

# FATIMA FERTILIZER





## ABOUT THE COMPANY

With its innovative "Salam Kissan" campaign, Fatima Fertilizer has once again earned international acclaim and won the prestigious Drum Award 2023 in London, in the category, "Social Purpose: Social Media

Fatima Fertilizer became the first company to have clocked 60,220,000 safe man-hours, which is the highest accomplishment within the global fertilizer industry





## OUR MISSION

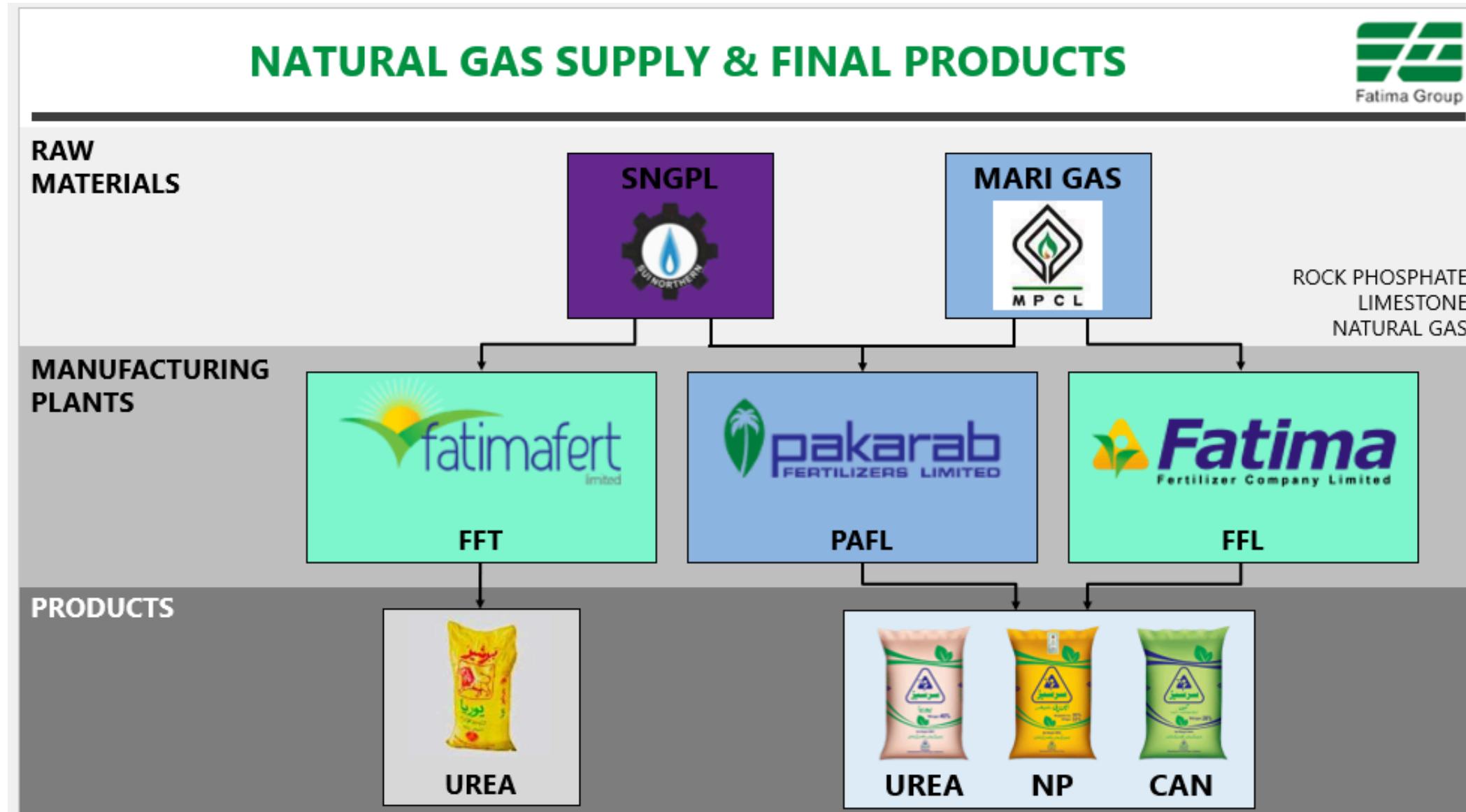
**To be the preferred fertilizer company for farmers, business associates and suppliers by providing quality products and services.**

**To provide employees with an exciting, enabling and supportive environment to excel in, be innovative, entrepreneurial in an ethical and safe working place based on meritocracy and equal opportunity.**

**To be a responsible corporate citizen with a concern for the environment and the communities we deal with**



# PRODUCTION PROCESS

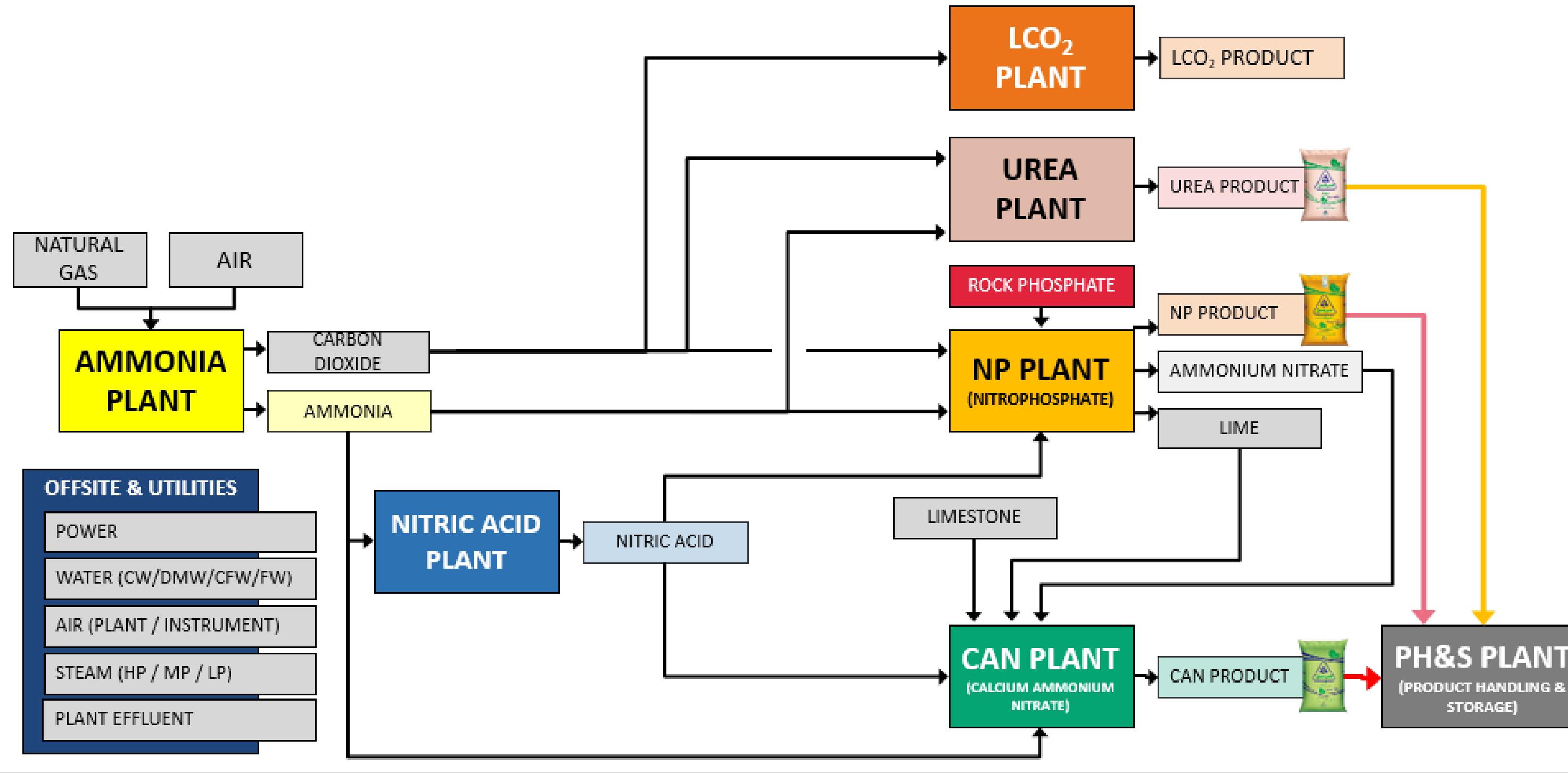


Fatima Fertilizer has a continuous process and uses product layout

Product Layout: activities arranged according to the sequence of operation that need to be performed

# PRODUCTION PROCESS

## RAW MATERIALS TO FINAL PRODUCTS



# PRODUCTION PLAN



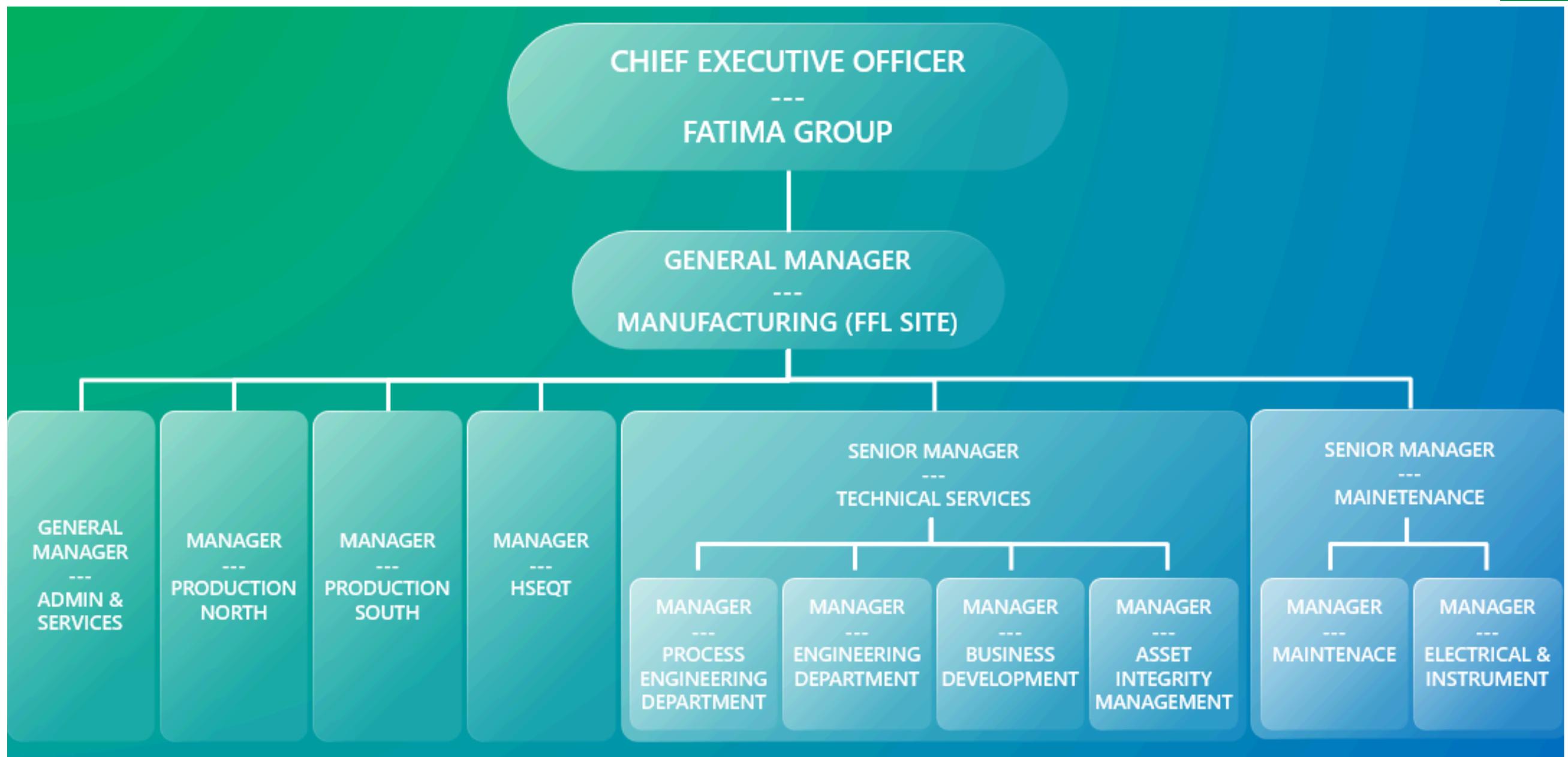
FATIMA FERTILIZER LIMITED

## PRODUCTION PROFILE YEAR 2023

PREPARED BY	SAAD AHMED
REVISION #	06
ISSUE DATE	09 Dec 2022, Fri
PROCESS ENGINEERING DEPARTMENT	

2023	MONTH	INTERMEDIATES		FINAL PRODUCTS			SALES		TOTAL PRODUCT		CHANGE FROM PREVIOUS TARGET					
		NH3	NA	UREA	CAN	NP	NH3	NA	UREA + NP + CAN							
	TARGET PRODUCTION	MT/YEAR	555,158	458,200	514,194	449,235	333,475	-	6,000	1,296,904	-	53,259				
	CAPACITY FACTOR	%	111.81	91.17	103.99	99.58	86.84									
	ONSTREAM FACTOR		0.87	0.91	0.90	0.88	0.88									
	MONTH	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov				
	Dec	YEAR END														
 <b>1 NH3 PLANT</b>	1.1	TARGET CAPACITY (NAMEPLATE 1500)	%	112.00	112.00	111.67	111.00	111.00	111.00	111.67	112.67	113.33	113.33	111.81		
	1.2	TARGET PRODUCTION DAILY	MT	1,680.0	1,680.0	1,675.0	1,665.0	1,665.0	1,665.0	1,675.0	1,690.0	1,700.0	1,700.0	1,677.1		
	1.3	TARGET PRODUCTION MONTHLY	MT/MONTH	50,400.0	45,360.0	50,250.0	48,285.0	49,950.0	48,285.0	49,950.0	50,782.5	10,050.0	51,545.0	49,300.0	51,000.0	46,263.1
	1.4	TARGET PRODUCTION QUARTERLY	MT/QUARTER		146,010.0			146,520.0			110,782.5			151,845.0	555,157.5	
	1.5	PLANNED SHUTDOWN	DAYS	1.0	1.0	1.0	1.0	1.0	1.0	0.5	24.0	0.5	1.0	1.0	34.0	
	1.5.1	COMPLETE SHUTDOWN	DAYS	-	-	-	-	-	-	20.0	-	-	-	-	20.0	
	1.5.2	PARTIAL S/D WITH FRONT END IN OPS	DAYS	1.0	1.0	1.0	1.0	1.0	1.0	0.5	4.0	0.5	1.0	1.0	14.0	
	1.6	OPERATING DAYS	DAYS	30.0	27.0	30.0	29.0	30.0	29.0	30.5	6.0	30.5	29.0	30.0	331.0	
	1.7	ON-STREAM FACTOR	-	0.94	0.93	0.94	0.94	0.94	0.94	0.97	0.11	0.97	0.94	0.94	0.87	
	1.8	MONTHLY CONSUMPTION	MT/MONTH	50,150.0	45,110.0	50,000.0	48,617.6	48,618.0	48,534.4	49,700.0	50,635.8	11,946.9	51,286.7	49,300.0	51,258.3	555,157.7
				250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	250.0	-	-	-	
	1.8.1	NH3 AVAILABLE FOR UREA	MT/MONTH	26,726.1	23,642.9	26,404.6	25,829.4	26,957.3	25,768.3	26,411.8	27,077.2	4,552.7	27,845.4	26,476.1	27,455.6	295,147.3
	1.8.2	NH3 USED BY NA	MT/MONTH	11,886.0	10,697.4	11,801.1	11,325.7	10,807.8	11,325.7	11,631.3	11,716.2	3,891.3	11,461.5	11,325.7	11,801.1	129,670.6
	1.8.3	NH3 USED BY CAN	MT/MONTH	6,529.4	5,853.9	6,414.8	6,083.0	5,844.4	6,060.9	6,277.3	6,277.3	2,389.8	6,414.8	6,304.2	6,529.4	70,979.1
				0.1602	0.1747	0.1721	0.1780	0.1602	0.1780	0.1721	0.1751	0.1780	0.1751	0.1719	0.1750	0.1721
	1.8.4	NH3 USED BY NP	MT/MONTH	5,008.4	4,915.6	5,379.4	5,379.4	5,008.4	5,379.4	5,379.4	5,564.9	1,113.0	5,564.9	5,193.9	5,472.1	59,358.6
	1.8.5	NH3 SALES	MT/MONTH	-	-	-	-	-	-	-	-	-	-	-	-	
	1.9	OPENING INVENTORY	MT	2,000.0	2,250.0	2,500.0	2,750.0	2,417.4	3,749.4	3,500.0	3,750.0	3,896.7	1,999.8	2,258.1	2,258.1	-
	1.10	CHANGE	MT	250.0	250.0	250.0	(332.6)	1,332.0	(249.4)	250.0	146.7	(1,896.9)	258.3	-	(258.3)	-
	1.11	CLOSING INVENTORY	MT	2,250.0	2,500.0	2,750.0	2,417.4	3,749.4	3,500.0	3,750.0	3,896.7	1,999.8	2,258.1	2,258.1	1,999.8	-

# Mapping Information Flow



**Top-down leadership style**

- > Defined hierachal structure

**Inter-division and Intra-division flow of information:**

- > Multiple departments within production units
- > Forward and backward integration

# New Technologies

01

## **ORA (Operator Round Automation)**

- In-House development
- Manual operator reading processes are fully automated via Tablet integration.
- First time in Pakistan

02

## **APC (Advanced Process Control)**

- Software based tool
- energy optimization of the plant
- enhanced capacity and energy efficiency of Ammonia and Nitric acid plants

03

## **Cold Box Expander with DCS (Distributed Control System)**



# Challenges faced while implementing new technology into operations



## ORA (Operator Round Automation)

› external solutions priced at 65 to 70 million PKR but solved with In-house development around 8 to 10 million PKR vs.



## APC (Advanced Process Control)

› high installation and procurement costs  
› after cost-benefit analysis it was accepted to be bought

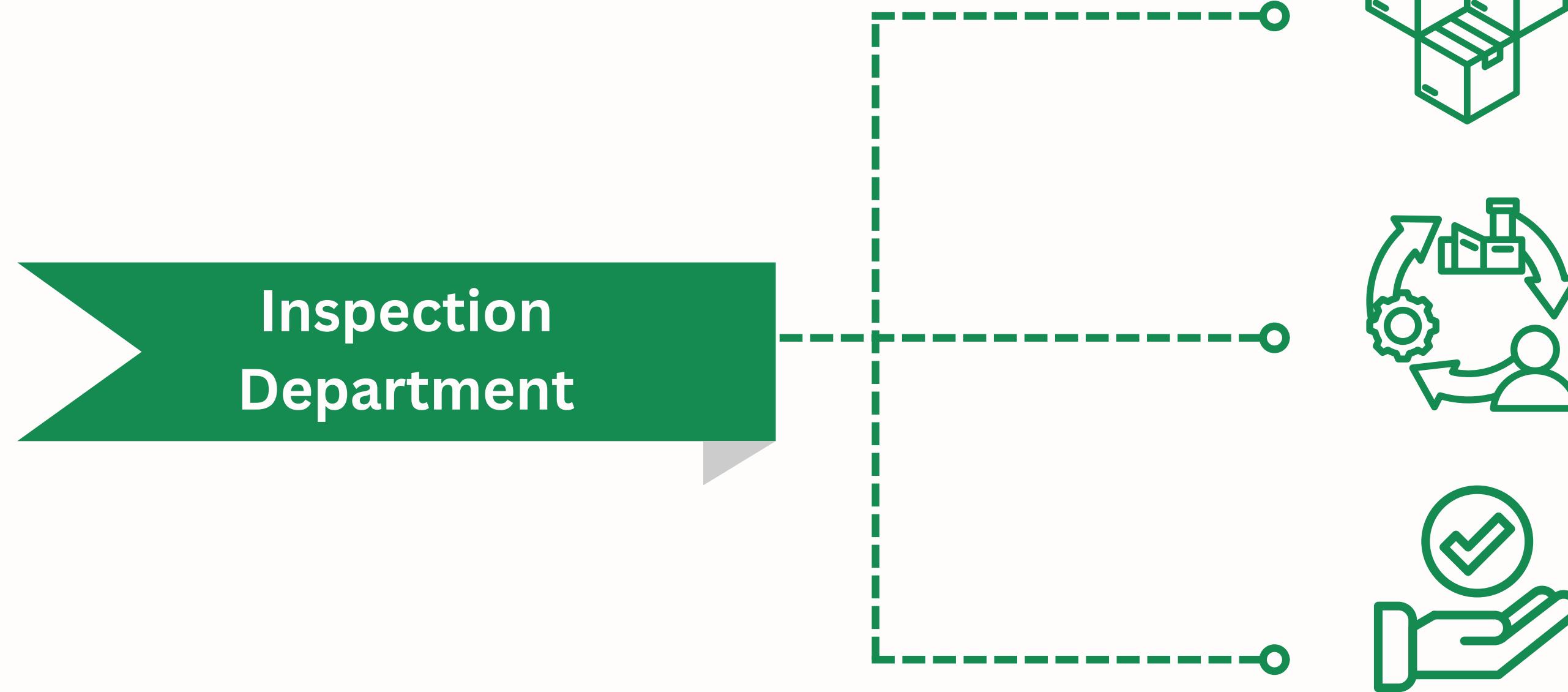


## DCS (Distributed Control System)

› Integrating DCS with the cold box was a major challenge that was overcome with the help of IT and research



# QUALITY CONTROL



Inspection  
Department

## Before production

MTS, workshops,  
material analyzer

## During production

Ensure process control  
by lab tests and process  
team

## After production

Market checks

# Recommendations

Introduce an ERP system instead of sheets

Ensuring tracking, better data analysis and automation



# QUALITY OF CONFORMANCE

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- Work space
- Township facility - diverse employees from all over country
- Well-being of families
- Recreational activities
- Wellness and safety

## Work design and Motivation

- Behavioral school
- Job rotation & enrichment
- Motivation by spot awards & checks
- Extensive trainings
- Counselling and recognition in meetings

- **1<sup>ST</sup> NATIONAL INDUSTRY AWARDED ATD BEST & EXCELLENCE IN PRACTICE AWARDS**
- **RANKED 12<sup>TH</sup> AMONG WORLD'S 200 COMPANIES**



# Extensive Trainings

## Training

Overall Training Man-Hours	2018	2017
Soft Skills (Manufacturing + Non-Manufacturing)	28,082	1,592
Functional Trainings (Manufacturing)	42,000	40,094
Functional Trainings (Non-Manufacturing)	544	691
<b>Total Hours</b>	<b>70,626</b>	<b>42,377</b>

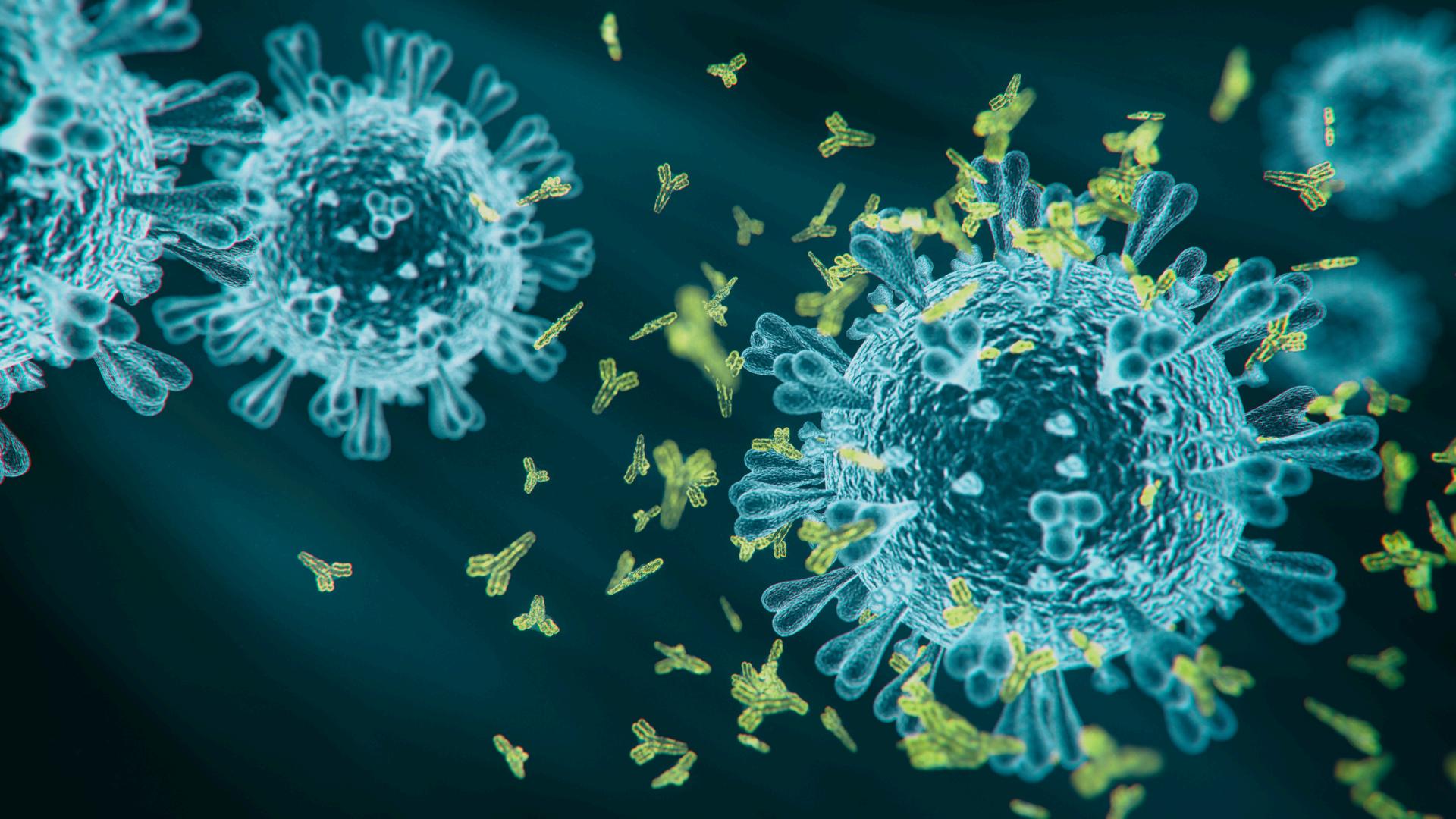
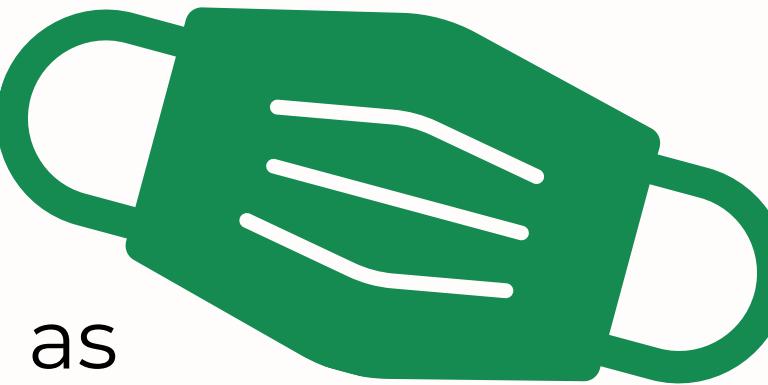


# Covid-19 Impact

- Uninterrupted operations during the COVID-19 pandemic
- The inelastic nature of demand
- Agricultural needs for fertilizers remain constant regardless of external disruptions
- No prominent supply chain disruption

Restrictions in plants, such as

- Masks mandatory - fine of 200PKR on violating protocols
- No outdoor events for employees and access to recreational facilities restricted
- Number of workers allowed in one vicinity at a time restricted



# Inventory Management

## Raw Material Procurement

### Natural Resources

- Water (groundwater)
- Nitrogen (air)

### Local

- Natural Gas (Mari, Sindh)
- Limestone (Sukkur)

### Imported

- Phosphoric acid
- Rock Phosphate

# Inventory Management

## WareHousing

### On-site storage

- Limited space
- 30000 metric tonnes Urea and 20000 metric tonnes CAN
- 20000 metric tonnes of Nitric acid can be stored

### Types of warehouses

- Bulk Warehouses
- Sales Warehouses

### Rental System

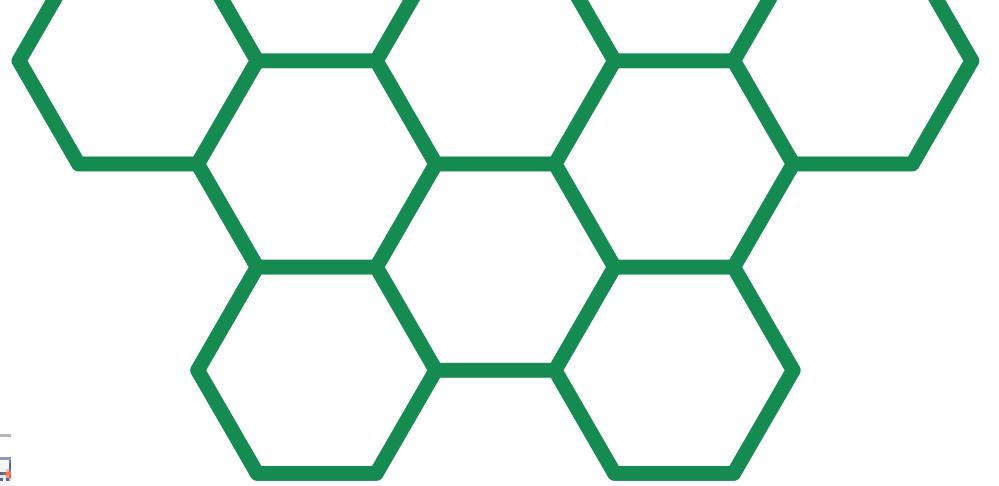
- Warehouses rented during off-peak season

# Inventory Management

- Fatima Fertilizer uses a **Level Output Strategy**.
- Stable output rate but **greater inventory cost** than under chase strategy.
- Holding cost is calculated using **historical data** and prevailing **market conditions** and added to the **annual production plan** at the start of the year.
- **Higher holding costs** and **lower profitability** of the company **during floods**.
- **Lead times** vary from **2 to 4 weeks** for **locally** sourced raw materials and **2 to 6 months** for **internationally** sourced raw materials.



# ANALYSING

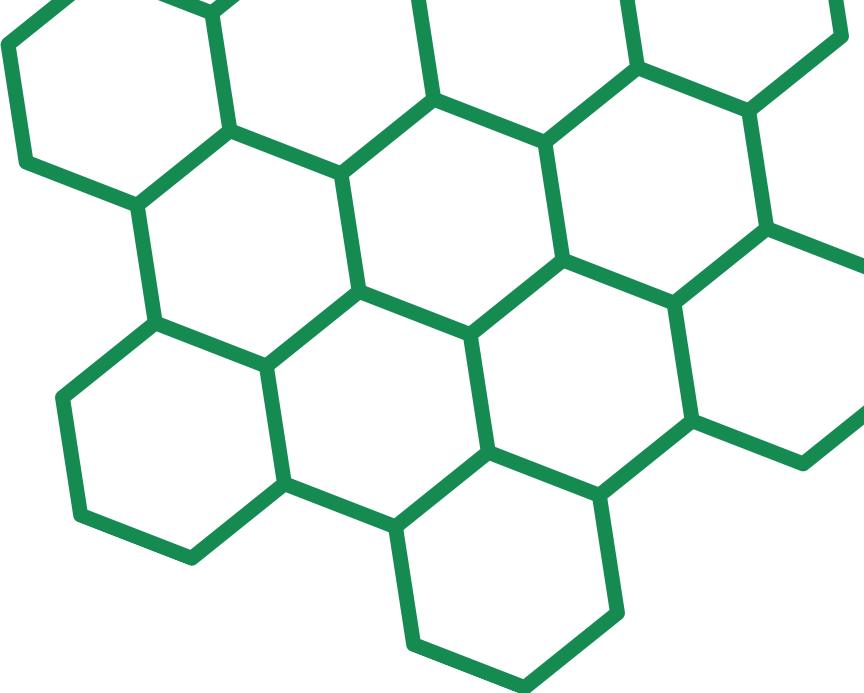


B	C	D	E	F	G	H	I
Opening Inventory MT	Production MT	Consumption MT	Closing Inventory MT	Forecast Inventory MT	Inventory Alert		
2668	42756	53024	-7600	-1774	Low Inventory		
2158	55436	53542	4052	7753	High Inventory		
2359	57474	48379	11454	7712.5	High Inventory		
2774	53365	52168	3971	9934	Normal		
1814	59542	45459	15897	5069	High Inventory		
2396	50266	58421	-5759	-3546.5	Low Inventory		
2647	43511	47492	-1334	6969	Low Inventory		
2035	59698	46461	15272	2769	High Inventory		
2553	40746	53033	-9734	-6942.5	Low Inventory		
2918	42944	50013	-4151	720	Low Inventory		
2965	43331	40705	5591	-3733.5	High Inventory		
2206	41991	57255	-13058		Low Inventory		

- **Variability Indication:** low and high suggests significant variability in demand or supply. This suggests a need to maintain safety stock

# KEY PROBLEM

## Weak supply chain for acquiring and managing Raw Material



### 1 RELIANCE ON A SINGLE VENDOR

- Shortage of **rock phosphate**
- Currently being addressed by searching for **alternate vendors** from Algeria and Egypt
- A **trade-off** between guarantees offered by **OEM** and **lower prices** offered by alternate vendors

### 2 POOR INVENTORY OPTIMIZATION

- Inventory is **not up to date**
- It is not adequately optimized to accommodate:
  - > Any **build-up** of a specific raw material by **changing order quantities**
  - > **Changed lead times** and safety stock due to **import restrictions**

### 3 LACK OF SAFETY STOCK

- The **Catacarb Crisis**:
  - > Plant **equipment malfunctioned** at the ammonia plant due to **impurities** in raw materials.
  - The **plant shut down** for **3 weeks**
    - An **air compressor** at the nitric acid plant got **damaged** due to a **foreign (metal) object ingress**
    - > Production at **NP, CAN, and Nitric acid** plants **halted** for **2.5 months** - lost billions

# SOLUTIONS >

**Effective inventory management is paramount as it helps strike a balance between inventory investment and customer service**

**A-B-C analysis** to prioritize the most important raw materials as per the criteria of delivery problems

**Class A: phosphoric acid, rock phosphate** (import restrictions, long distances, longer transportation, and volatile lead times)

**Class B: natural gas, nitrogen** (locally sourced, less uncertainty, shorter distance and lead times)

**Class C: water** (naturally available)

Incorporation of **modular design** into plant equipment

**Interchangeable parts** could have greatly expedited faulty part replacement

Use **reorder point** ordering with the cushion of **safety stock** to avoid unplanned plant closures, saving billions of rupees.

# SOLUTIONS >

Foster **long-term relationship** building with **suppliers** through effective communication, support programs, and feedback mechanisms.

Evaluate **vendors** based on reliability, distance, and responsiveness

**EOQ (Economic Order Quantity)** model to determine the optimal order size, which minimizes the annual cost

# Economic Order Quantity Model

	A	B	C	D	E	F	G
1			EOQ MODEL				
2							
3	Zones	Annual Demand (metric tonne)	Holding Cost	Ordering Cost	EOQ	No of orders per year	No of orders per month
4	North Zone	1038039	0.50	150.00	24956.43003	41.59405006	3.466170838
5	Central Zone	858682	0.50	150.00	22698.22019	37.83036699	3.152530583
6	South Zone	789440	0.50	150.00	21763.82319	36.27303866	3.022753221
7	Total	2686161			69418.47342	38.69518973	3.224599144
8							
9							
10							

# Recommendations

01

**increase demand during the off-peak seasons by offering (bulk) discounts to the farmers**

02

**employ a perpetual inventory system for effective inventory optimization**



03

# Recommendations

**Acquire critical parts of equipment directly from the source (local producers in Sindh) to bypass intermediaries, saving up to 10 lakhs per machine part.**

**Need to review quality due to the lack of branding.**



# Fatima Fertilizer Inventory Turnover Calculation

**The company's Inventory Turnover for the fiscal year that ended in Dec. 2023 is as follows:**

$$\begin{aligned} \text{Inventory Turnover (A: Dec. 2023)} \\ \\ &= \text{Cost of Goods Sold} / \text{Average Total Inventories} \\ \\ &= \text{Cost of Goods Sold (A: Dec. 2023)} / (\text{Total Inventories (A: Dec. 2022)} + \text{Total Inventories (A: Dec. 2023)}) / \text{count} \\ \\ &= 161240.415 / ((61766.372 + 47244.72) / 2) \\ \\ &= 161240.415 / 54505.546 \\ \\ &= 2.96 \end{aligned}$$

A photograph of a large industrial complex, likely a refinery or chemical plant. In the center-left, there is a tall, light-colored vertical tower with a red and white checkered pattern at its top. To its left is a shorter, grey cylindrical tank. In the background, several tall, thin white chimneys or stacks rise against a clear blue sky. The foreground is a flat, grassy field.

**Thank you.**

# Credit Authorship Statement

**Rufia Shakeel:** Selection of Organization, data collection, data compilation, Quality management, work design and motivation, preparing interview guide and was present during interviews.

**Areha Nawaz:** Data compilation, New Technology integration, challenges faced while implementing new technology, mapping information flow, COVID impacts, formatting and editing of the presentation, preparing interview guide, and was present during interviews.

**Hadia Rizwan:** Data compilation, inventory management, key problem and solutions, recommendations, EOQ model, preparing interview guide and was present during interviews.

**Manal:** data compilation, inventory management, key problem and solutions, preparing interview guide and present during interviews.

**Nazia:** data compilation, quality management, work design and motivation, preparing interview guide and was present during interviews.

**Izzah Waseem:** data compilation, introduction and conclusion, production process, preparing interview guide, and was present during interviews.