Specification Document
Sustainable Optimization and Ecological Management with SAP MM and PM in the Agri-Food Industry

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1. Introduction

This specification document aims to define the scope of the project for sustainable optimization and ecological management in the agri-food industry. By leveraging SAP MM (Materials Management) and PM (Plant Maintenance) modules, the project seeks to centralize and optimize environmental data to improve energy performance, reduce the carbon footprint, and ensure sustainable resource management.

2. Study of the Existing System or Company

The company operates in the agro-food industry, specializing in the production and distribution of food products. It relies on a complex supply chain, production processes, and maintenance operations to ensure efficiency and quality. The existing system is supported by SAP modules, including Materials Management (MM) and Plant Maintenance (PM), which manage procurement, inventory, equipment maintenance, and supplier relationships.

Agro-Food Companies in Tunisia:

> - **Carthage Grains (Délice Group):**

>> • **Strengths**: Carthage Grains, a major player in the vegetable oils industry in Tunisia, has implemented initiatives to reduce its carbon footprint and optimize energy efficiency. However, the centralization of environmental data is still in development.

>> • **Weaknesses**: Real-time management of energy consumption and CO_2 emissions is not yet fully integrated.

> - **Les Huileries de Tunisie (HTT):**

>> • **Strengths**: HTT is a pioneer in the sustainable management of olive oil production. The company optimizes its energy consumption and resources to minimize its environmental footprint.

>> • **Weaknesses**: The integration of environmental data with supplier and supply chain management is still an area for development.

Agro-Food Companies Internationally:

> - **Nestlé**:

>> • **Strengths**: Nestlé is a leader in sustainability, with global initiatives to reduce its carbon footprint and centralize environmental data. The company has a robust infrastructure for energy management.

>> • **Weaknesses**: While data integration is advanced, the lack of real-time monitoring of emissions and energy consumption at the supplier level remains a challenge.

- ➢ **Unilever**:

    - **Strengths**: Unilever is recognized for its ongoing sustainability efforts and its reduction of CO_2 emissions. The company closely monitors the environmental impact of its activities and continuously improves its sustainable supply chain.

    - **Weaknesses**: Full integration of environmental data with supplier management and optimization of predictive maintenance could be further strengthened.

- ➢ **Cargill**:

    - **Strengths**: Cargill has a strong approach to sustainability with efforts to minimize its environmental impact. The company invests in technological solutions to improve energy efficiency and emission management.

    - **Weaknesses**: Like many other global companies, real-time management of supplier performance and predictive maintenance remain challenges to overcome.

Our Added Value:

- **Integration of Environmental Data with SAP MM and PM:** By combining SAP MM and PM modules with AI, we offer a solution that centralizes environmental data and optimizes resource and maintenance management.

- **Real-Time Monitoring:** The development of dynamic dashboards allows companies, both local and international, to track their energy consumption, CO_2 emissions, and supplier performance in real time.

- **Predictive Maintenance and Resource Optimization:** Through artificial intelligence and machine learning, companies can predict equipment failures and optimize maintenance schedules to reduce costs and environmental impact.

3. Data Description

The project is based on the integration and analysis of multiple structured data sources extracted from SAP systems and environmental sensors.

Data Files

Materials.txt

- **Source** : Table MARD de SAP.

- **Content**: Information on raw materials and finished products.

- **Key Attributes**: Material ID, Material Name, Type, Unit_Price, Stock Initial, Supplier_ID, Total_Stock_Value, Arrival Date,

Carbon_Footprint_per_Unit_kgCO2e, Transport_Distance_km,
Recycled_Packaging, Water_Consumption_per_Unit_liters.

1. **Notifications.xml**

   - **Source** : Table QMEL de SAP.

   - **Content:** Alerts and notifications on equipment failures or issues
     related to raw materials**.**

   - **Attributs clés** :ID, Catégorie, Description, Priorité, Timestamp.

2. **Equipements.xlsx**

   - **Content:** Technical and environmental data on industrial equipment.

   - **Key Attributes**:Equipment ID, Equipment_Name, Category,
     Maintenance Cycle, Location, Manufacturer, CO_2 Emissions kg,
     Energy_Consumption_kWh, Energy Type, Maintenance_Frequency,
     Estimated_Lifetime_Years.

3. **Suppliers.csv**

   - **Contenu** : Informations sur les fournisseurs, y compris leurs
     certifications et pratiques durables.

   - **Key Attributes**:

     - Supplier_ID, Supplier_Name, Location, Contact_Email,
       Phone_Number, Environmental_Certifications, Transport_Type,
       Renewable_Energy_Percentage, Sustainability_Program.

4. **Climate_Environmental_Data.json**

   - **Content:** Information on suppliers, including their certifications and
     sustainable practices.

   - **Key Attributes**:

     - Location, Date, Temperature, Humidity, Wind_Speed,
       CO2_Ambient_Level.

- **Table materials**

Attributes	Description	Type of data	Example
Material ID	Unique identifier for each raw material or product.	Texte	M001
Material Name	Descriptive name of the raw material or product.	Texte	Fromage râpé

Type	Category or type of the raw material or product (e.g., Dairy product, Cereals).	Texte	Produit laitier
Unit_Price	Unit price of the raw material or product.	Nombre décimal	122.31
Stock Initial	Initial stock quantity available for the raw material or product.	Nombre entier	361
Supplier_ID	Supplier ID for the supplier providing the raw material or product.	Texte	SUPPLIER_10
Total_Stock_Value	Total stock value based on quantity and unit price.	Nombre décimal	44153.91
Arrival Date	Arrival date of the raw material or product at the site or warehouse.	Date	10/30/2023
Carbon_Footprint_per_Unit_kgCO2e	Carbon footprint per unit of raw material or product in kilograms of CO_2.	Nombre entier	722
Transport_Distance_km	Distance traveled to transport the raw material or product, in kilometers.	Nombre entier	500
Recycled_Packaging	Indicates whether the packaging is recycled or not (Yes/No).	Texte (Oui/Non)	Non
Water_Consumption_per_Unit_liters	Water consumption per unit of raw material or product in liters.	Nombre entier	3610

Table Equipements

Attributes	Description	Type de donnée	Exemple
Equipment ID	Identifiant unique pour chaque équipement.	Texte	E4861
Equipment_Name	Nom descriptif de l'équipement.	Texte	Machine d'Inspection Visuelle
Category	Catégorie ou type d'équipement.	Texte	Conditionnement
Maintenance Cycle	Périodicité prévue pour la maintenance de l'équipement (ex. Bimensuelle).	Texte	Bimensuelle
Location	Emplacement ou site où l'équipement est utilisé.	Texte	Atelier Conditionnement Sousse
Manufacturer	Nom du fabricant ou de l'entreprise qui a produit l'équipement.	Texte	AgroTech Inc.
CO2 Emissions kg	Quantité d'émissions de CO_2 en kilogrammes générée par l'équipement.	Nombre décimal	437.086107
Energy_Consumption_kWh	Consommation énergétique de l'équipement en kilowattheures (kWh).	Nombre décimal	1333.09818
Energy Type	Type d'énergie utilisé par l'équipement (ex. Solaire, Électrique).	Texte	Solaire
Maintenance_Frequency	Fréquence de la maintenance planifiée (ex. Annuel).	Texte	Annuel
Estimated_Lifetime_Years	Durée de vie estimée de l'équipement en années.	Nombre entier	17

Table suppliers

Nom de l'attribut	Description	Type de donnée	Exemple
Supplier_ID	Identifiant unique pour chaque fournisseur.	Texte	SUPPLIER_1
Supplier_Name	Nom de l'entreprise ou du fournisseur.	Texte	Laiterie Centrale
Location	Emplacement ou ville où se trouve le fournisseur.	Texte	Tunis
Contact_Email	Adresse e-mail de contact du fournisseur.	Texte	contact@laiteriecentrale.com
Phone_Number	Numéro de téléphone du fournisseur.	Texte	+216 71 25 2525
Environmental_Certifications	Certifications environnementales détenues par le fournisseur (ex. Agriculture Biologique).	Texte	Agriculture Biologique
Transport_Type	Type de transport utilisé par le fournisseur pour les livraisons (ex. Routier, Maritime).	Texte	Unknown
Renewable_Energy_Percentage	Pourcentage d'énergie renouvelable utilisée par le fournisseur dans ses opérations.	Nombre décimal	32.085454275
Sustainability_Program	Indique si le fournisseur dispose d'un programme de durabilité (Oui/Non).	Bolleen (Oui/Non)	Oui

Table Climate environmental

Nom de l'attribut	Description	Type de donnée	Exemple
Location	Emplacement ou région où les données climatiques ont été collectées.	Texte	Nabeul
Date	Date de collecte des données environnementales.	Date	2024-07-19
Temperature	Température mesurée à l'emplacement donné (en degrés Celsius).	Nombre décimal	33.4
Humidity	Taux d'humidité mesuré à l'emplacement donné (en pourcentage).	Nombre entier	91
Wind_Speed	Vitesse du vent mesurée à l'emplacement donné (en mètres par seconde).	Nombre décimal	0.8
CO2_Ambient_Level	Niveau de dioxyde de carbone dans l'air ambiant à l'emplacement donné (en ppm - parties par million).	Nombre décimal	489.45

Table Notifications

Nom de l'attribut	Description	Type de donnée	Exemple
ID	Identifiant unique pour chaque notification.	Texte	2
Catégorie	Catégorie associée à la notification (ex. Fournisseur, Matériel, Stock, etc.).	Texte	Matériel
Description	Détails de la notification (message explicatif).	Texte	Stock critique détecté pour le matériel M117.
Priorité	Niveau d'urgence de la notification (ex. Critique, Moyenne, Faible, etc.).	Texte	Critique
Timestamp	Date et heure à laquelle la notification a été générée.	Date/Heure	10/14/2023 14:15

Project Objectives

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Energy Optimization:

- Reduce energy consumption and CO_2 emissions from equipment.

- Predict anomalies that can be monitored.

- Identify the least efficient equipment and propose improvements.

Sustainable Raw Material Management:

- Minimize losses due to expired or surplus stock.

- Favor sourcing from certified and environmentally friendly suppliers.

Strengthening Preventive Maintenance:

- Anticipate equipment failures using artificial intelligence.

- Reduce repair costs and unplanned downtime.

Monitoring Environmental Impact in Production:

- Track environmental indicators (carbon footprint, water consumption, etc.) per production site.

- Analyze the impact of climatic conditions on production.

6. Sustainable Development Goals (SDGs)

Key Performance Indicators (KPIs) and Measurements

1. Total Energy Consumption (Sum Measure)

2. CO_2 Emissions per Process (or per Site)

3. Recyclable Materials Rate (% Ratio)

4. Energy Cost per Unit Price (Ratio)

5. CO_2 Emissions Reduction (% Ratio)

6. Average Energy Consumption per Site (Average Measure)

7. Suppliers' Environmental Performance (Ratio)

8. Stock Shortage Rate (% Ratio)

8. Key Decision Makers

1. Environmental Compliance Manager

Role:

- Ensures compliance with local and international environmental regulations.

- Analyzes the environmental impact of company operations, including CO_2 emissions.

- Proposes corrective actions to reduce the company's carbon footprint.

Impact on the Project:
Key to validating that sustainable resource management practices meet regulatory standards, enhancing the company's environmental credibility.

2. Procurement Director

Role:

- Negotiates with suppliers to optimize procurement costs.

- Ensures a sustainable supply chain by evaluating the carbon impact of suppliers.

- Oversees raw material management through SAP MM.

Impact on the Project:
Influences purchasing strategies by promoting eco-friendly materials, reducing costs, and ensuring sustainable procurement practices.

3. Maintenance Manager

Role:

- Plans preventive and corrective maintenance for industrial equipment.

- Uses SAP PM to anticipate equipment failures and optimize performance.

- Ensures energy efficiency through targeted maintenance interventions.

Impact on the Project:
Contributes to sustainability by minimizing equipment downtime, improving energy efficiency, and extending the lifespan of machinery.

5. Sustainable Development Manager

Role:

- Defines and implements long-term sustainability strategies.

- Collaborates with all departments to integrate environmentally friendly practices.

- Measures the impact of corporate actions on the environment and recommends continuous improvements.

Impact on the Project:
Central to ensuring that the project goes beyond compliance, embedding sustainable practices across all operational levels.

Conclusion

This project aims to enhance sustainability and energy performance in the agro-food industry through optimized resource management and the use of data analytics and artificial intelligence technologies. The integration of environmental data and industrial processes will help reduce costs and carbon footprint while ensuring compliance with environmental standards.

Research Sources

1. **SAP Official Documentation** – *SAP MM and PM Modules for Resource and Environmental Management*
   https://www.sap.com

2. **ISO 14001: Environmental Management Systems** – *Guidelines for Environmental Compliance and Sustainability*
   https://www.iso.org/iso-14001-environmental-management.html

3. **United Nations Sustainable Development Goals (SDGs)** – *Framework for Sustainable Industrial Practices*
   https://sdgs.un.org

4. **Cargill, Nestlé, Unilever, and Danone Sustainability Reports** – *Case Studies on Environmental Strategies in the Agro-Food Industry*

   ➢ https://www.cargill.com/sustainability

   ➢ https://www.nestle.com/sustainability

   ➢ https://www.unilever.com/planet-and-society/

   ➢ https://www.danone.com/impact/sustainability.html

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