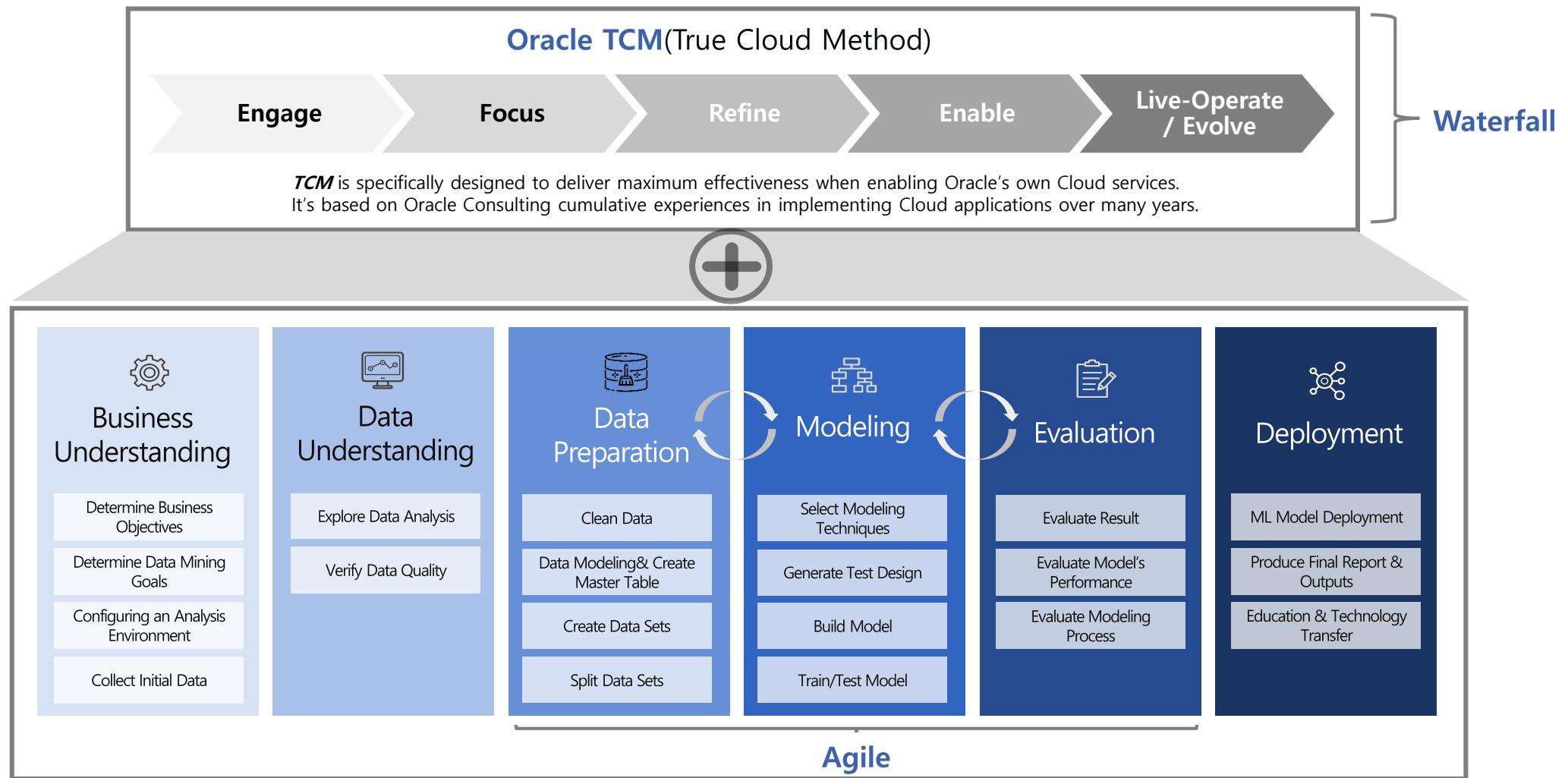
3.2.3 Forecasting System for Pipeline Products

Develop forecast by using various source data, relevant markets, product data, and invented Driver Factors



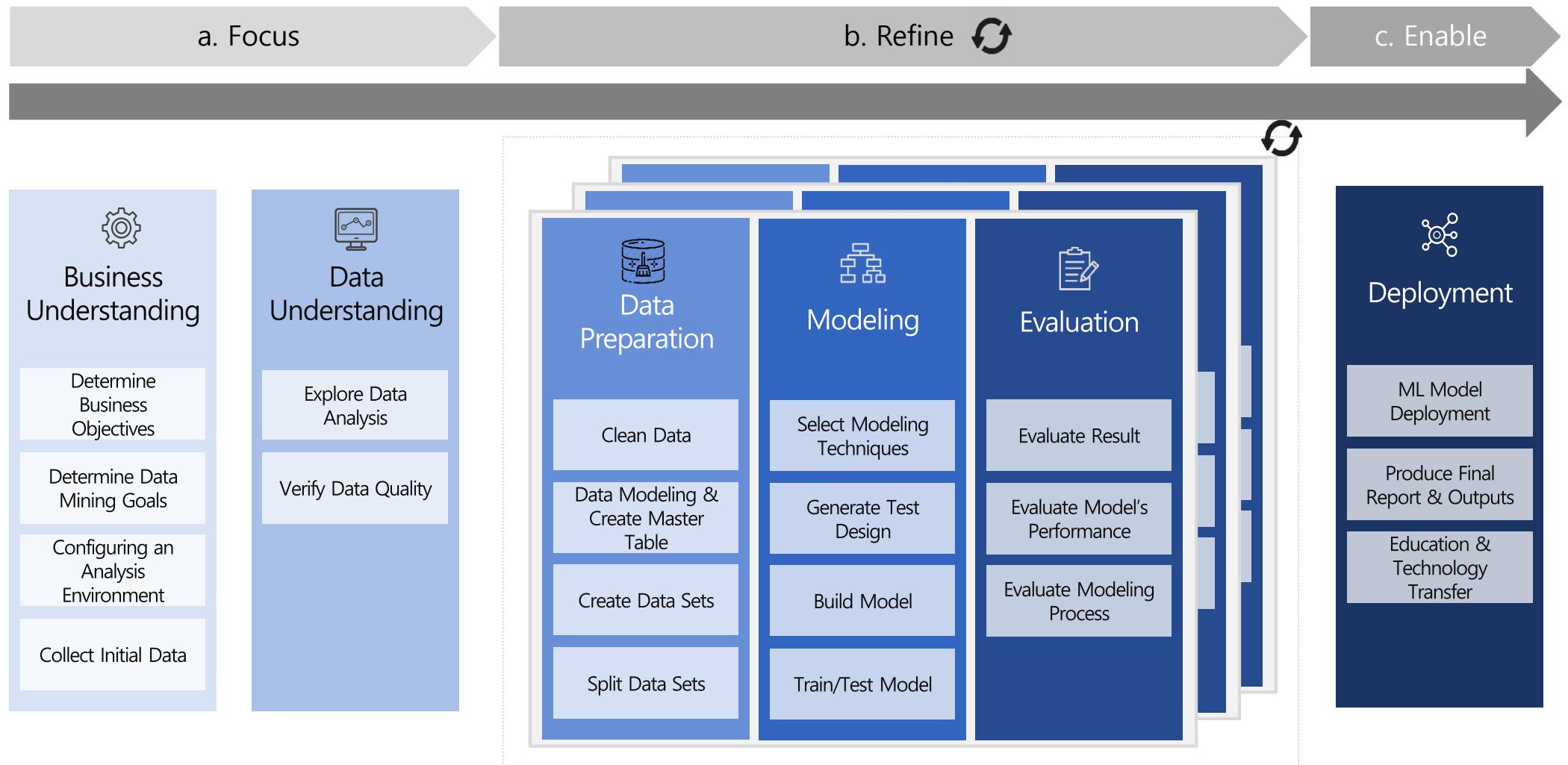
3.2.5 Implementation Plan > Analysis Methodology

- Implement project utilizing TCM and CRISP-DM. TCM is specifically designed to deliver maximum effectiveness when enabling Oracle's own Cloud services. CRISP-DM is the most validated analysis methodology



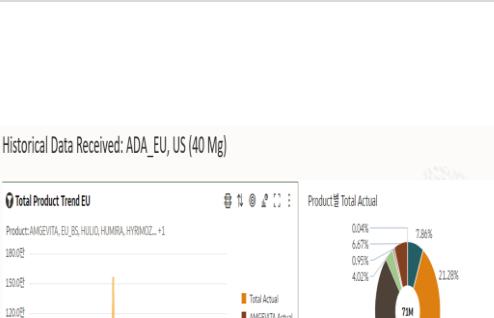
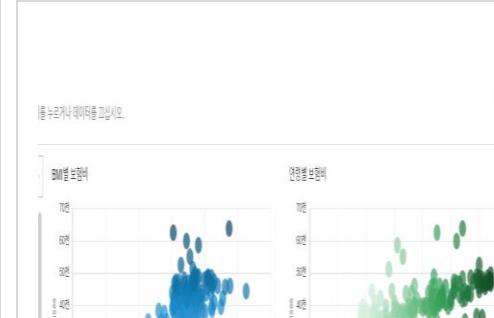
3.2.5 Implementation Plan > Analysis Methodology

Implement project utilizing TCM and CRISP-DM. TCM is specifically designed to deliver maximum effectiveness when enabling Oracle's own Cloud services. CRISP-DM is the most validated analysis methodology



3.2.5 Implementation Plan > Implementation Process > a. Focus

First phase, Focus includes understanding of S company ' business and data

Business Understanding	Data Understanding
<p>Task</p> <ul style="list-style-type: none"> Determine Business Objectives Determine Data Mining Goals Configuring an Analysis Environment Collect Initial Data <p>Description</p> <ul style="list-style-type: none"> Steps to understand the business purpose and analysis goals and to develop a project plan. An understanding of the business domain and setting of project goals are essential. Collect the Initial data for analysis and forecasting. <p>Outputs</p> <ul style="list-style-type: none"> Project Performance Plan WBS 	<p>Task</p> <ul style="list-style-type: none"> Explore Data Analysis Verify Data Quality <p>Description</p> <ul style="list-style-type: none"> Steps to check data quality and explore data Identify issues with data quality and discover insights through data analysis <p>Outputs</p> <ul style="list-style-type: none"> EDA Results Data Quality Results 

3.2.5 Implementation Plan > Implementation Process > b. Refine

First phase, Focus includes Data Preparation, Modeling, and Evaluation

Data Preparation	Modeling	Evaluation
Task	Task	Task
Description	Description	Description
<ul style="list-style-type: none"> • Clean Data • Data Modeling& Create Master Table • Create Data Sets • Split Data Sets 		<ul style="list-style-type: none"> • Select Modeling Techniques • Generate Test Design • Build Model • Train/Test Model
<p>Steps to select and clean data for analysis and to create a set of data</p> <p>Identify the noise, outliers, and missing values of the data.</p> <p>Clean data and create a dataset.</p> <p>Separate data for train and test for predictive analysis.</p>	<ul style="list-style-type: none"> • Selecting modeling techniques and algorithms and optimizing the parameters used in the modeling process • Assess the modeling results with a test dataset to identify model overfitting or underfitting issues 	<ul style="list-style-type: none"> • Steps to assess whether the modeling results are relevant for the purpose of the analysis • Evaluate the analysis results and modeling process and determine whether the implementation results are finally accepted
<p>Data Preparation Results</p> <p>Data Sets(Train/Test)</p>	<p>Outputs</p> <ul style="list-style-type: none"> • Modeling Results 	<p>Outputs</p> <ul style="list-style-type: none"> • Modeling Results

3.2.5 Implementation Plan > Implementation Process > c. Enable

First phase, Focus includes Deployment

Deployment

[Online Education]
Get started with Oracle Cloud Infrastructure Forecasting

Oracle Cloud Infrastructure Overview - The true enterprise cloud

ORA

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About This Workshop

Forecasting is a common data science problem that aids companies with effective and efficient planning, goal setting and to forecast future events like demand etc. OCI-PSF service uses data science and machine learning to deliver high quality and reliable forecasts. It is fully managed, serverless and multi-tenant service, accessible over REST APIs. Forecasting methods can be simple statistical models or highly complex, such as machine learning models using neural networks etc.

Users can then send new data to the endpoints to get the forecast results of desired horizon. In this workshop, we want to help users achieve the following objective:
The users will be able submit historical data as inline data via end-points and get forecast

Task

- ML Model Deployment
- Produce Final Report & Outputs
- Education & Technology Transfer

Description

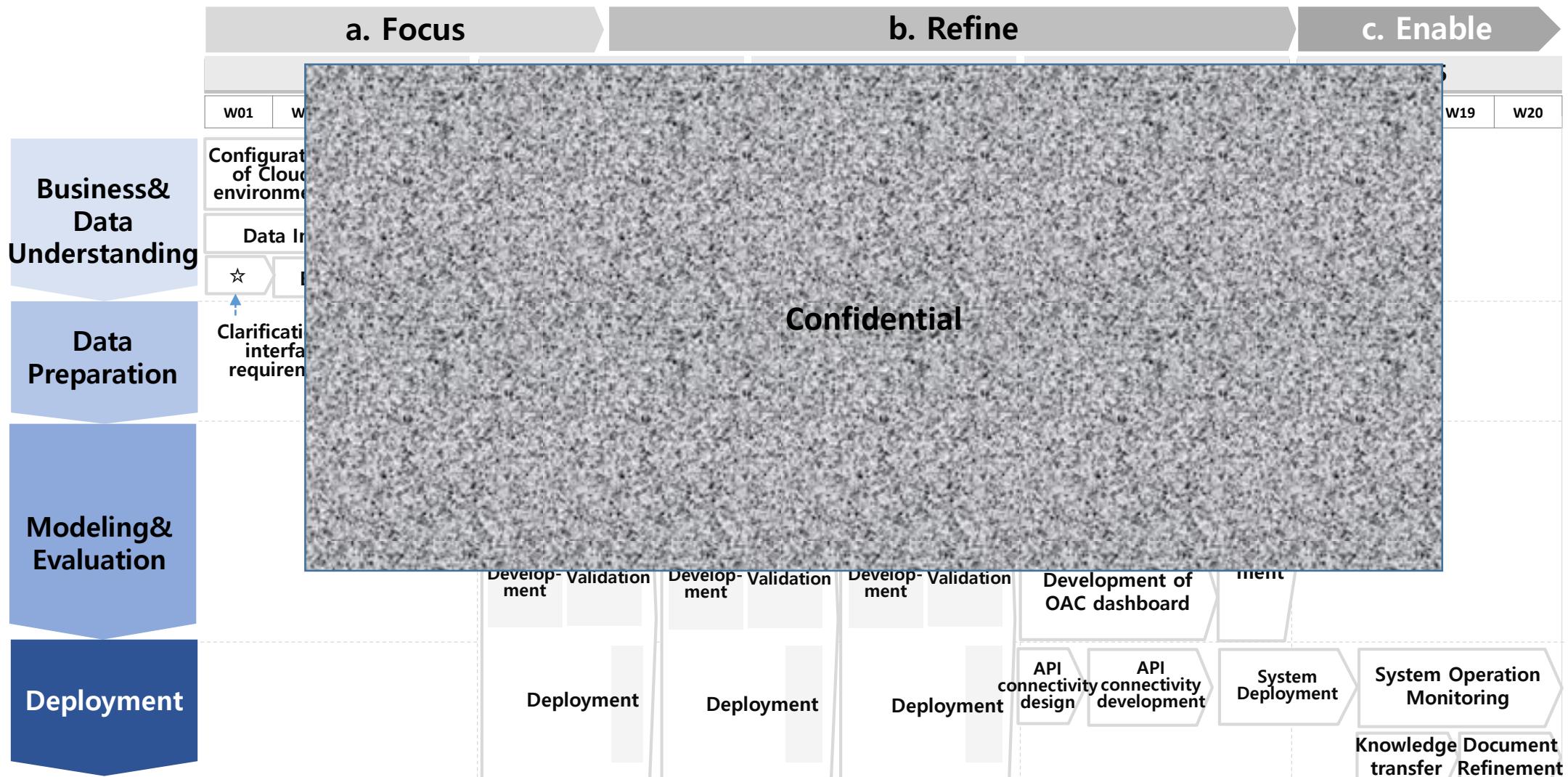
- Steps to plan for the application of the completed model to the actual work
- Develop a plan for monitoring and maintenance of the model.
- Training and technology transfer on system and model operation

Outputs

- Final Reports

3.2.5 Implementation Plan > Timeline of such activities

- Implement the Sales forecasting system development project divided into Focus, Refine, and Enable phases.



End of Document



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