FACULTY OF COMPUTING

UNIVERSITI TEKNOLOGI MALAYSIA

**ENTERPRISE SYSTEMS DESIGN AND MODELING   - SECP3744-01**

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**Report**

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# Introduction

For a small shirt printing company collaborating with a partner, transitioning from WhatsApp-based order processing to a centralized system tracking the entire production process is crucial. This shift will provide real-time visibility into operations, streamline inventory management, and consolidate customer data for personalized service. By implementing this centralized approach, the company can make data-driven decisions, enhance collaboration with partners and external services, and ensure efficient production and delivery of high-quality printed shirts, ultimately driving business growth and profitability in the competitive manufacturing landscape.

## 1.1    Overview

Manufacturing operations can benefit significantly with a centralized system that manages and monitors the entire production process, including the firm, partners, and external services. This is especially true for small-scale shirt printing businesses that rely on partners to produce shirts and operate on a low production scale. The business may obtain real-time visibility into all aspects of its operations—from obtaining shirt supplies to printing and client delivery—by centralizing production data. This enables quick problem identification and resolution to guarantee seamless operations. In addition to encouraging collaboration and integration between the business, its partners, and outside services, this centralized approach enables data-driven decision-making to drive business growth and profitability. It also makes it easier to coordinate effectively and communicate smoothly in order to deliver high-quality printed shirts.

## 1.2    Problem Statement

1.2.1    Inefficient order processing: orders are now placed and monitored using WhatsApp, which causes confusion, delays, and potential errors

1.2.2    Inadequate inventory control: It is challenging for the business to maintain stock levels and quickly fulfill orders since it lacks real-time visibility into its inventory.

1.2.3    Customer data is dispersed among multiple WhatsApp conversations, which makes it difficult to keep an extensive customer database and offer individualized service.

1.2.4    Limited analytics and reporting: Without a specialized system, the business is unable to assess important performance indicators and provide insightful reports, which impedes the use of data to inform decisions.

## 1.3    Project Objectives

### 1.3.1    Optimize resource allocation and inventory management

Collaboration with other departments to optimize resource allocation, inventory management, and supply chain logistics based on system-generated insights. Aims to enhance efficiency and streamline operations by leveraging data-driven insights for better resource utilization and inventory control.

### 1.3.2    Dashboard and reporting implementation

Dashboard and reporting system that provide insights and historical data. The dashboard offers a visual representation of key performance indicators and project metrics, facilitating informed decision-making and performance evaluation based on historical data trends.

## 1.4   Project Scopes

1.4.1 Optimize resource allocation and inventory management
- Develop an integrated system that connects production, inventory, and supply chain data to generate insights for optimizing resource allocation and inventory management.
- Implement data analytics and forecasting models to predict demand and optimize inventory levels.
- Establish automated triggers and alerts for inventory replenishment based on predefined thresholds.
- Integrate with supplier systems to streamline the procurement process and ensure timely delivery of materials.

1.4.2 Dashboard and reporting implementation
- Develop a customizable dashboard that displays key performance indicators (KPIs) and project metrics in real-time.
- Provide the ability to filter and drill down into data based on various parameters.
- Implement data visualization techniques to present information in a clear and concise manner.
- Ensure the dashboard is accessible from various devices and supports multiple user roles with appropriate permissions.
- Generate comprehensive reports based on historical data, covering areas such as production efficiency, quality, inventory turnover, and financial performance.

## 1.5 Project Important

### 1.5.1 Optimize resource allocation and inventory management

- Efficient resource allocation and inventory management are crucial for the printing shirt company to minimize waste, reduce costs, and ensure timely production. Implementing a system that optimizes these aspects allows the company to enhance its operational efficiency, meet customer demands promptly, and increase overall profitability.

### 1.5.2 Dashboard and reporting implementation

- The implementation of a dashboard and reporting system delivers useful insights and historical data for informed decision-making. With real-time performance metrics and key indicators, the company can track progress, identify areas for improvement, and make strategic decisions to drive business growth. This system enables the company to stay competitive, adapt to market changes, and enhance overall operational efficiency.

# Literature review

## 1.6  Introduction

Migration from a simple standalone application such as WhatsApp may not be an appropriate measure to advance into maximizing business capability. However, there is no urge to delve deeper into focusing this business process perspective if the enterprise does not apply proper information transfer and management which is handled by the Enterprise Information System. Besides that, the company also needs to encompass Enterprise Architecture (EA) in having a proper framework in various business aspects to enhance overall business performance.

## 1.7  Fundamental Theory & Concept

### 1.7.1  What is  enterprise information system

GmbH, L. (n.d.) defines an Enterprise Information System (EIS) as any type of information system that improves the operations of an organization's business process through integration. This frequently requires providing high-quality service, managing massive volumes of data, and being able to serve a huge and perhaps complex organization or corporation.

An EIS can enhance business productivity by reducing service cycle, product development times, and marketing cycles. It can also integrate existing applications, leading to increased operational efficiency and cost savings. However, it's important to note that the financial benefits of implementing an EIS are not typically immediate.

An EIS has various integrated systems such as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Enterprise Content Management (ECM), Corporate Performance Management (CPM), Human Resource Management (HRM), Enterprise Asset Management (EAM), and Electronic Document Management System (EDMS) (GmbH, n.d.).

### 1.7.2  What is enterprise architecture

An organization's corporate strategy, procedures, data, and technology are all aligned to meet its objectives through the use of enterprise architecture, a strategic framework. It offers a comprehensive perspective of the company, facilitating efficient decision-making, resource optimisation, and business environment adaption.

It combines a number of underlying disciplines, including:

- Business architecture
- IT architecture
- Technology architecture
- Security architecture

This speciality, which is equally focused on the fields of business and IT, establishes useful guidelines for teams and departmental units to share resources wisely and expedite work.

The purpose of creating a business capability map or blueprint, enterprise architecture seeks to provide a framework that describes the operations and structure of an organization. A thorough understanding of the company, including its IT resources and business procedures, ought to be provided by this framework.

Furthermore, enterprise architecture aims to promote standardization and team alignment by balancing environments throughout teams and organizations. Usually, the advice given is based on the particular business needs of an organization.

The inception of enterprise architecture dates back to the 1960s and 1970s, a time when businesses realized they needed a methodical way to handle their expanding IT infrastructure.

John Zachman initially used the term "enterprise architecture" in the 1980s. A number of frameworks and techniques for directing the creation and use of enterprise architecture evolved during the 1990s.

Enterprise architecture became more widely used in the 2000s as businesses realized how important it was to match IT investments with business strategy.

Enterprise architecture is still developing today as a result of new technologies, commercial difficulties, and the dynamic environment of companies looking to maximize productivity and flexibility.

Raising IT architectures to facilitate these advantages resulted in the emergence of prevailing working methods, the majority of which were created by governments, major tech corporations, or consortiums, and which set the foundation for contemporary enterprise design frameworks.

1. ArchiMate

ArchiMate is a graphical modeling language and framework specifically designed for enterprise architecture. It offers a standardized notation to describe, analyze, and visualize the relationships between various architectural domains.

2. The Zachman Framework

The Zachman Enterprise Architecture Framework is a structured approach that aids organizations in analyzing and aligning various aspects of their enterprise. It features a grid-like structure with six rows representing different perspectives (planner, owner, designer, builder, subcontractor, and user) and columns representing different aspects (scope, business model, system model, technology model, detailed representation, and function).

3. The Open Group Architecture Framework (TOGAF)

TOGAF is a methodology for designing, implementing, guiding, and maintaining enterprise architecture using controlled phases, known as the Architectural Development Method (ADM). Its strategies have been iteratively refined over the past 25 years.

4. Federal Enterprise Architecture Framework (FEAF)

Initially developed for the U.S. Government to integrate its federal agencies, FEAF is an architectural framework that employs a collaborative planning methodology. It has become a popular enterprise architecture model used in both public and private sectors.

5. Gartner's Enterprise Architecture Framework

Gartner, a global leader in IT research and insights, has developed its own enterprise architecture methodology based on best practices gleaned from its consulting experiences. This framework focuses more on business outcomes than on abstract phasing.

(LeanIX GmbH, n.d.)

## 1.8    Previous Researches/ Systems

There are multiple researches on how the Enterprise Information System or also known as EIS is suitable for printing companies regardless of the operational size of the enterprise whether big, medium or small. Majority of the researches suggest the enterprise to adopt the use of Enterprise Resource Planning or ERP because its feature as centralized system is a solid solution as these enterprises only use disjoint software or standalone that are unable to enhance the system efficiency. ERP also offer various benefits such as:

a. Streamlined operation
ERP systems are able to automate various business processes, reducing manual effort while minimizing errors.

b. Enhanced collaboration
ERP system allows external data flow which leads to collaboration between different departments and stakeholders with good communication and information sharing across the organization.

c. Scalability
The good scalability of ERP can help enterprises to be ready and well prepared for business growth.

d. Improved decision-making
ERP systems are able to provide real-time data, allowing business and enterprise to come with informed data-driven decisions.

Even with these benefits offered by ERP, the researchers also pointed out several keys that enterprises need to consider when transitioning to implement ERP. First is on how enterprises need to get good participation from all stakeholders and across organizations layers. The emphasis on the participation is due to the efficiency of ERP will be truly affected and maximum ERP efficiency could only be achieved with a strong organizational structure in enterprise that gave proper support and commitment to the use of ERP.

Next, it needs to be noted that enterprises need to select suitable ERP software that can achieve the enterprise needs. This means that enterprises do not require to adopt a new, perfect software that can be costly and also time consuming. This selection of proper ERP software also encompasses the enterprise's EA so that perfect correlation between technology layers align well with company vision from a business perspective. Complexity and incompatibility of ERP is one of leading factors that prevent ERP adoption, so scientific methods need to be studied meticulously to acknowledge the best ERP for a particular enterprise.

## 1.9  Technology Used SAP

SAP S/4HANA and SAP Ariba are prominent solutions used to implement EIS and EA in printing companies.

SAP S/4HANA: An integrated ERP system that runs on the SAP HANA in-memory database, providing real-time data processing and analytics. It enhances operational efficiency, scalability, and decision-making capabilities through its simplified data model and modern user experience (Wortmann, 2017).

SAP Ariba: A cloud-based procurement solution that connects buyers and suppliers, facilitating end-to-end procurement processes. It improves collaboration, reduces procurement costs, and enhances compliance and transparency (Lahiri, 2016).

## 1.10  Summary

Enterprise Information Systems (EIS) is a type of information system that integrates various business processes to improve operational efficiency and enhance overall business performance, particularly suitable for printing companies as it can handle large volumes of data and provide a centralized platform for managing business operations.Next, Enterprise Architecture (EA) is a framework that provides a structured approach to manage and integrate various business aspects, such as IT, business processes, and organizational structures, essential for enhancing overall business performance by ensuring alignment between business and IT strategies. Lastly, SAP technology is used to implement EIS and EA in printing companies. By using SAP, ERP offers benefits such as streamlined operations, enhanced collaboration, scalability, and improved decision making, making it suitable as a solution for these enterprises.

# Methodology

## 3.1 Introduction

Software Development Life Cycle (SDLC) is a methodology of structured process that is used to design, develop and test software which define the entire procedure of software development process. It consists of a precise plan that starts with planning, defining, designing, building, testing and deployment. SDLC guarantees a speed up development, lowers the chance of project failure, and aids in effective resource management.

## 3.2 The Chosen Methodology

The Waterfall methodology is a project management approach based on a linear, sequential procedure (Parades, 2024).  Contains five phases of management, and each of the phases requires a deliverable from the previous phase to proceed. This methodology is particularly beneficial for projects with clearly defined requirements and stable objectives. The Waterfall methodology was chosen for this project as it provides a clear framework and disciplined approach that is perfect for implementing the SAP procurement system at a small shirt printing company. The well-defined stages enable comprehensive documentation and unambiguous milestones, decreasing uncertainty and making it easier to manage the project scope and timeline. This project also has clear requirements and objectives.

(Parades, 2024): https://safetyculture.com/topics/waterfall-methodology/

## 3.3 Phases of the chosen methodology

The Waterfall SDLC model portrayed a linear, down-stream system in which it demonstrates how each process consecutively executed to another process (Malleswari et al., 2018). The output or result of one phase will act as the input for the next phase. Figure 3.3 shows the step or sequence of phases for Waterfall SDLC model in which it started with requirement analysis followed by system design, implementation, testing , deployment and lastly, maintenance.
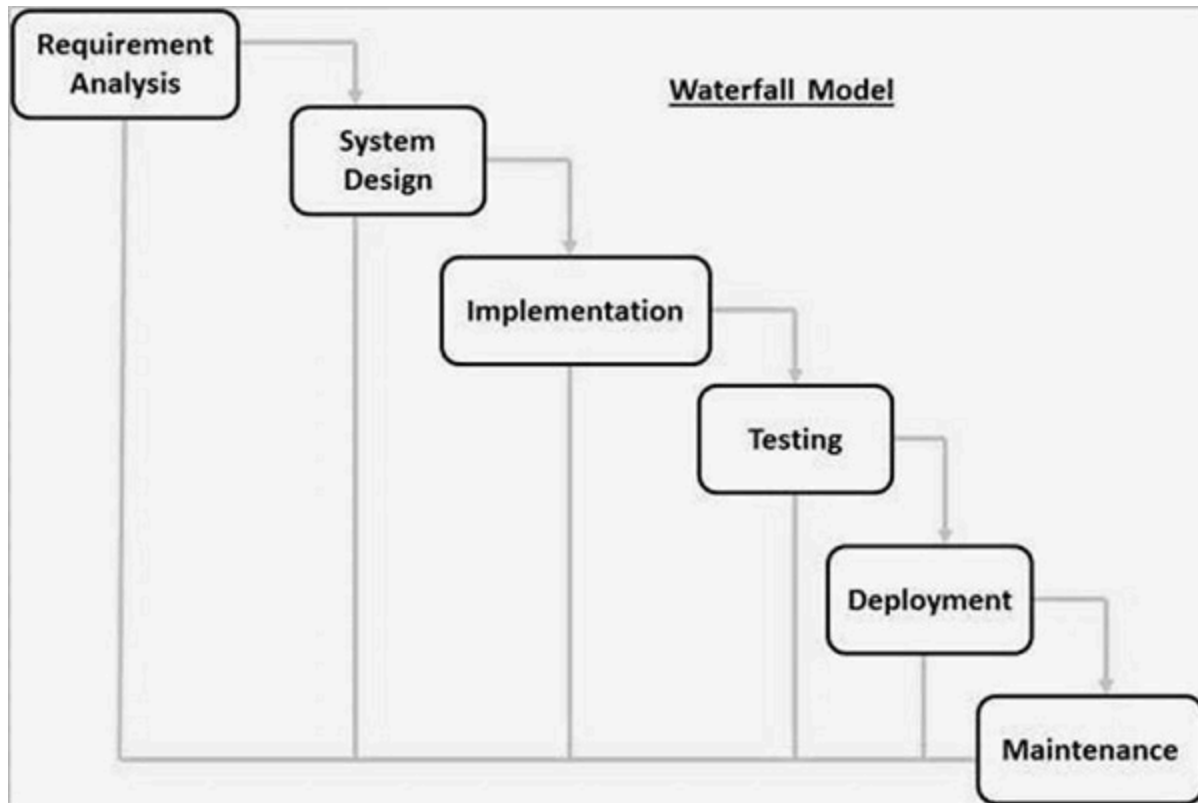
Figure 3.3 Waterfall SDLC Model (tutorialspoint, n.d)

1. Requirement analysis

In this phase, the requirements analysis is done by agreement of both stakeholders and developer. The inputs for the analysis mostly come from the clients and product owner based on the cost, completion time, available features, and requirements. So, this phase will create a specification of a system behavior to be implemented.

2. System Design

In the system design phase, all specifications and requirements gathered in the previous phase are studied. This phase helps in choosing the right algorithm design, software architecture design, database planning, and data structure definition (A. Alshamrani, 2015).

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## 3.4 Project Planning Schedule (* include in phases of the methodology)
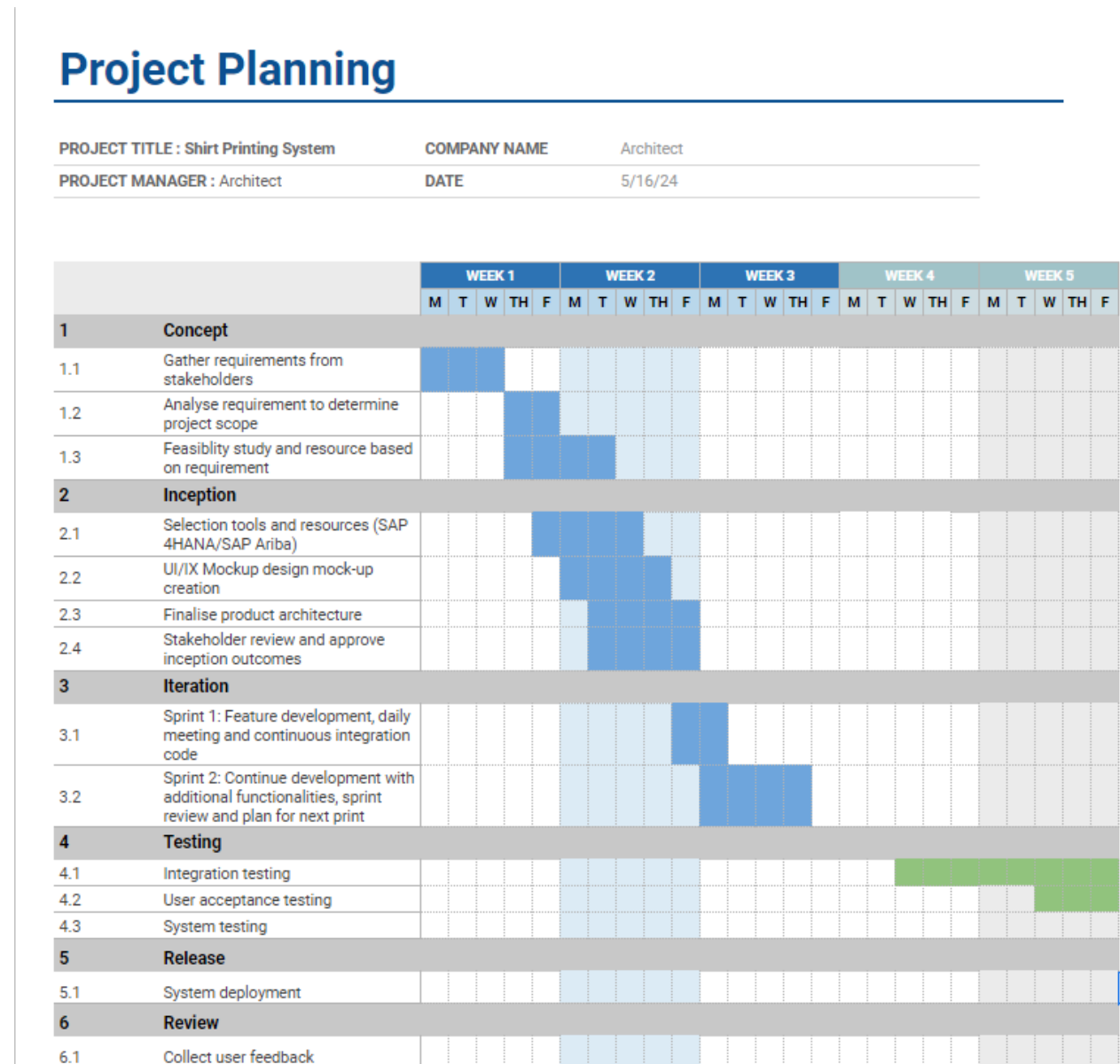


Figure 3.4 Gantt chart of our project planning

▦ Architect EIS Gantt chart

## 3.4  Summary

The Software Development Life Cycle (SDLC) is a structured process for designing, developing, and testing software, ensuring a systematic approach to software development. It consists of phases starting with planning, defining, designing, building, testing, and deployment. SDLC aims to accelerate development, reduce project failure risks, and optimize resource management.

The chosen methodology for the project is the Waterfall methodology, which follows a linear, sequential approach with six phases: requirement analysis, system design, implementation, testing, deployment, and maintenance. This methodology suits projects with well-defined requirements and stable objectives, providing a clear framework for implementing systems like SAP procurement at a small shirt printing company. Its structured stages facilitate comprehensive documentation, clear milestones, and effective project scope and timeline management.

# System Requirements

## 4.1 Introduction

System requirements is a process to transform the stakeholders' views of desired capabilities into a technical, developer view of how the system can fulfill those capabilities. It describes the requirements that the system-of-interest (SoI) must meet to satisfy the stakeholders needs. They are expressed in a suitable combination of well-formed textual statements and supporting models or diagrams (Katz et al., 2024) . In waterfall methodology, requirement gathering is the first step of the methodology where all requirements will be gathered in a structured manner from stakeholders, customers, and developers. Implementation of effective system requirements gathering techniques will help to find perfect system requirements whether functional or non-functional.

(Katz et al., 2024) : https://sebokwiki.org/wiki/System_Requirements_Definition

## 4.2 System Requirements Gathering Techniques

The system requirements process is a crucial step in the traditional waterfall system development life cycle. Gather comprehensive information about the project requirements using a variety of ways such as interview, use case, brainstorming, and more. To begin developing, it is important to collect all the necessary requirements and documentation, including the project scope that outlines the functional requirements, deliverables, features, deadlines, and costs; stakeholder expectation obtained through interviews to align the project with their interest; market research on competing apps, current market trends, and customer needs to identify an unserved niche; assembling a team of programmers, designers, and other resources; and conducting a kickoff meeting with the team and stakeholders to discuss the gathered information and set expectation (ProjectManager, 2024).

(ProjectManager, 2024) : https://www.projectmanager.com/guides/waterfall-methodology#:~:text=Requirements%3A%20The%20key%20aspect%20of,until%20the%20product%20is%20complete.

### 4.2.1 Use case diagrams

Use cases are a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal. It also is one of the techniques and tools that are used in the requirement gathering phase of waterfall methodology (Lane, 2021). Use cases help to organize each user's requirements by describing various external entities that act on the system and the specific interactions they have with the system to accomplish the business objective. Use cases also help prevent developers from missing any requirements by providing a comprehensive understanding of the system functionality and user interactions.

### 4.2.2 Role play

Role play helps ensure that the needs of all users are being met by involving different people in various roles. During a role play session, participants take on different roles, such as users, stakeholders, and developers, to examine individual system requirements from many perspectives and generate discussions and new ideas. This approach provides a complete understanding of how the various parts of the system need to function to support the overall process.

### 4.2.3 Brainstorming

Participants can share their thoughts freely without facing criticism or debate. Then, they will refine the ideas and organize and prioritize them (Lane, 2021). This technique encourages creative and critical thinking and ensures that a variety of perspectives are considered. Documenting the session's outcome will help as a future reference and help in aligning the business objectives and stakeholders' expectations.

### 4.2.4 Interview

Directly communicate with the stakeholders on the product solves, background information about business needs, and any other concerns to consider (Lane, 2021).  Structured interviews use a planned set of questions to maintain consistency, while unstructured interviews are more flexible and allow for in-depth investigation of certain topics. This technique aids in the collection of comprehensive and relevant requirements, ensuring that they are aligned with business objectives and appropriately represented in the first project documentation.

(Lane, 2021) : https://www.perforce.com/blog/alm/requirements-gathering-templates

# 4.3 System Requirements

## 4.3.1 Functional Requirements

4.3.1.1 FR<Create Purchase Contract>
The user shall be able to create purchase contracts of the purchase requisitions.

4.3.1.2 FR<Manage Purchase Contracts>
The user shall be able to manage purchase contracts.

4.3.1.3 FR<Manage Purchase Orders>
The user shall be able to manage purchase orders from the purchase contracts.

4.3.1.4 FR<Post Goods Receipts for Purchasing Documents>
The user can be able to post goods receipts for purchasing documents.

### 4.3.1.5 FR<Create Supplier Invoice>
The user can be able to create supplier invoices.

### 4.3.1.6 FR<View supplier Invoice List>
The user can be able to view supplier invoice lists.

### 4.3.1.7 FR<Monitor Supplier Line Item>
The user can be able to monitor supplier line items.

## 4.3.2 Non-Functional Requirements

### 4.3.2.1 NFR<Usability>
The system should have user friendly interface and easy to navigate

### 4.3.2.2 NFR<Performance>
The system should able to handle multiple user request simultaneously

### 4.3.2.3 NFR <Maintainability>
The system should be built in a way that allows easy updates and changes. It should also be simple to test and fix, which helps with its upkeep in the future.

### 4.3.2.4 NFR <Security>
The system should secure and protect sensitive data like password hashing

### 4.3.2.5 NFR <Reliability>
The system should be responsive and not encounter frequent failures and system crashes

# 4.4 Summary

In conclusion, proper techniques in requirement gathering can lead to a successful software development. For example role play can ensure comprehensive input that is relevant to the case study can be recorded and can be the guidance in creating the final solution. The specification of all functional and non-functional requirements are helpful in shaping how the final solution will work and what deliverables that are to be expected. High quality system requirements also can be achieved through comprehensive upfront planning and detailed documentation, ensuring all requirements align with business objectives and are well-understood by all stakeholders.

# Chapter 5: System analysis and design

## 5.1 Introduction

This chapter delves into the comprehensive analysis and design of the proposed Enterprise Information System (EIS) for the small shirt printing company, with a specific focus on the SAP procurement system. The objective is to outline the existing challenges, analyze the current systems, and propose a robust, integrated solution that enhances operational efficiency and scalability through the implementation of SAP modules such as Purchase Requisition, Purchase Order, Invoice, and Payment.

## 5.2 System Analysis

The process of system development begins with system analysis, which involves problem identification to determine the issues the system aims to address, such as automating a business process, improving data management, or enhancing user experience. Once the problem is understood, the next step is gathering and documenting requirements through communication with the customer and developer. Before development, a feasibility study is conducted to evaluate the technical, operational, and financial aspects of the proposed solution. Defining the scope of the system is crucial to prevent feature creep and ensure the project remains within its boundaries. This comprehensive approach ensures a well-designed and effective system (GeeksforGeeks, 2024).

### 5.2.1 Case Study

The case study focuses on a small-scale shirt printing company facing significant operational inefficiencies due to the use of fragmented systems. The reliance on WhatsApp for order processing leads to confusion, delays, and errors, while the lack of a centralized inventory management system hampers stock control and order fulfillment. This case study highlights the urgent need for an integrated EIS to streamline operations, improve data accuracy, and enhance customer service through the SAP procurement system.

### 5.2.2 Company Organization Structure

The shirt printing company is organized in several key departments that are responsible for different aspects of the business. It has 5 main departments; Management, Finance, Operation, Human Resources, and Marketing and Sales.

1. Management
   - This department is responsible for the company's goals and growth. Managers for the top level of the management chain are CEOs, presidents, vice presidents, and board members (Malsam, 2023). The CEO is responsible to oversee the overall operations, strategic planning, and decision making processes. This involves ensuring that all departments are aligned with the company's goals and growth strategies.The operations manager will manage daily operations such as order and printing, coordinates between departments, and ensure that printing production schedules and business objectives are met.
   (Malsam, 2023): https://www.projectmanager.com/blog/four-functions-of-management#:~:text=The%20four%20functions%20of%20management%20are%20planning%2C%20organizing%2C%20leading%20and,of%20any%20professional%20managerial%20position.

2. Finance
   - This department is responsible for managing the company's financial health. The primary responsibility is to manage financial resources while ensuring stability and compliance. Finance department manages income and expenditure while ensuring the business runs smoothly with minimal disruptions (Teodorescu, 2024). Maintaining correct accounting records, budgeting, financial forecasting, and payroll processing are the key responsibilities. The finance team needs to manage tax compliance, compilers financial reports, and works with other departments to allocate resources effectively.
   (Teodorescu, 2024): https://www.indeed.com/career-advice/career-development/what-does-finance-department-do

3. Operations
   - This department is responsible for production, order fulfillment, and inventory management. Plan and schedule production runs, regulate inventory levels (including raw material and finished goods), maintain standard quality, and ensure order processing is completed on time. Their responsibilities also include logistics and distribution, which ensures that products reach clients effectively.

4. Human Resources
   - This department is in charge of recruiting, hiring, and onboarding new employees. They provide performance reviews, manage employee benefits, and resolve workplace problems, and complaints. An HR department mission is to maximize staff productivity while also protecting the company from any personnel difficulties that may emerge. HR tasks include compensation and benefits, recruitment, retention, termination, and staying current on any regulations that may affect the organization and its employees (Kenton, 2024).

(Kenton,                                                                                              2024): https://www.investopedia.com/terms/h/humanresources.asp#:~:text=It%20is%20tasked%20with%20maximizing,the%20company%20and%20its%20employees.

5. Marketing and Sales
   - This department focuses on promoting the company's products and driving revenue. They design advertising campaigns, devise sales strategies, and handle customer relations. This department collaborates closely with other teams to ensure that marketing efforts are aligned with business goals.

This report focuses on the Management department and procurement part, and highlights the critical areas where the integration of an SAP procurement system can drive significant improvements. SAP's centralization and automation will enhance operational efficiency, data accuracy, and help the organization achieve its strategic growth goals.

### 5.2.3 Current System Analysis

- **Order Processing**: The use of WhatsApp for order processing leads to fragmented communication, lost orders, and delayed responses.

- **Inventory Control**: Manual inventory management results in inaccuracies, stockouts, and overstocking, affecting the company's ability to meet customer demand.

- **Customer Data Management**: Customer information is scattered across multiple WhatsApp conversations, making it difficult to build a comprehensive customer database and deliver personalized services.

- **Reporting and Analytics**: The lack of a centralized system limits the company's ability to generate reports and analyze performance metrics, hindering data-driven decision-making.

# 5.3 System Design

Systems design is the methodology of shaping the structure, components, modules, interfaces, and data of a system to fulfill specific requirements. It involves converting user needs into a comprehensive plan that guides the execution phase. The objective is to establish a well-structured and effective framework that achieves the desired function while considering aspects such as scalability, maintainability, and performance (GeeksforGeeks, 2024).

## 5.3.1 System Architecture
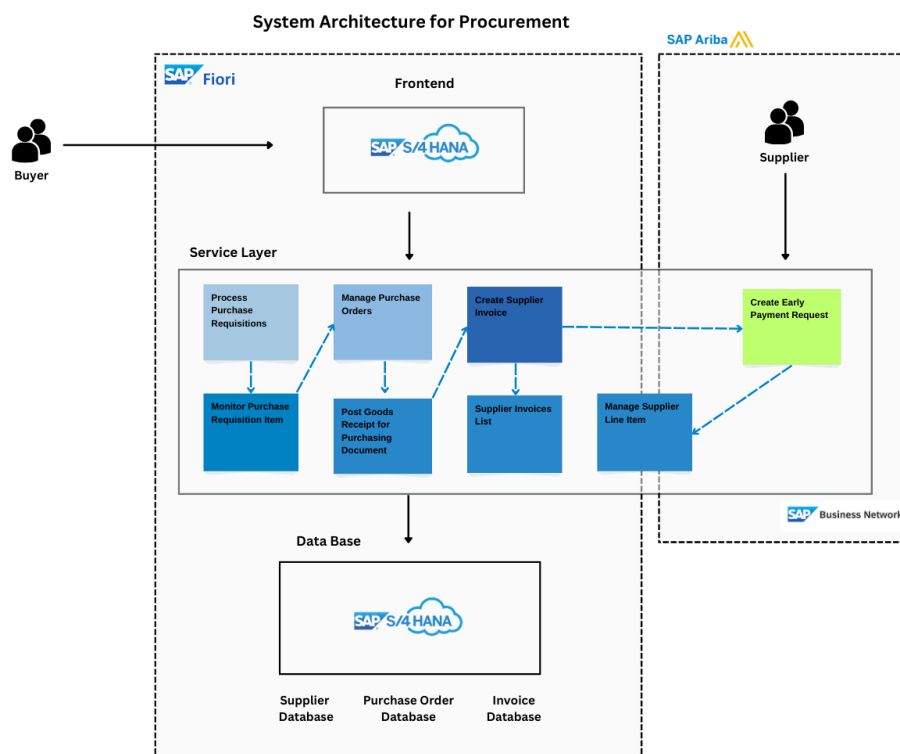


Figure 5.1 System Architecture

The system architecture for procurement represents the system's structure, illustrating the connections between its components and detailing the functions each component performs. It generally depicts the key functions of the system and the relationships between various system components (InterviewBit, 2024).

## 5.3.2 Component of the Architecture

Fronted
1. **SAP Fiori**
   - SAP Fiori is used as an user interface tool. It is a user experience (UX) technology from SAP. It is used by the users to interact with the system. SAP Fiori enables users to create business applications that are easy to use. It's design principles and tools are compatible with SAP S4/HANA and other enterprise software (SAP Fiori, n.d). Implementing SAP Fiori in the shirt printing company can increase the accuracy and speed of procurement operations, minimizing supply chain delays and errors, and ultimately contributing to smoother production workflows and overall efficiency.

      (SAP Fiori, n.d): https://www.sap.com/sea/products/technology-platform/fiori.html#:~:text=SAP%20Fiori%20is%20a%20design,that%20run%20on%20any%20device.

2. **SAP S/4HANA**
   - SAP S/4 HANA provides real-time processing and analytics capabilities. It is designed for digital business and built on the in-memory SAP HANA database. SAP S/4HANA is a cutting-edge enterprise resource planning (ERP) system that includes built-in cognitive technologies like AI, machine learning, and advanced analytics. It transforms business operations through intelligent automation and runs on SAP HANA, a premier in-memory database known for its real-time processing speeds and considerably simplified data model (SAP Business Accelerator Hub, n.d).

Service Layer
- **Process Purchase Requisitions**: Automates the initiation of purchase requests by employees, streamlining approval workflows and ensuring timely procurement.
- **Monitor Purchase Requisition Items**: Provides real-time visibility into the status of purchase requisition items, enabling proactive management of procurement activities.
- **Manage Purchase Orders**: Converts approved purchase requisitions into purchase orders, sends them to suppliers, and tracks their fulfillment status.
- **Post Goods Receipt for Purchasing Document**: Manages the receipts of goods and updates the corresponding purchasing documents to reflect the goods received.
- **Create Supplier Invoices**: Allows suppliers to submit invoices electronically, ensuring accurate and timely processing.
- **Supplier Invoices List**: Maintains a comprehensive list of all supplier invoices, facilitating efficient tracking and reconciliation.
- **Manage Supplier Line Item**: Manages individual line items within supplier invoices, ensuring accurate tracking and management of each item.
- **Create Early Payment Request**: Allow suppliers to create requests for early payment, integrating with the SAP Ariba Business Network to facilitate these requests.

Database
1. **SAP S/4HANA Database**: Stores all related data to suppliers, purchase orders, and invoices:
    a. **Supplier database**: Stores all supplier-related information.
    b. **Purchase Order database**: Stores all purchase order-related information.
    c. **Invoice database**: Stores all invoice-related information.

Integration with SAP Ariba
1. **SAP Ariba Business Network**: This integration allows for streamlined communication and transaction processes between the enterprise and its suppliers. SAP Business Network allows buyers and suppliers to communicate more efficiently by automating the whole procurement process from source to settlement.  This integration improves supplier management, assures compliance, and delivers advanced analytics for more informed decision-making  (Ariba Network, n.d).

(Ariba Network, n.d):
https://www.sap.com/sea/products/spend-management/ariba-network.html#:~:text=SAP%20Business%20Network%2C%20formerly%20known,and%20discover%20new%20business%20opportunities.

## 5.3.3 Project Design
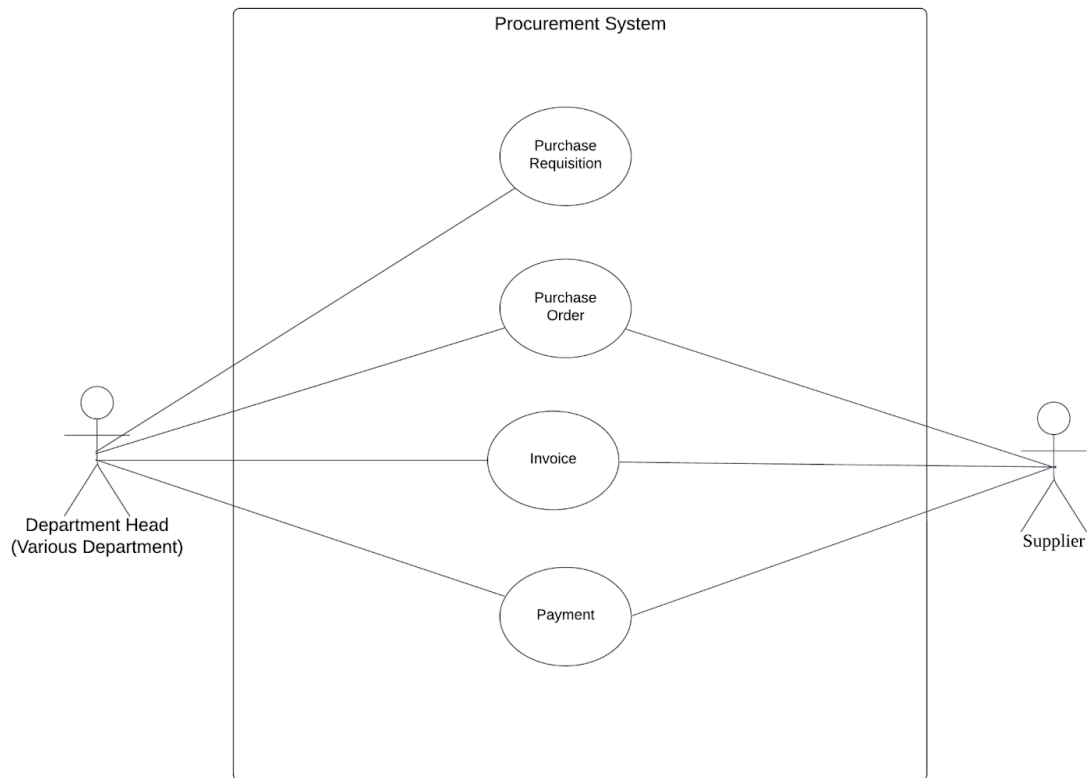


Figure 5.2: Main Use Case

Figure above consists of four main use cases where each use case has its own submodule. Actors involved are Department Head from various departments where they will be attached with use case Purchase Requisition, Purchase Order, Invoice, and Payment while actor Supplier will handle Purchase Order, Invoice and Payment.
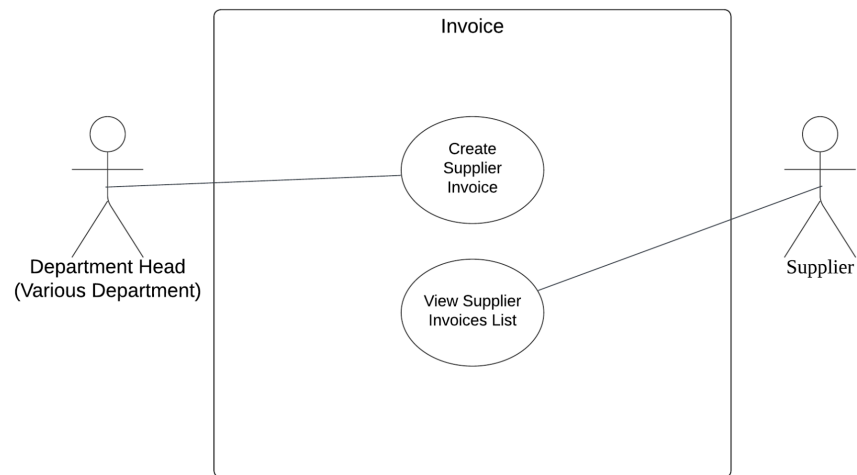
Figure 5.3: Invoice Use Case

| **Use case:** Create Supplier Invoice |
|---|
| **ID:** PS3 |
| **Actors:** Department Head |
| **Preconditions:** Goods/service can be retrieved well from 'Manage Purchase Order'. |
| **Flow of events:**<br>1. Login: User login into SAP S4/HANA System<br>2. Navigate to Create Supplier Invoice: User click button "procurement" at the header and then click "Create Supplier Invoice"<br>3. Enter invoice details: Enter details such as Invoice Date, Company Code, Invoicing Party, Purchasing Order References, G/L Account, and Amount<br>4. Validate Information: The system validates information against the purchase order and goods receipt by clicking button "check"<br>5. Post invoice: lastly, click button "post" to post the invoice to Supplier Invoice List |
| **Postconditions:**<br>● The supplier invoice is successfully created and stored in the system<br>● Financial records are updated. |
| **Exception Paths:**<br>● If invoice details do not match the purchase order or goods receipt, the system flags discrepancies for review<br>● If approver reject the invoice, it is sent back to the department head for correction |

| **Use case:** Supplier Invoice List |
|---|
| **ID:** PS4 |
| **Actors:** Supplier |
| **Preconditions:** User has permission to access the invoice list |
| **Flow of events:**<br>　　1. Login: User login into SAP S4/HANA System<br>　　2. Navigate to Supplier Invoice List: User click button "procurement" at the header and then click "Supplier Invoice List"<br>　　3.  Select View Invoices: The user selects the option to view existing invoices.<br>　　4. Specify Search Criteria: The user inputs or selects criteria for filtering the invoices (e.g., date range, supplier, status).<br>　　5. Retrieve and Display Invoices: The system retrieves and displays a list of invoices matching the criteria.<br>　　6. Review Invoice Details: The user can select specific invoices to view detailed information. |
| **Postconditions:** User can view and analyze list of supplier invoice |
| **Exception path:** If there is no invoice meet the specified criteria, the system displays message indicating there is no match records |

## Create Supplier Invoice

**Actor** — **SAP S4/HANA**

- Login →
- ← Login Successful
- Click "Supplier Invoice" →
- Enter details →
- Click "Check" →
- ← Validate Information
- Click "Post" →
- ← Post Invoice

**Loop**
**Exception**
- ← Discrepancies Found
- Review and Correct →

## Supplier Invoice List

**Actor** — **SAP S4/HANA** — **Search Page**

- Login →
- ← Login Successful
- Click "Procurement" →
- Click "Supplier Invoice List" →
- Select View Invoice
- Specify Search Criteria
- Click "Search" →
- ← Retrieve and Display Details
- Review Invoice Details

**Loop**
**Exception**
- ← No Matching Found

Figure 5.4: Purchase Requisition Use Case

| Use case: Create Purchase Contract |
|---|
| **ID:** PR1 |
| **Actors:** Department Head |
| **Preconditions:** Login: User login into SAP S4/HANA System. |
| **Flow of events:**<br>1. Navigate to Process Purchase Requisition: User click button "Procurement" at the header and then click "Process Purchase Requisition (V2)".<br>2. Click on Create button to display header fields such as supplier, purchasing organization, and purchasing group of the purchase order for entry.<br>3. Fill the information needed in the General Information tab; Purchasing Document Type, Supplier, and Purchasing Group.<br>4. Under Items tabs; click "Create" to display purchase order item fields such as material, net price, warehouse, and so on input.<br>5. Click "Order" to add a new Contract to the system. |
| **Postconditions:** The purchase contract is successfully created and stored in the system. |

| **Use case:** Manage Purchase Contracts |
|---|
| **ID:** PR2 |
| **Actors:** Department Head |
| **Preconditions:** Made a purchase contract |
| **Flow of events:**<br>    **1.** At the drop down menu, choose "Manage Purchase Contracts".<br>    2. From the list of purchase contracts, choose any purchase contracts and click " Create Purchase Order" to make a new purchase order. |
| **Postconditions:** User can create purchase order |
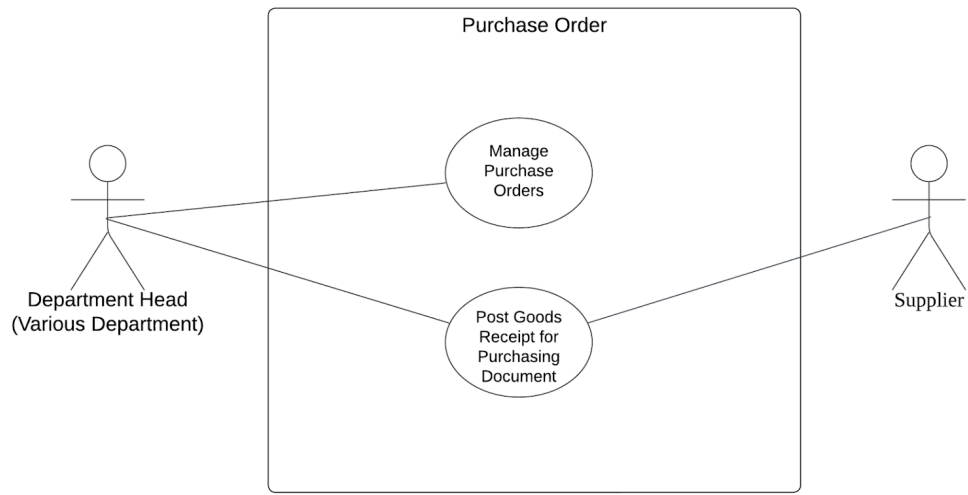
Figure 5.5: Purchase Order Use Case

| **Use case:** Manage Purchase Orders |
|---|
| **ID:** PO1 |
| **Actors:** Department Head(Various Department) |
| **Preconditions:** Login: User login into SAP S4/HANA System. |
| **Flow of events**<br>1. Navigate to Procurement Tab: User then click "Manage Purchase Orders" button.<br>2. Choose the "Create" button or hit "Ctrl + Enter".<br>3. Fill in the Information needed in the General Information<br>I. Basic Data: Purchasing Doc. Type, Supplier, and Purchasing Group.<br>II. Items:<br>    - Choose the "Create" button or hit "Ctrl + Enter".<br>    - Fill the Information needed: Material, Order Quantity, and Net Order Price.<br>III.Click the "Order" button.<br>4. The new Purchase Order has been added to the system. |
| **Postconditions:** The Purchase Order has been successfully added to the system. |

| |
|---|
| **Use case:** Post Goods Receipt for Purchasing Document |
| **ID:** PO2 |
| **Actors:** Department Head(Various Department), Supplier |
| **Preconditions:**<br>Login: User login into SAP S4/HANA System.<br>Purchase Order has been added to the system successfully.<br>Copy Purchase Order number. |
| **Flow of events**<br>  1.  Navigate to Procurement Tab: User then click "Post Goods Receipt for Purchasing Document" button.<br>  2.  Paste the Purchase Order number on the Purchasing Document.<br>  3.  Select the "Post" button on the lower right side. |
| **Postconditions:** Purchasing Document has been successfully posted. |
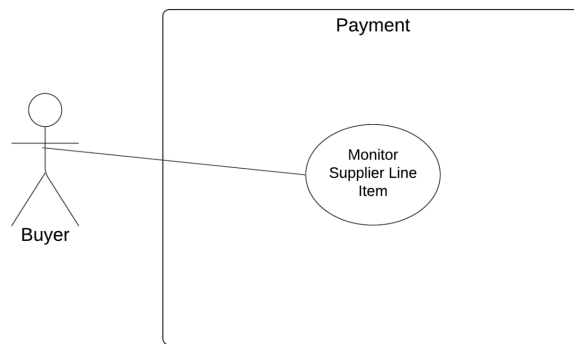
Figure 5.6: Payment Use Case

| Use case:Monitor Supplier Line Item |
|---|
| **ID:** PS10 |
| **Actors:** Buyer |
| **Preconditions:**<br>Buyer has created a purchase order.<br>Supplier has approved the purchase order.<br>Buyer has posted the goods receipt.<br>Buyer has created the supplier invoice. |
| **Flow of events:**<br>1. User navigates to "Manage Supplier Line Items".<br>2. User fills in information about supplier, company code, status, open on key date and item type before choosing "go".<br>3. The system will list all the filtered items.<br>4. User view the clearing status<br>5. User choose the item by selecting checkbox and choose "Edit Line Item" to update the items information<br>6. User clicks on "Journal Entry" to see options about managing journal entries.<br>7. User selects "Display Process Flow AP".<br>8. Users view the process flow starting from purchasing until clearing. |
| **Postconditions:** Users can see the status of clearing and due payment. |

## 5.3.4 Database Design
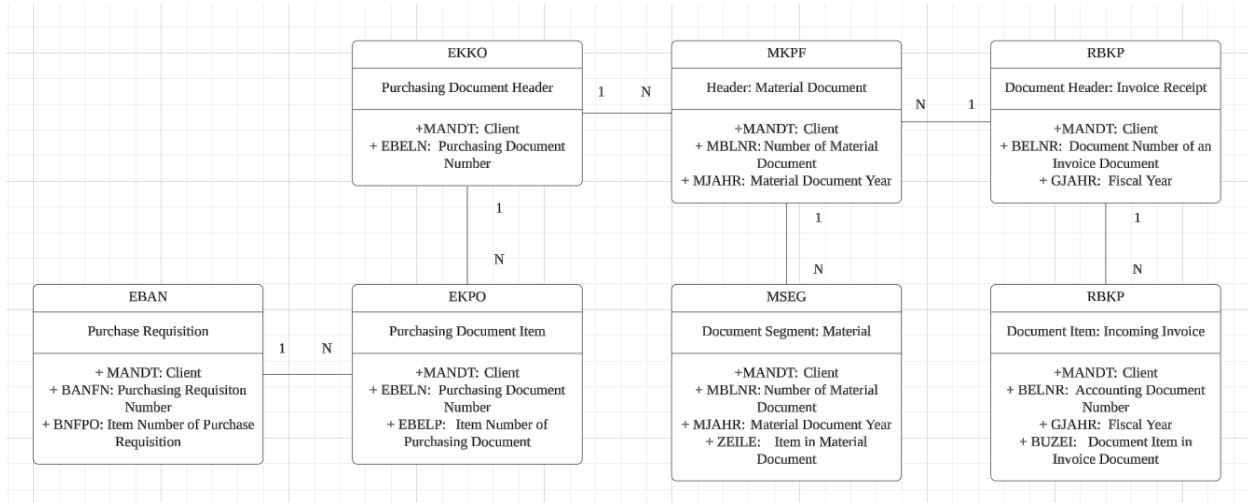


*Figure 5.3.4: Database Design for Procurement Management System*

The majority of business objects and documents in SAP have a hierarchical structure made up of header and item levels. While the item level retains specific information for each line item in the document, the header level holds general and aggregated data about the entire document.

For instance, in a purchase order, the item level would contain information about each individual item being ordered, such as part numbers, quantities, and prices, while the header level would contain information like the purchase order number, vendor details, and payment terms.(Outati, 2024)

This distinction between header and item data is a fundamental concept in SAP and applies to a wide range of business objects, including invoices, goods receipts, and sales orders . Understanding this hierarchy is crucial when integrating and analyzing SAP procurement data, as it allows for the appropriate tables to be identified and the relationships between them to be understood.

Explanation of each tables:

1.  EBAN (Purchase Requisition).
    The purpose of a purchase requisition is to instruct the Purchasing department to acquire a specific quantity of a material or service, ensuring its availability at a designated time. It's important to note that a purchase requisition is an internal document and is not utilized outside the organization.

In SAP, purchase requisitions are unique in that they only possess a line item table, with no header details. Typically, in a Material Management (MM) flow, a purchase requisition precedes a purchase document, such as a purchase order (LeanX, 2024).

2. EKKO (Purchasing Document Header).
   A header and one or more line items are present in a purchasing document. Table EKKO stores the header, while Table EKPO stores the line items. With the help of the purchasing document number (field EBELN), the two tables can be connected. Relevant information for the entire document is contained in the header. The items list the goods or services that need to be purchased. For instance, the document header contains information about the vendor and the document number, and each item specifies the material description and the order quantity.

   Although they may not all have the same business purpose, the various document categories in the purchasing document table have the same document structure. The field EKKO.BSTYP contains the definition for the document category. Tables contain the following categories of documents can be found in EKPO/EKKO:

   - Purchase order (PO)
     The buying entities request or instruct a vendor (external supplier) to supply certain materials or render/perform certain services/works, formalizing a purchase transaction.
   - Contract
     In the SAP Purchasing component, a type of "outline agreement", or longer-term buying arrangement. The contract is a binding commitment to procure a certain material or service from a vendor over a certain period of time.

   Purchase requisitions are an additional category of purchasing documents. These are internal company documents that are kept in table EBAN rather than the purchasing document table.

3. EKPO (Purchasing Document Item).
   A header and one or more line items are present in a purchasing document. Table EKKO stores the header, while Table EKPO stores the line items. With the help of the purchasing document number (field EBELN), the two tables can be connected. Relevant information for the entire document is contained in the header. The items list the goods or services that need to be purchased. For instance, the document header contains information about the vendor and the document number, and each item specifies the material description and the order quantity.

4. MKPF (Header: Material Document).
   All material document headers are included in Table MKPF. Every time there is a material movement within the organization, a material document is created. A material document has one or more line items in addition to a header. Table MKPF is where header data is kept. Table MSEG contains line items. Fields MBLNR and MJAHR are where the connection between MKPF and MSEG is made.

5. MSEG (Document Segment: Material).
   Table MSEG contains all material document line items. A material document is created whenever a material movement occurs within the organization. A material document contains a header and one or more line items. Header data is stored in table MKPF. Line items are stored in table MSEG. The link between MKPF and MSEG is made on fields MBLNR and MJAHR

6. RBKP (Document Header: Invoice Receipt).

7. RSEG (Document Item: Incoming Invoice).

## 5.3.5 Interface Design

User interface (UI) design is the process designers use to create interfaces in software or computerized devices, emphasizing appearance and style. The goal is to design interfaces that users find easy to use and enjoyable. UI design encompasses graphical user interfaces as well as other forms, such as voice-controlled interfaces (Interaction Design Foundation, 2024).
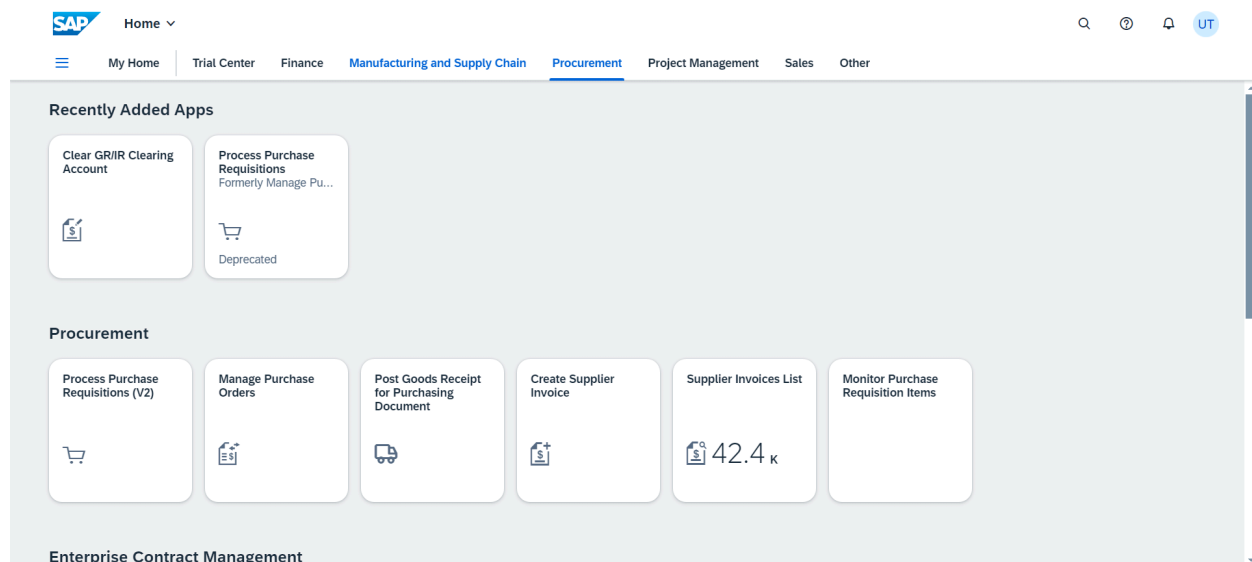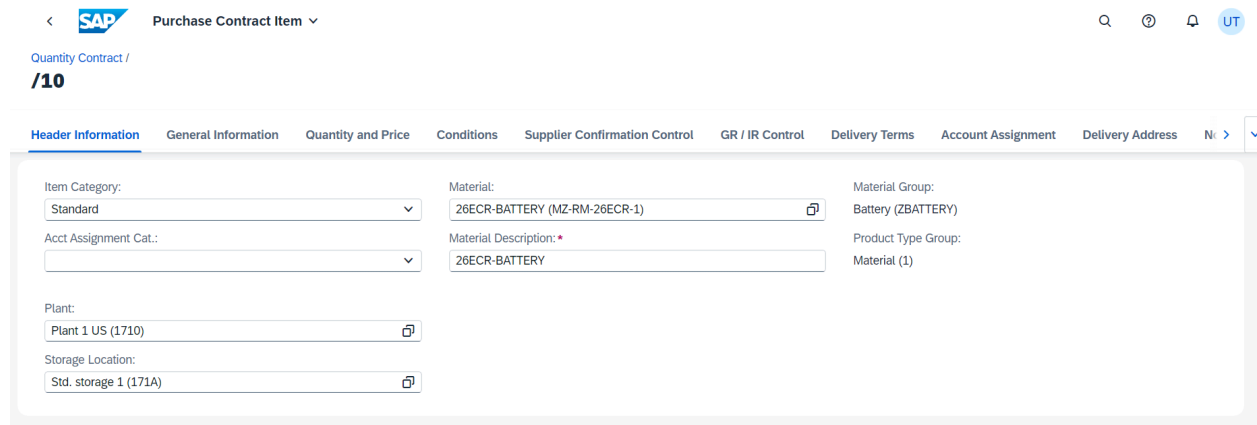


Figure 5.7: Interface of Procurement Main Page

Login to SAP trial webpage and choose "Procurement". Click "Process Purchase Requisitions (V2)" to start creating contract

Figure 5.7: Interface of Process Purchase Requisition

There are filters available that can help to find any purchase requisitions by refining the list based on selected criteria.



Figure 5.8: List of Purchase Requisition

This is the list of purchase requisitions based on the applied filters. Choose any purchase requisitions by clicking the boxes.

Figure 5.9: Interface of Quantity Contract

Ensure that all necessary information is accurately filled in within the contract. To avoid any errors, meticulously complete all required fields and provide all essential details.



Figure 5.10: Interface of Purchase Contract Items List

Expand the Purchase Contract Item to fill in all necessary details.

Figure 5.11: Interface of Purchase Contract Item

Some of the information is automatically filled based on the selected items.



Figure 5.12: Interface of Quantity and Price for Purchase Contract Item

Fill in the quantity details per item.

General Information    Quantity and Price    Conditions    Supplier Confirmation Control    **GR / IR Control**    Delivery Terms    Account Assignment    Delivery Address    Notes    Attachments    ∨

### GR / IR Control

Underdelivery Tolerance in %:
0.0

Overdelivery Tolerance in %:
0.0

Unlimited Overdelivery Allowed:
☐

Stock Type:
Unrestricted-use

Tax Code:

Kanban Indicator:
∨

Origin Acceptance:
☐

Info at Registration:
☐

Goods Receipt:
☑

Non-Valuated Goods Receipt:
☐

Invoice Receipt:
☑

GR-Based Invoice Verification:
☑

Figure 5.13: Interface of GR/IR Control for Purchase Contract Item

General Information    Quantity and Price    Conditions    **Supplier Confirmation Control**    GR / IR Control    Delivery Terms    **Account Assignment**    Delivery Address    Notes    Attachments    ∨

### Account Assignment

#### Account Assignments (1) Standard ∨

Delete    ⧉    ⚙

| Account Ass… | G/L Account | Quantity | Distribution… | |
|---|---|---|---|---|
| ○ 1 | 5110… ⧉ | 5.000 | 0.0 | › |

### Delivery Address

Name:
Storage Location 171A - Address Name 1

Street:
Deer Creek

House Number:
3475

City Postal Code:

Telephone:

Cell Phone:

Fax:

Email:

P.O. Box:

P.O.Box Lobby:

P.O. Box Postal Code:

Company Postal Code:

Figure 5.14: Interface of Account Assignment for Purchase Contract Item

Expand the Account Assignments section to fill in the account assign information.

Figure 5.15: Interface of Account Assignment



Figure 5.16: Interface of Purchase Contract

After clicking "Create", the successful contract will be displayed.

Figure 5.17: Interface of Purchase Contracts List in Manage Purchase Contract

Click the drop down menu in the header and choose "Manade Purchase Contract". All purchase contracts will be listed.



Figure 5.18: Interface for creating a new purchase order.

Select the same supplier as the Purchasing Contract.
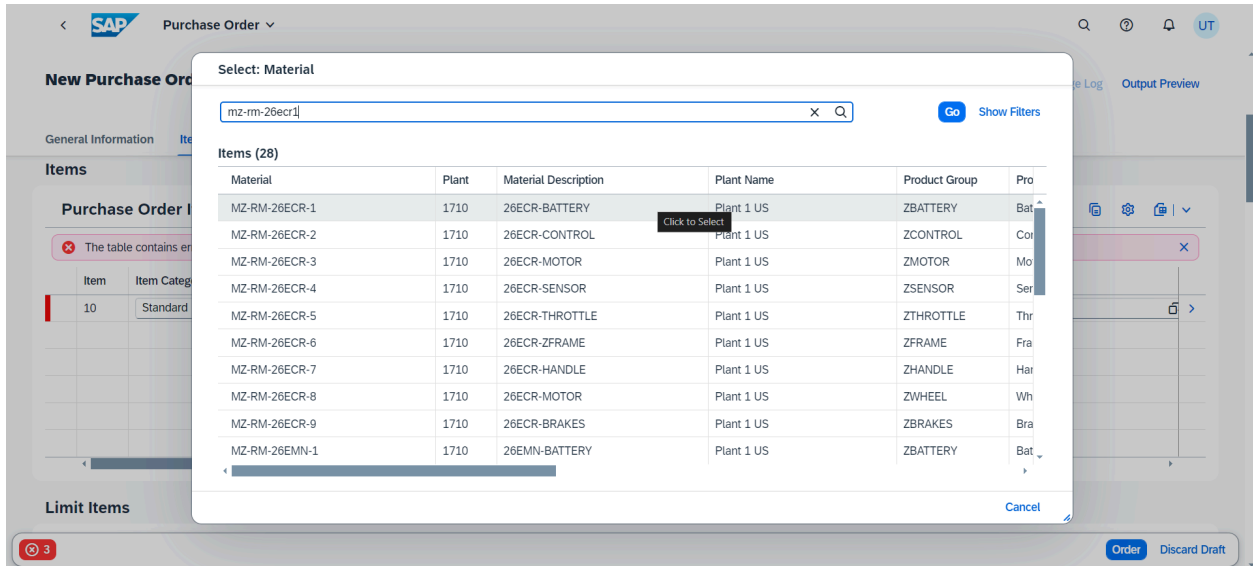
Figure 5.19: Interface for Select Material needed from the supplier.
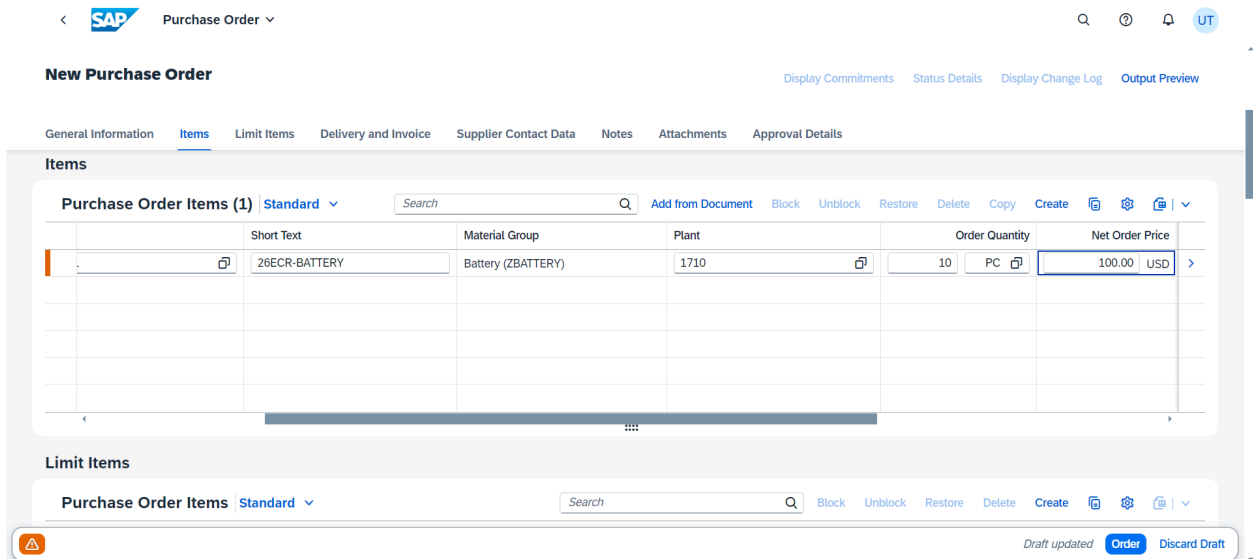


Figure 5.20: Interface for Purchase Order Items, Enter Order Quantity and Net Order Price.

Figure 5.21: Interface for Successful Purchase Order Document.



Figure 5.22: Interface for Post Goods Receipt for Purchasing Document.

Figure 5.23: Interface for Purchasing Document with reference to Purchase Order Created Earlier.



Figure 5.24: Interface for successfully created document.

# Create invoice
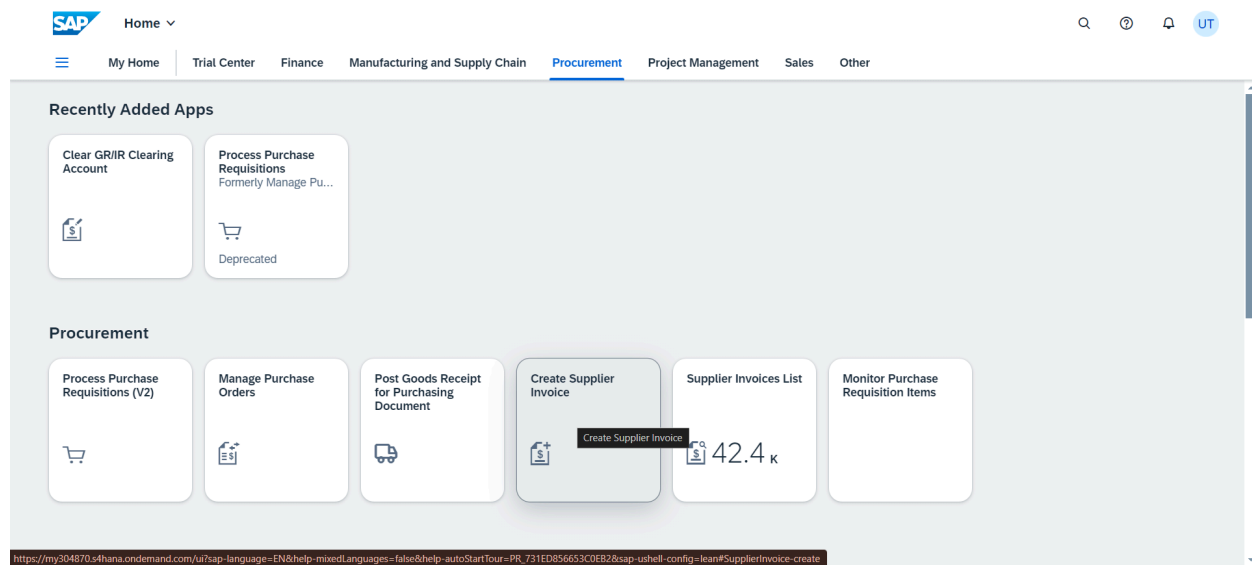


Figure 5.25: Interface for Create Supplier Invoice

Click "Create Supplier Invoice" at the main page of procurement



Figure 5.26: Interface for fill in informations of new supplier invoice

Insert information for "Invoice Date", "Invoice Party", "Company Code" and "Reference" and "Gross Invoice Amount" at this General Information part.

Figure 5.27: Interface for adding reference number of purchase order

At the Purchasing Document Reference, fill in the value of "Purchase Order/Scheduling Agreement" based on the reference number created from "Manage Purchase Order". After the reference number is inserted, it will display general information of the purchased item.



Figure 5.28: Interface to validate information

After all of the information inserted, click "Check" button to see if there is any error displayed during the process. If there is no error shown, click the "Post" button to complete the process.
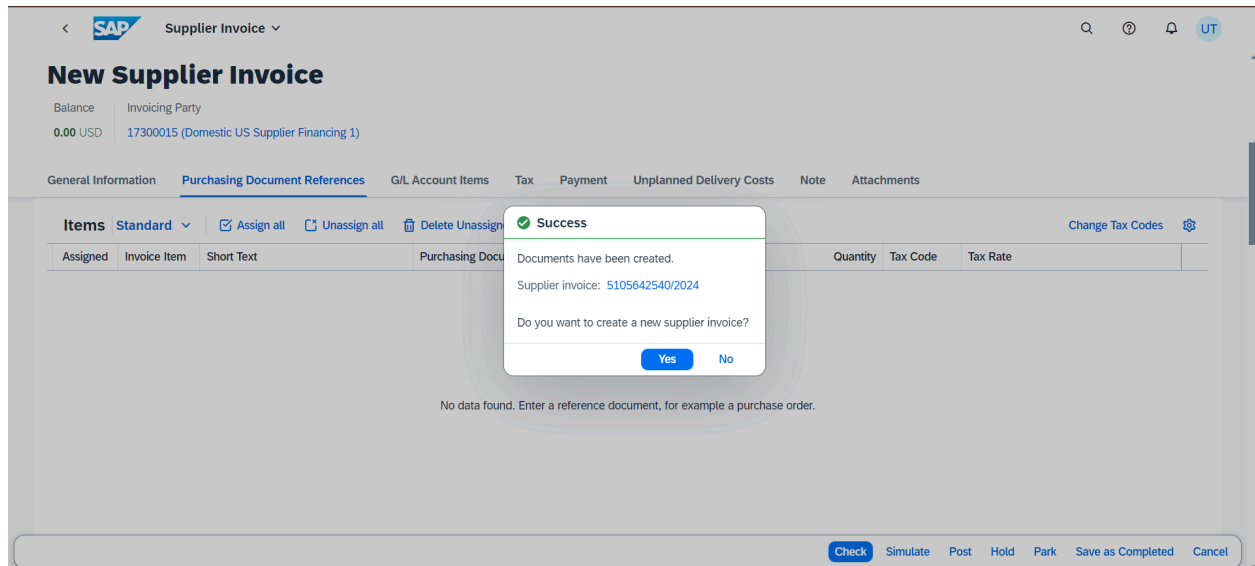
Figure 5.29: Interface of invoice is successfully created

This shows that the invoice is created. Click "no" button so that it will be redirected to main page of Procurement
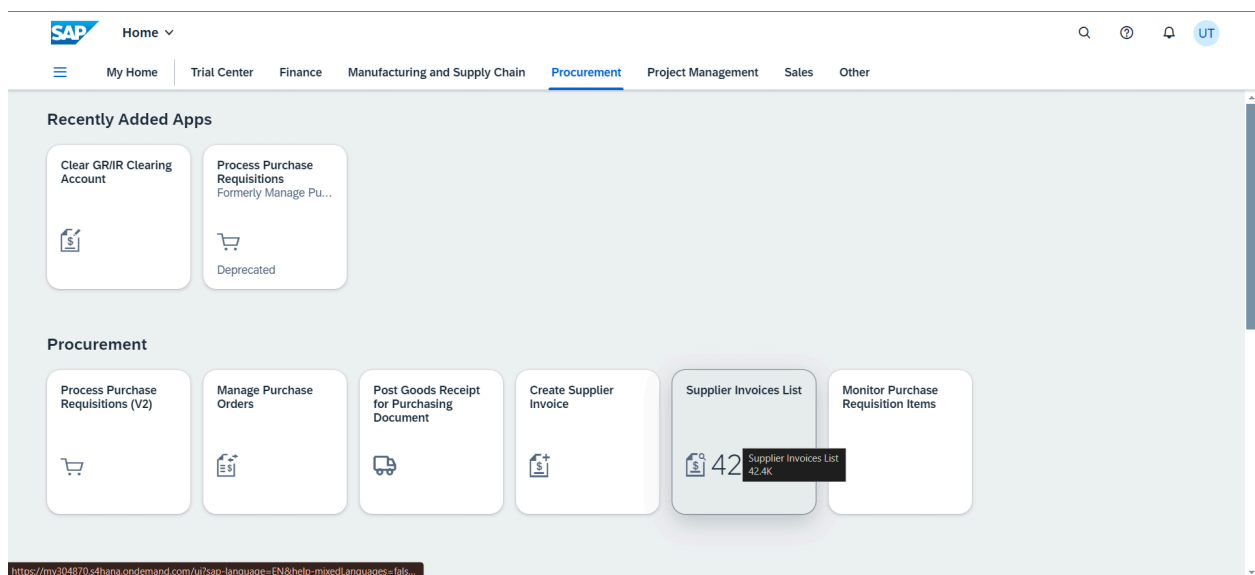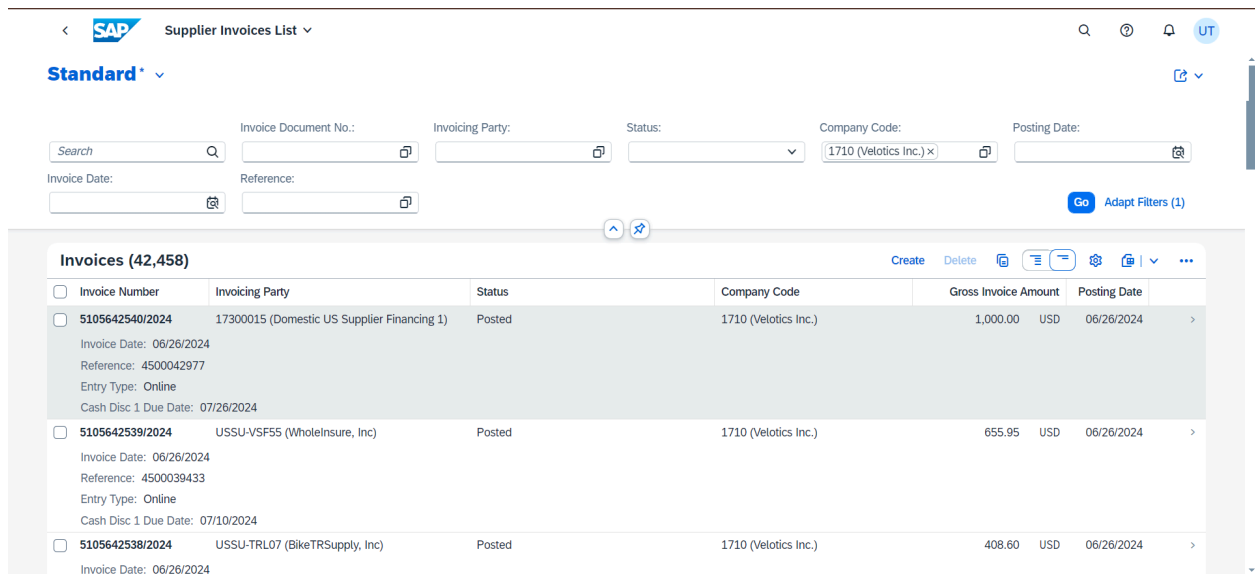


Figure 5.30: Interface to view Supplier Invoice List

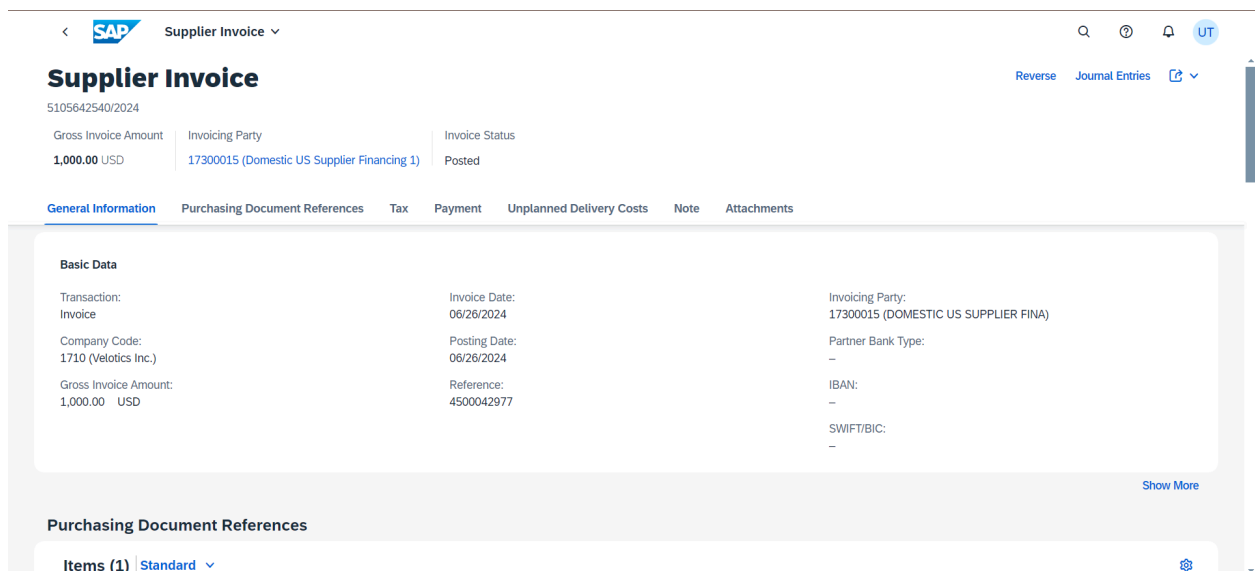Click "Supplier Invoices List" to view invoice that has been created

Figure 5.31: Interface of the list of invoices

Click on the invoice that we had created .



Figure 5.32: Interface for viewing general informations of supplier invoice

This page shows the overall information invoice that we had created

Manage Supplier Line Item
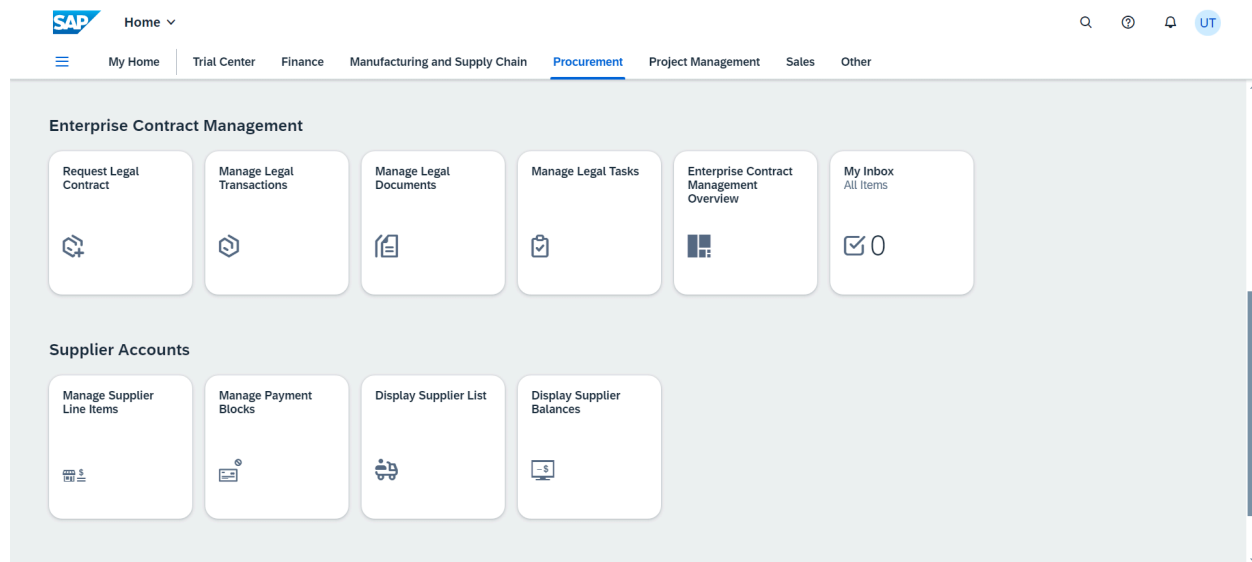


Figure 5.33: Interface of Procurement System

In the homepage, select 'Manage Supplier Line Item' under the 'Supplier Accounts' section
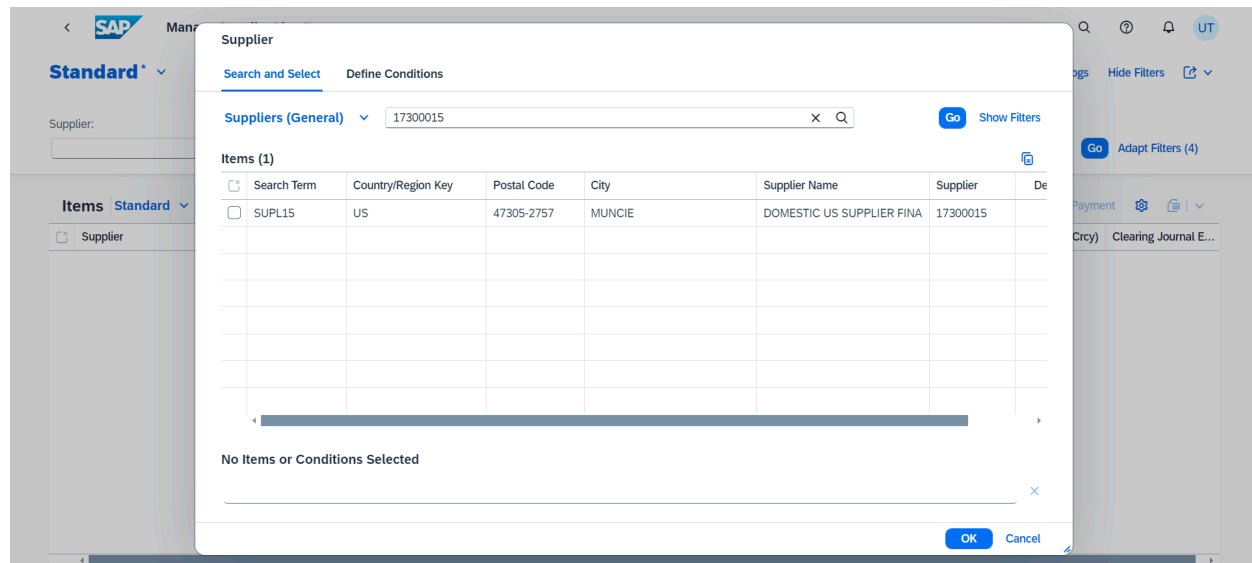


Figure 5.34: Interface of 'Search and Select Page'

In the supplier 'Search and Select' page, search or type the supplier company code in the search bar and click the 'OK' button after selecting the company from the item list.
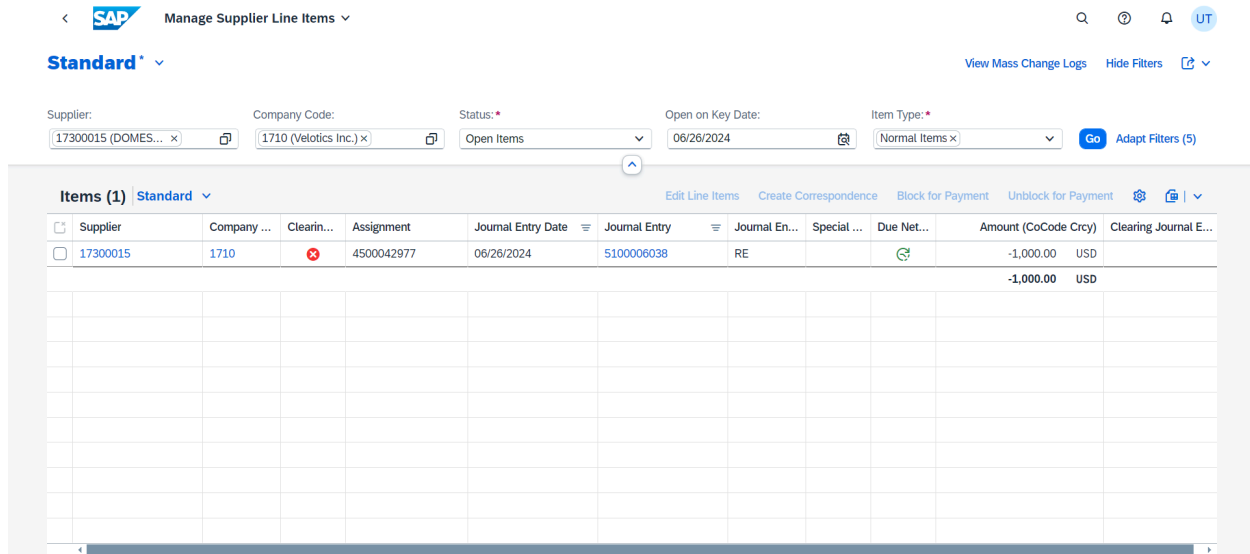
Figure 5.35: Interface of 'Manage Supplier Item' with filtered supplier company.

We will redirect to the main page where now we can see the item info from our invoice. Clearing status that shown in the figure indicate the payment for the respective invoice is still not done and due net column show that the payment is still behind the due with its amount in the next column
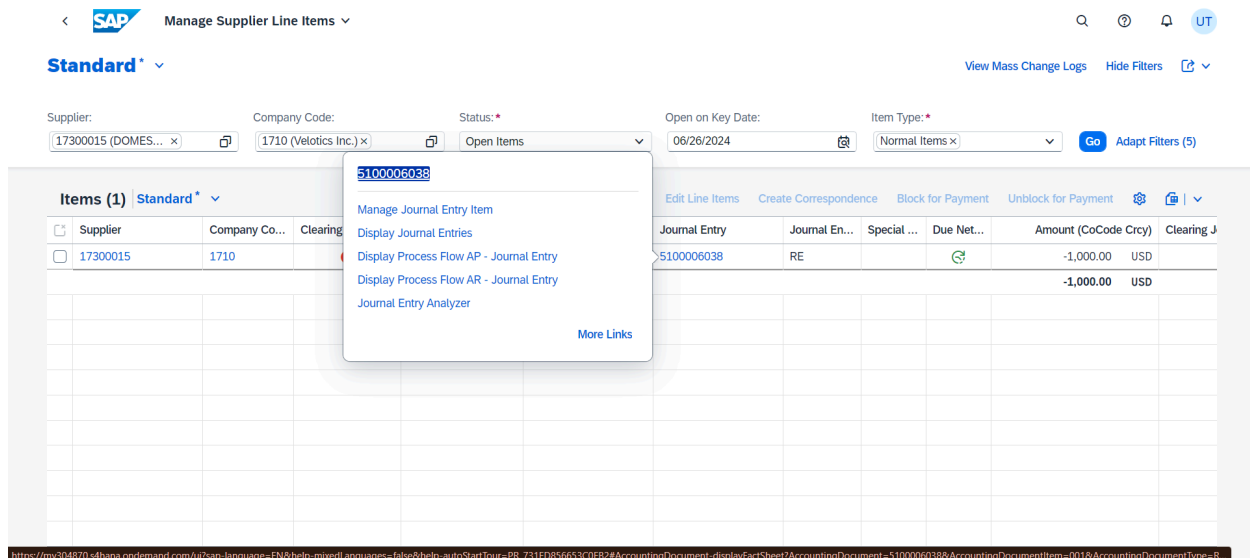


Figure 5.36: Interface of 'Manage Supplier Item' with filtered supplier company

At the 'Journal Entry' column, click on the numbers and the following options are displayed, click on 'Display Process Flow AP - Journal Entry'.
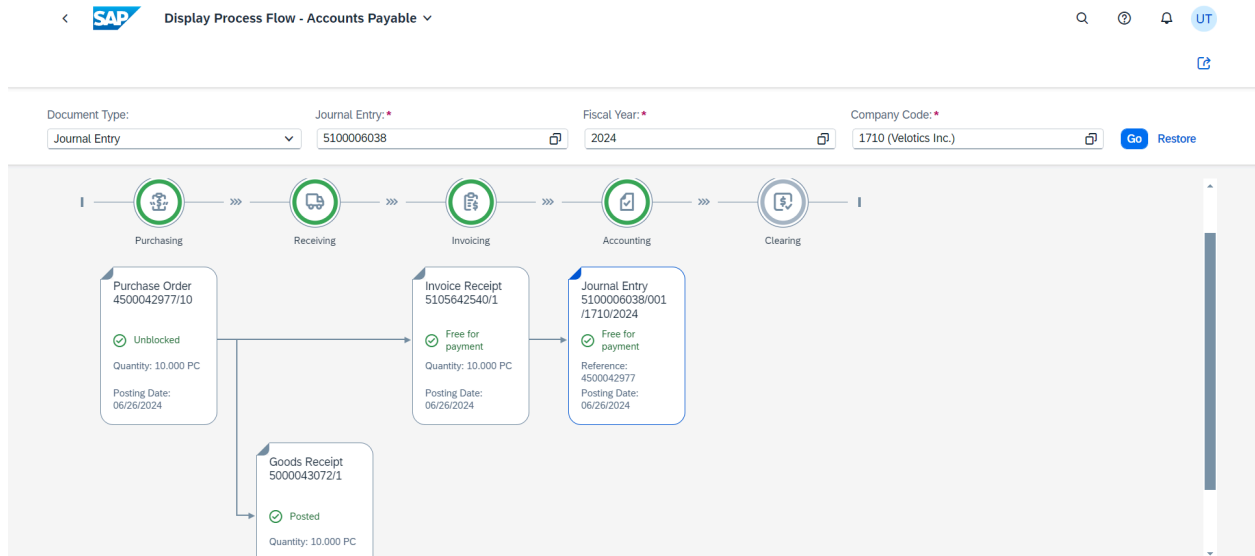
Figure 5.37: Interface of 'Display Process Flow AP - Journal Entry'

In this page, the process of the supplier items from account payable is illustrated starting from processes like purchasing, receiving, followed by invoicing, accounting, and lastly clearing.



Figure 5.38: Figure 5.35: Interface of 'Manage Supplier Item' with filtered supplier company

Back to the main page, select the item that you want to edit and click on the 'Edit Line Item' button.

Figure 5.39: Figure 5.35: Interface of 'Edit Line Item'

In this page, we can set the payment data info for example put the item into the payment request block for immediate transaction to Account Payable (AP) and also we can edit dunning data and additional data.

## 5.4 Summary

System analysis and design for the small shirt printing company focuses on integrating the SAP S4/HANA procurement system to handle current challenges such as fragmented order processing and lack of centralized inventory management. The procurement use case diagram contains 4 main use cases. To complete this use case, the system architecture was designed, including the SAP Fiori for user interface, SAP S/4 HANA for real time processing, and SAP Ariba for supplier interactions. It also includes database design with centralized data storage in SAP S/4HANA, as well as user-friendly interface designs for procurement procedures. This complete design intends to streamline operations, improve data accuracy, and increase the company's overall efficiency.

# Chapter 6: System Implementation

## 6.1 Introduction

This chapter outlines the implementation process of the proposed enterprise information system, detailing the development, coding, testing, and deployment phases to ensure a smooth transition from the current system to the new integrated solution based on SAP procurement modules.

## 6.2 System Development

The system development phase follows the Waterfall Software Development Life Cycle (SDLC), emphasizing linear, sequential procedures. The key stages include:

1. Requirement Analysis:
   Objective: Collaboration with other departments to optimize resource allocation, inventory management, and supply chain logistics based on system-generated insights
   Inputs: Inputs include client specifications, cost considerations, completion time, and available features. Three criteria chosen in the project are case study, company organization, and current system analysis.
   Output: Specification document outlining system behavior to be implemented.

2. System Design:
   Objective: Develop detailed design based on requirements gathered in the previous phase. Includes algorithm design, system architecture, component of the Architecture, Project Design, Database Design, and Interface Design.
   Output: Comprehensive system design documentation.

This structured approach of the Waterfall SDLC ensures systematic progress through defined phases, with each phase building upon the outputs of the previous one. It emphasizes thorough planning, documentation, and sequential execution, making it suitable for projects with stable requirements and clear objectives.

## 6.3 Summary

This chapter focuses on the systematic implementation of the enterprise information system, leveraging SAP procurement modules. By following the Waterfall Software Development Life Cycle (SDLC), the process goes through three essential phases: starting with requirement analysis to optimize resource allocation and supply chain logistics, progressing through detailed system design, and culminating in the implementation phase.

# Chapter 7: Conclusion

## 7.1 Introduction

This chapter focuses on concluding and highlighting the post-implementation of SAS4/HANA Procurement Management System by providing a comprehensive overview of the system's impact on the daily operational for the business. Next, it lists the challenges faced during implementation, and also proposes strategies for future enhancements so that the system is able to meet the evolving needs of the business.

## 7.2 System Contribution/Achievement

The system contribution has significantly enhanced the efficiency and effectiveness of the business operations, leading to improved customer satisfaction and increased profitability. The Implementation of the SAP S4/HANA Procurement Management System has greatly improved overall operational efficiency in streamlining order processing, inventory management, and customer data handling, reducing errors and delays. This would replace the current WhatsApp-based system with included features such as order tracking, automated notifications, and user-friendly interface. By centralizing data, it improved the accuracy of inventory levels and customer information. Real-time visibility into inventory levels, enabling the business to maintain optimal stock levels and quickly fulfill orders. The system also enhanced collaboration in which facilitated better communication and coordination between departments and with external partners, leading to more efficient operations.

## 7.3 System Constraint

Despite its numerous benefits, the system has some constraints that need to be addressed:

- **Initial Implementation Cost**: The cost of implementing the new system, including SAP licenses, hardware, and training, can be substantial.

- **Employee Training**: Ensuring that all employees are adequately trained to use the new system effectively requires time and resources.

- **Resistance to Change**: Some employees may resist transitioning from the old system to the new one, necessitating change management strategies.

- **Ongoing Maintenance**: Continuous maintenance and updates are required to keep the system secure and up-to-date with technological advancements.

Despite its benefits, the system has some constraints such as the initial cost of implementation, the need for employee training, and potential resistance to change from staff accustomed to the

old system. Additionally, continuous maintenance and updates are required to keep the system up-to-date with technological advancements.

## 7.4 Future Suggestion

To improve the effectiveness and efficiency of the SAP S4/HANA procurement system, numerous potential changes and extensions can be considered:

**Regular training program:** Develop a users training program either physically or virtually to keep users with the up-to-date system. This can help to ensure continued efficient use and maximizes the return on investment in the system.

**Complete guideline:** As the SAP will improve their technology year by year, a complete guideline needs to be prepared for the user especially for the new users. As the system is updated, the guideline also needs to be updated. Use the latest interface in the guideline diagram to avoid any misunderstanding and confusion.

**Mobile accessibility:** Develop an on the go procurement system so the users can access the system easily without need to bring many devices. This will increase the flexibility and responsiveness as users can use and monitor the system anywhere and anytime.

**User feedback mechanism:** To meet users satisfaction, establish a robust mechanism for users to provide their insights and suggestions. This will help to improve the system and identify the areas for enhancement.

## 7.5 Summary

In conclusion, SAP S4/HANA Procurement Management System proves that it can be a gamechanger for the business by maximizing operational performance with process streamlining, data centralization, real-time visibility and enhanced collaboration. However, the system constraint will affect the overall positive impact of the system so the proposed suggestion needs to be implemented pragmatically to handle all the constraints and put this system in a proper environment to be used daily.

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