Distribution Requirement Planning Implementation

IE3100R Systems Design Project | Department of Industrial & Systems Engineering

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I. Problem Description

Weatherford Asia Pacific is currently having sub-optimal levels of inventory, which has affected the firm's profitability and competitiveness.

Key issues include:

- Absence of clear planning processes
- Compromised inventory management strategies
- Inability to display demand forecasts to the required level of detail
- High variability of product demand

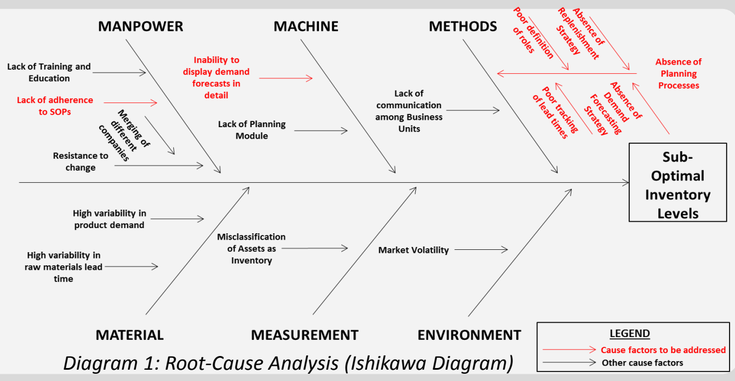

Diagram 1: Root-Cause Analysis (Ishikawa Diagram)

II. Methodology

Define | Measure | Analyze | Improve | Control

- **Define** project problem
- **Measure** current performance using KPIs
- **Analyse** current performance and propose solutions
- **Improve** process by implementing the solution
- **Control** and monitor process performance and KPIs

DMAIC

III. Project Objectives

1. **Identify** and **address** root cause factors contributing to sub-optimal levels of inventory
2. **Analyse** and **introduce** solutions that will improve inventory optimization
3. **Recommend measures** to enhance regional inventory visibility, monitor performance & facilitate continual process improvement

Where we were

1. Absence of Planning Process
2. Lack of Inventory Visibility
3. High Demand Variability
4. No Safety Stock Policy

Where we are moving towards

1. Efficient Planning Process Flow
2. Inventory Visibility
3. Low Aggregate Demand Variability
4. Effective Safety Stock Policy

IV. Implementation

Deliverable 1: Forecast Management Application & Improved Process Flow

Before

Demand planners are only able to view limited demand forecast information in the initial JD-Edwards interface as shown in Figure 1.1.

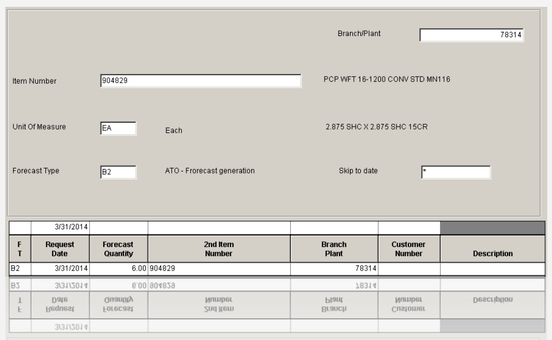

Figure 1.1: Initial JDE platform

After

Both forecasted & actual demand data are now displayed, to the required level of details, including project description, estimated cost and demand type, as shown in Figure 1.2.

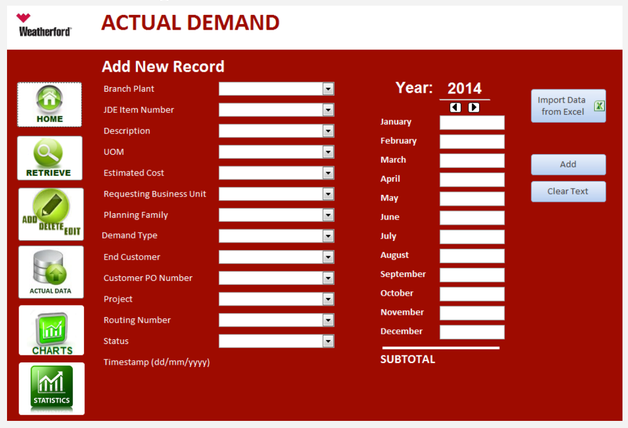

Figure 1.2: Improved Forecast Management Application

Comparison

Figure 1.3 compares the current JDE platform with the improved Forecast App, highlighting additional fields provided by the latter.

	JDE	Forecast Application
Branch Plant	☑	☑
Customer PO Number	☑	☑
Control Chart		☑
Demand Type	☑	☑
Description of Forecast	☑	☑
End Customer		☑
Estimated Cost		☑
Forecast Quantity	☑	☑
Forecast Performance Measure		☑
Item Number Short	☑	☑
Planning Family		☑
Project Description		☑
Requesting Business Unit		☑
Routing Number		☑
Status		☑
Timestamp		☑
UOM	☑	☑

Figure 1.3: Comparison between current & improved platforms

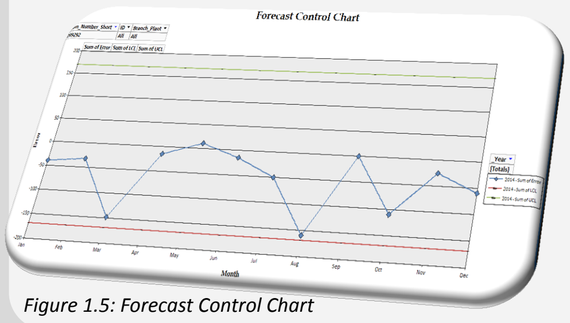

Figure 1.5: Forecast Control Chart

Improvement

Demand Planning is now streamlined and executed more efficiently with the Forecast App.

The application bridges existing gaps in inventory management flow as shown in Figure 1.4.

Forecast performance indices and **control charts** can now be generated for monitoring and analysis (Figure 1.5).

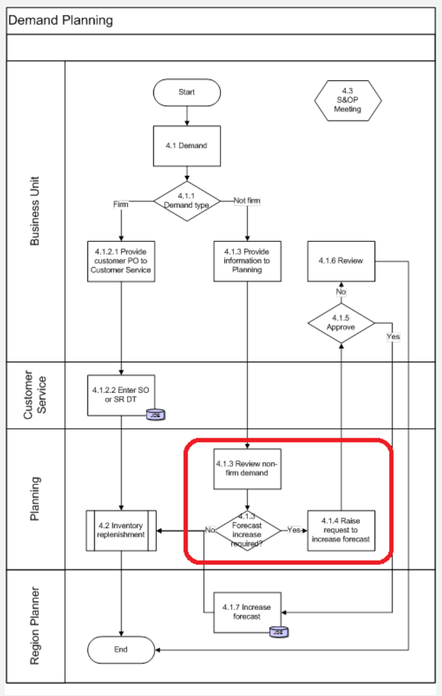

Figure 1.4: Streamlined Demand Planning Process

Deliverable 2: Establishment of Regional Inventory Hub

The consolidation of a regional inventory hub leverages on the benefits of risk pooling. It reduces the variability in aggregate demand, which in turn decreases the required level of safety stock.

In view of this, the project proposed to establish a regional inventory hub and analyzed its feasibility.

Selecting Hub Location - AHP

17 potential hub locations in the Asia-Pacific region were analyzed using Analytic Hierarchy Process (AHP) methodology. Figure 2.1 shows the AHP hierarchy which summarizes the goal, 5 selection criteria and alternatives considered.

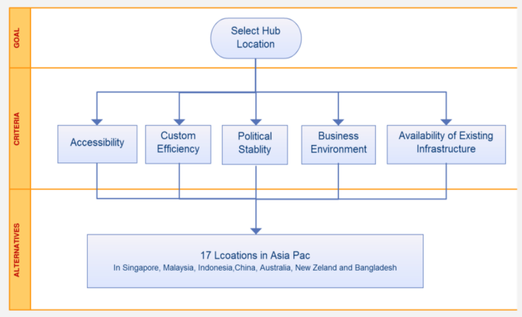

Figure 2.1: AHP Hierarchy

Ideal mode			RATINGS	RATINGS	RATINGS	RATINGS	RATINGS
Alternative	Total	Costs	Accessibility (L: .109)	Customs Efficiency (L: .281)	Business Environment (L: .157)	Political Stability (L: .041)	Availability of Existing Infrastructure (L: .412)
Singapore	.975		<2000	4.00 - 5.00	1 - 10	4.00 - 5.99	Abundant
Perth	.733		3001-4000	3.00 - 3.99	11 - 30	2.00 - 3.99	Abundant
Tianjin	.660		3001-4000	3.00 - 3.99	61 - 100	4.00 - 5.99	Abundant
Kemaman	.598		<2000	3.00 - 3.99	1 - 10	6.00 - 7.99	Sufficient
Labuan	.509		<2000	3.00 - 3.99	1 - 10	6.00 - 7.99	Lacking
Brisbane	.451		3001-4000	3.00 - 3.99	11 - 30	2.00 - 3.99	Sufficient
Songkhla	.361		2000-2100	2.00 - 2.99	11 - 30	6.00 - 7.99	Sufficient

Figure 2.2: Expert Choice ranked locations

The locations were rated and ranked according to the weighted selection criteria, as summarized in Figure 2.2.

Cost-Effectiveness Analysis

A **cost analysis** was performed for the top five performing locations and compared against their respective effectiveness, as shown in Figure 2.3.

Sensitivity analysis was then conducted to account for error margins, and represented in the efficient frontier in Figure 2.4.

Singapore and Tianjin were on the efficient boundary while Perth was clearly dominated.

Final decision-making involves a trade-off between cost and effectiveness.

Location	Cost/USD	Effectiveness
Singapore	$ 3,359,887	0.975
Perth	$ 3,739,523	0.733
Tianjin	$ 2,038,595	0.660
Kemaman	$ 2,274,007	0.598
Labuan	$ 2,380,300	0.509

Figure 2.3: Detailed Cost Analysis

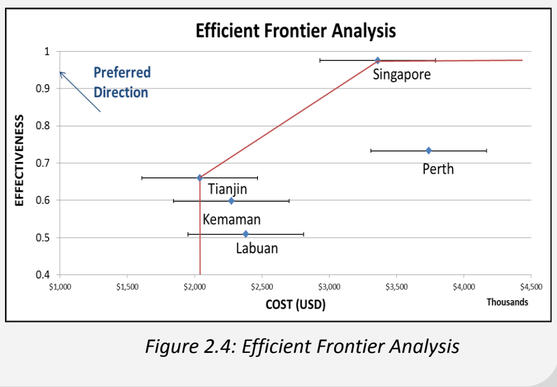

Figure 2.4: Efficient Frontier Analysis

V. Impact of Project

Beta-testing of the Forecast Management Application was executed in November 2013 in Australia. The key performance indicator Purchase-Consumption Ratio was tracked to measure the resulting impact.

The drop in Purchase-Consumption Ratio from 1.56 to 0.85, closer to the target value of 0.9, indicates that Weatherford Australia is managing its inventory better as shown in Figure 3.1.

Before	After	Target
1.56	0.85	0.90

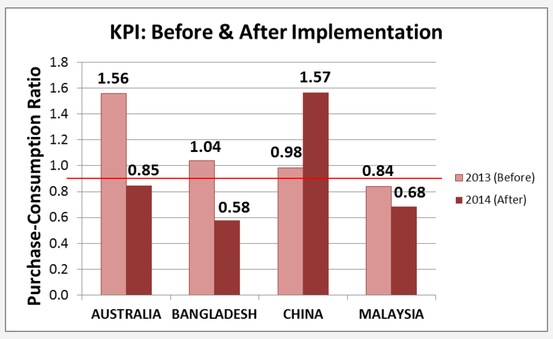

Figure 3.1: Improved KPI in Australia VS other countries

Validation

	Modes of Validation	Remarks	Results
Deliverable 1 Forecast App	Test Cases	Inputted specific test cases to check for the accuracy of specific outputs	☑
	Feedback from Company	Continuous communication with industrial supervisors for feedback	☑
Deliverable 2 Regional Hub	Cost Analysis	Project cost savings of hub establishment	☑
	Sensitivity Analysis	Determine sensitivity of each selection criteria. Carried out what-if analysis to verify accuracy of results	☑

VI. Future Directions

Objectives

1. **Identify** and **address** root cause factors
2. **Analyse** and **introduce** solutions toward inventory optimization
3. **Recommend measures** to enhance regional inventory visibility, monitor performance & facilitate continuous process improvement

Contributions

- ✓ Established fundamental Demand Planning processes
- ✓ Analyzed feasibility of establishing inventory hub
- ✓ Devised effective Safety Stock policy

Future Directions

- ✓ Extend usage of Forecast Application to entire region
- ✓ Improve planning accuracy of demand forecast
- ✓ Establish regional planning unit to execute and monitor inventory strategies