



**ISLAND
FURNITURE**

System Analysis and Design Report

IS3102 Enterprise Systems Development

Integrated Solution Track - Team IT05

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1. Executive Summary

This report details Kent Ridge Technology's (KRT) custom Enterprise Resource Planning (ERP) System for the newly established Island Furniture, led by the Merlion Investment Holding, which aims to build a world-class furniture manufacturing and retailing giant.

KRT is a well-established company with numerous project portfolios. It is globally recognized as one of the top providers of quality software solutions. In order to support Island Furniture's global state, ERP system facilitates operational requirements including manufacturing resource planning, sales automation, procurement and replenishment processes. In addition, the system is built to maximize organizational business gains with minimal cost by integrating hardware, which consists of Point of Sales (POS), E-commerce website and M-commerce mobile application, with its Customer Relationship Management Sub-systems.

This report provides a summary of requirement findings in section 2. In section 3, a revised business and system requirement analysis is provided with elaborated business processes and is also supported with activity diagrams or scenarios where appropriate for a clearer illustration.

A High-level architecture of the entire system and hardware integration is provided in the section 4. In addition to the list of sub-systems and hardware applications, an overall entity class diagram for the entire integrated ERP system will be illustrated.

Section 5 includes the detailed functional module designs. In this section, various UML diagrams will be provided to demonstrate module design and functionalities for each functional sub-system and hardware application.

In section 6, user interface design documents actual screen shots of the aesthetic design elements, supported by the explanation of interface design principles used. In the last section, the report includes the naming conventions used, as well as any open source codes used.

KRT's ERP system and hardware integration will support the Island Furniture business's growth into a premier worldwide furniture brand.

2. Summary of Requirement Findings

2.1 Overall Business Objectives

The custom ERP system is designed to achieve operational excellence and customer and supplier intimacy in alignment with the business objectives of Island Furniture. The ERP system is a cutting edge system which automates Island Furniture's manufacturing operations and retail sales requirements, provides supplier portal for smooth communication and quicker information flow, and supplies real time data and reports for decision making and analytical needs to improve customer services. As a result, the ERP system helps Island Furniture strengthen both supplier and customer relationships, as well as gain competitive advantage in the furniture retail market.

After various meeting with senior management of Island Furniture, KRT's ERP IT05 team establishes business objectives which can be augmented by IT to gain sustainable competitive advantages. The ERP system is designed and developed to fulfill these business objectives and support business strategy.

The ERP system addresses the core business objectives below:

1. Reduce employees' workload by streamlining business processes and automating routine tasks
2. Enhance managerial level decision making by providing real-time information access and relevant data retrieval
3. Provide an integrated view of information for transparency, accessibility and traceability.
4. Facilitate quick replenishment process by supporting smooth communication and accurate information flow across upstream and downstream of supply chain.
5. Encourage more purchases through the provision of various customer channels to bring higher convenience and satisfactory for shopping experience
6. Engage and retain customers by establishing good customer relationships and enhancing loyalty
7. Furnish marketing analyst team with relevant analytical results and prediction

2.2 Overall System Requirements

In order to ensure Island Furniture's competitive edge over industry incumbents, KRT's ERP IT05 team has worked closely with the identified business objectives and crafted an innovative and customized solution that best fits Island Furniture's business strategy and operational needs.

The ERP system handles Island Furniture's main business functions in the following eight sub-systems and two integrated hardware applications : Common Infrastructure (CI), Global Headquarter (HQ) Sub-system, Manufacturing Resource Planning (MRP) Sub-system, Supply Chain Management (SCM) Sub-system, Inventory Management (IM) Sub-system, Kitchen Management (KM) Sub-system, Operational Customer Relationship Management (OCRM) Sub-system, Analytical Customer Relationship Management (ACRM) Sub-system, Point Of Sales (POS) Application, M-Commerce Application. On top of these system functions, a supplier portal and a customer E-commerce portal are also part of the solution.

The ERP system's CI ensures transparency, traceability and accessibility. Every action is logged in the backend records which can be retrieved easily for auditing purposes. This sub-system provides basic security functions to guard organizational data. The system users of Island Furniture are given specific roles and access rights based on their authorities and positions.

The Global HQ Sub-system maintains organizational standards such as product information, loyalty program policy, and facility information. It also focuses on demand aggregation and sales forecasting for each product at each store. Based on the sales forecast, the global HQ will be used to generate Monthly Production Schedule (MPS) for production. An Ad-hoc back order will be created at global HQ to ensure correct information flow, if there is an ad hoc replenishment request from the individual store.

The MRP Sub-system and the SCM Sub-system are deployed at each manufacturing facility to support resource planning decisions and inbound and outbound logistics of supply chain. The Supplier Portal is also integrated with SCM Sub-system to smoothen communication between purchasers and supplier with integrated order information flow, and in term improve supplier intimacy. The timely information dissemination and system backend accurate calculations greatly support decision making throughout all levels of the organization, enabling Island Furniture to operate its business with minimal cost.

Similarly, the IM Sub-system provides real-time updates of inventory movement and storage records, which also supports decision making. Besides, the warehouse management modules is able to streamline business processes as the system automatically identifies the vacant space in the warehouse based on the type of inbound inventory. Thus, the manual process of checking vacant space for storing inbound inventory can be replaced. The location of the inventory is recorded electronically to improve convenience when physically searching for inventory.

The KM sub-system ensures smooth business processes in both upstream and downstream of supply chain. The ERP system and POS are both customized to fit the kitchen's process flow in order to support kitchen's operations and business.

The ERP system's sophisticated Operational Customer Relationship Management(OCRM) Sub-system includes the loyalty program modules which is integrated with the E-commerce, M-commerce and POS applications to reward customers accordingly. It is standardised across all stores globally and can be used at any of the Island Furniture market places, retail outlets and restaurants. It aims to support customer acquisition and retention by studying customer behaviours and maintaining continuous customer engagements with the goal of achieving improvement of customer shopping experience and profit maximization for the company.

The E-commerce and M-commerce integration serves similar purpose which is to improve customer shopping experience by enabling online shopping list creation and online payment after browsing through the catalog of Island Furniture products. These applications also provide basic functionalities such as new user registration, personal profile management and checking of loyalty points and promotions.

The Point of Sales (POS) applications at all stores gives the company real time sales data, inventory updates and useful information about preferences of returning customers. The business intelligent tools incorporated in the Analytical Customer Relationship Management (ACRM) helps the marketing staff to gain better understanding of the customers, segment customers based on their net worth and find cross-selling opportunities. As a result, a personalized marketing strategy can be applied more accurately to retain customer and increase customer spending.

Finally, with these system functions and hardware integrations, ERP IT05 team's solution is believed to be able to sustain Island Furniture's international recognition.

3. Requirement Analysis

Table of Changes

S/N	Page No. (Proposal)	Page No. (SAD Report)	Change Type	Description of Change
1	17	8	Correction	Added brief overall introduction of CI
2	17	8	Correction	Corrected ambiguity about system administrator of each facility
3	19...	10...	Correction	Added system user roles at each module level in each sub-system design
4	20	12	Enhancement	Added two functionalities for security log
5	22...	15...	Correction	Added headings for all activity diagrams
6	21	13	Revision	Added default factory set-up description
7	33	25	Revision	Deleted Redundant functionalities of Factory Selection
8	34	25,26	Enhancement	Added functionalities of adding specific goods to each individual factory and store
9	37	29	Revision	Changed "View MRP Report" to "View MRP"
10	40	33,34	Revision	Changed description for procurement process and supplier selection process

11	42	37	Revision	Minor change of contract and non contract description
12	45	38	Revision	Changed remark for Assess purchase order and update purchase order status
13	45,46	39	Revision	Changed remark for create request for quotation, changed filter top 5/10 to filer top3/5 suppliers
14	45	39,42-43	Enhancement	Added new functionalities C.2.2.11 and refined Supplier Portal functionalities
15	46	40	Revision	Deleted C.2.4.4 to C.2.7
16	46	40	Enhancement	Added view, delete and edit purchase requisition functionality
17	48	41	Enhancement	Added alert contract expiry functionality
18	49	42,43	Enhancement	Added unblock supplier account and reset supplier account password functionalities
19	48	47	Revision	Added explanation of a storage section location can be tracked by system and vacant space in the warehouse
20	56	49	Enhancement	Added Send back order, delete back order and view safety stock level functionalitites

21	62	56	Revision	Combined Ingredient Movement Module to Ingredient Inventory Control Module
22	59	56	Correction	Added brief description of each kitchen sub-system modules
23	63	60	Correction	Added brief introduction for operational CRM
24	63	60	Revision	Edited operational CRM assumptions for loyalty program
25	63	61	Revision	Minor change of online purchase process description
26	68	65,66	Revision	Changed business logic for loyalty program policy
27	70	67	Revision	Changed of customer online redemption scenario
28	72	68	Correction	Added brief introduction to the sub-system analysis
29	73	70	Revision	Reformed the E&M commerce application module structure
30	75	72	Revision	Minor changes to the remark of Redemption Management module
31	75,76	72	Enhancement	Added a few more functionalities to POS

32	76,77,78	72,73,74,75,76	Revision	Added Customer Account Management to E-commerce and M-commerce. Restructure into two sub-modules per application
33	77,78	74,76	Enhancement	Added display total loyalty points to e&m commerce
34	79	78	Enhancement	Added Retrieve Customer Data functionality to ACRM
35	14,15	79,80	Revision	Added supplier portal at system architecture, added sub-modules for Supplier portal and E&M commerce application in the TVOC

3.1 Common Infrastructure

3.1.1 Business Requirement Analysis

Common Infrastructure serves as the core foundation underlying the entire ERP system, and provides security infrastructure and workspace for each user by allowing user access rights configuration. It consists of various modules that facilitate the use of the ERP system, each serving a distinct purpose as elaborated in the below requirement analysis.

3.1.1.1 Objectives

- Maintain system security on both application and transport layer;
- Support role-based and personalised workspace;
- Support system user account management;
- Enable system administrator to search for employee
- Log user actions and transaction

3.1.1.2 Assumptions

- Creation of account will be done by IT admin of IT department at each facility
- Senior managers will determine the access control, designation of scope for each user and authorization offline

3.1.1.3 Process Description

Account Creation and Login

The staffs of Island Furniture are given an account to access to the online web portal of ERP system. The IT admin from IT department of each deployed facility is the only authorised personnel to create and distribute staff accounts for that particular facility. For new staffs who do not have accounts, the system administrator would set up an account for them and configure certain access rights based on predefined user roles. A randomly generated password will be assigned when the administrator creates a new account. Thus, new users to the system are recommended to reset their initial password to a complex password. The login process only requires inputs of user name and password for accessing the personalized web page.

The customers of Island Furniture will need to go to the e-commerce web portal to register member account. This will be further elaborated in Operational Customer Relationship Sub-system.

Mid-way System Authentication Process

If any user managed to obtain a URL link to a page whereby only authorised users are allowed to access, the system will require the user to key in his/her username and password before giving them access to this page. Wrong password or username will lead to access being denied.

Password Lock and Reset

In order to achieve higher security level by preventing cases of unauthorised login due to account phishing, all internal staffs are only given three attempts to log into the system in the case of wrong input passwords. After three failed attempts, the account will be automatically locked up and denied the access of this particular user. The staff needs to approach IT admin to reset his/her account and a new randomly generated password will be sent to him/her via email. The user may then use this randomly generated password to

regain access to the system. It is highly recommended for the user to change his/her password after regaining access to the system to one that they are familiar with.

Users may also choose to manually log in to the system to reset their password. Password reset function will be displayed on the first login page among all other functions make available to the user.

Besides that, the system will automatically prompt all users to reset their password every three months. This is to minimize the risk of having their password being misused by unauthorized personnel to gain illicit access to the server.

Captcha Mechanism

Captcha Mechanism is implemented at the end of customer member registration page to verify that the user is human by entering a short garbled text which is unreadable by computer programs. This mechanism can prevent potential bots attacks from registering for accounts and collecting sensitive information. Thus, the customers can feel save to fill in their personal information when doing online registration with Island Furniture.

3.1.2 System Requirement Analysis

3.1.2.1 Sub-system Design

The common infrastructure is designed into the four modules :

A.1 System Security Module

A.2 System User Workspace Module

A.3 System User Account Management Module

A.4 Messaging Module

System Security Module

The module provides security infrastructure to protect the confidentiality and integrity of all the data handled by our ERP system. It provides Secure Socket Layer (SSL) to encrypt any sensitive data sent between the transport and application layers.

System user : Respective IT admin of the each facility

System User Workspace Module

The module adopts a user-centered design which allows user to login to own workspace with the correct access rights granted. System users are able to perform their tasks efficiently by accessing to the relevant functionalities. With the user account authentication, a user is unable to access the other user's workspace.

System User : All system users

System User Account Management Module

The module manages the system user accounts by enabling creation of user account, resetting password, configuring user roles and access rights.

System User : Respective IT admin of the each facility

Messaging Module

The module enhances the smooth communication between system users by providing the messaging functionality.

System User : All system users

3.1.2.2 List of Functionalities

Functionality Code	Name	Remark	AAU ID
A. Common Infrastructure			
A.1 System Security Module			
A.1.1	Secure Data Transaction	To secure the transaction of data between the server and client using SSL	1
A.1.2	Encrypt Data	Encrypt data in application layer by AES	
A.1.3	Session Timeout	Log out system user when session timeout	
A.1.4	Record Security Log	Record and maintain the log of user action	
A.1.5	Secure Human Access	Use Captcha Mechanism to protect website against bots	
A.1.6	Lock Out Account	To lock an account if user entered more	

		than 3 times of wrong passwords	
A.1.7	Hash Password	Hash password to increase system security	
A.1.8	Block User	Block user if the user has not logged in	
A.1.9	Initial Deployment	Enter details about plant or store for initial deployment	
A.1.10	Create First Admin Account	Allow creation of first admin account during initial deployment.	
A.1.11	Search Security Log	Search for a specific user's action log	
A.1.12	View Security Log	View all the logs	
A.2 System User Workspace Module			
A.2.1	Login/ Logout	System user login/logout	
A.2.2	Authenticate System User	Verify system user identity upon entering username and password	
A.2.3	Check Access Right	To check the login user's access rights so that only appropriate functionalities are disclosed	1
A.2.4	Update Password	Update user's password	
A.2.5	Update Profile	Update user profile	
A.2.6	View Profile	View user profile	
A.3 System User Account Management Module			
A.3.1	Create User	IT admin creates a new system user for its own store	
A.3.2	Search User	View system users list	
A.3.3	View User Information	View a user's basic information including name, contact, address and department.	
A.3.6	View All User	View all system users	
A.3.4	Update User Information	Update system user information including name, contact, address and department.	1
A.3.5	Delete User Account	Logical deletion of a system user account	
A.3.8	Configure User	Check or uncheck access rights for a	

	Access Right	specific user role	
A.3.9	Reset Password	Reset password of a particular system user account in the case of forget password	
A.3.10	Unlock User Account	Reset a new password for the locked user account	
A.4 Messaging Module			
A.4.1	Send Message	Send a short message to another internal user of same branch	1
A.4.2	Receive Message	Receive message sent by internal user	
A.4.3	Send Email	Send an electronic mail to another internal user using external communication channel	
A.4.4	Receive Email	Receive electronic mail from another internal user using external communication channel	

3.2 Global Headquarter Subsystems

3.2.1 Business Requirement Analysis

3.2.1.1 Objectives

- Provides a centralize location for stores to deposit their sales figures and other relevant information for sales forecasting
- Provide precise and updated sales forecast for each store
- Aggregate the demand for ad hoc replenishment
- Forward the production figures to manufacturing facilities
- Keep track of enterprise data (Information about all the stores, factories and product)
- Ensure all products have unique identification code

3.2.1.2 Assumptions

- The selection of factory to produce for a specific store is based on geographical distance only because the production capacity can be neglected. The factory is able to produce any amount given sufficient raw materials and parts.
- Standardization in naming for factory, store, warehouses and goods are circulated within the Island Furniture at country level.

3.2.1.3 Process Description

Default Factory Set-up

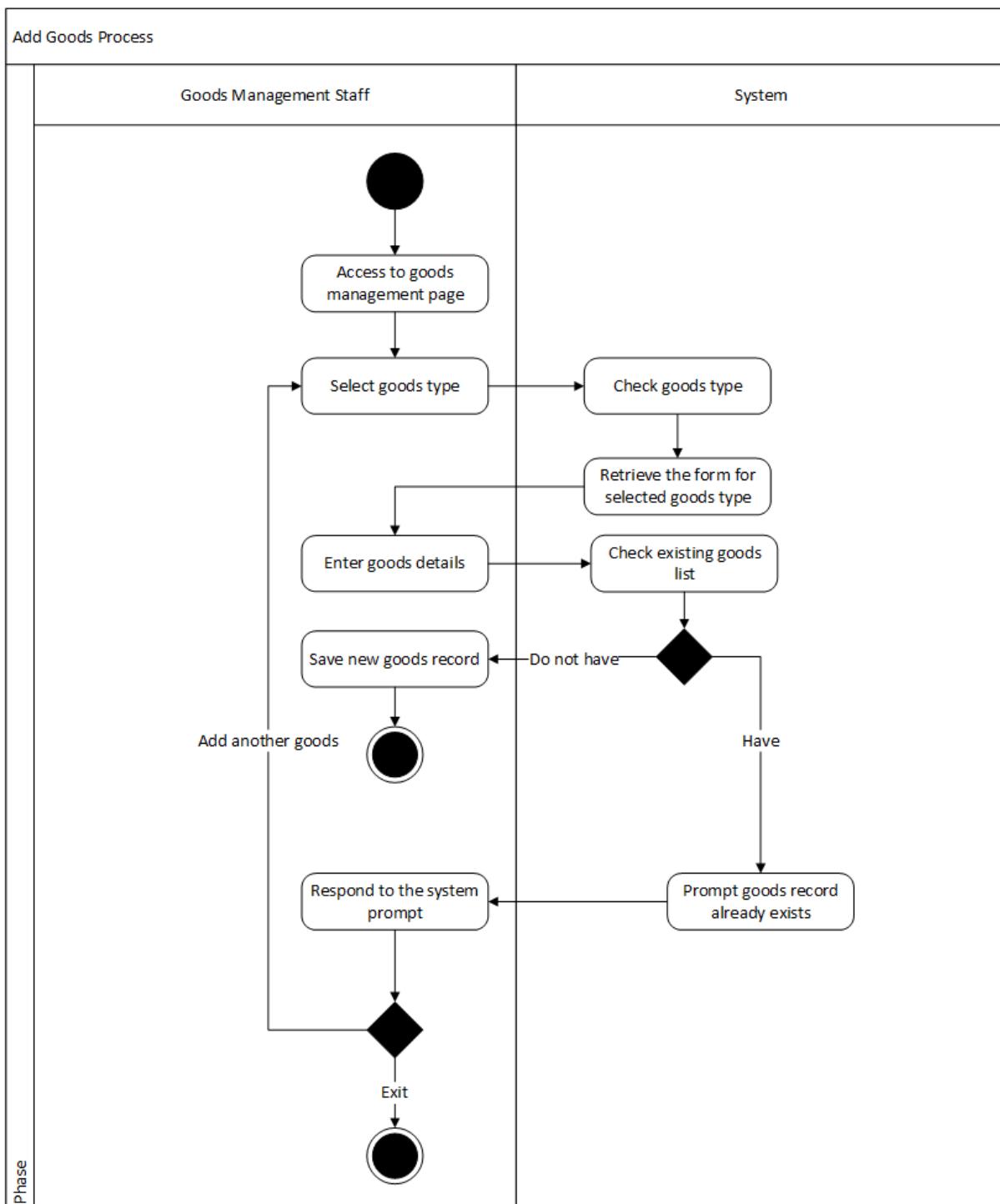
Headquarter staff can set two default factories for each product at each store. For example factory A is set to be the first default factory for product B at Store C, this means that so long as factory A is available, product B requested by Store C will be produced at factory A.

Goods Record Management

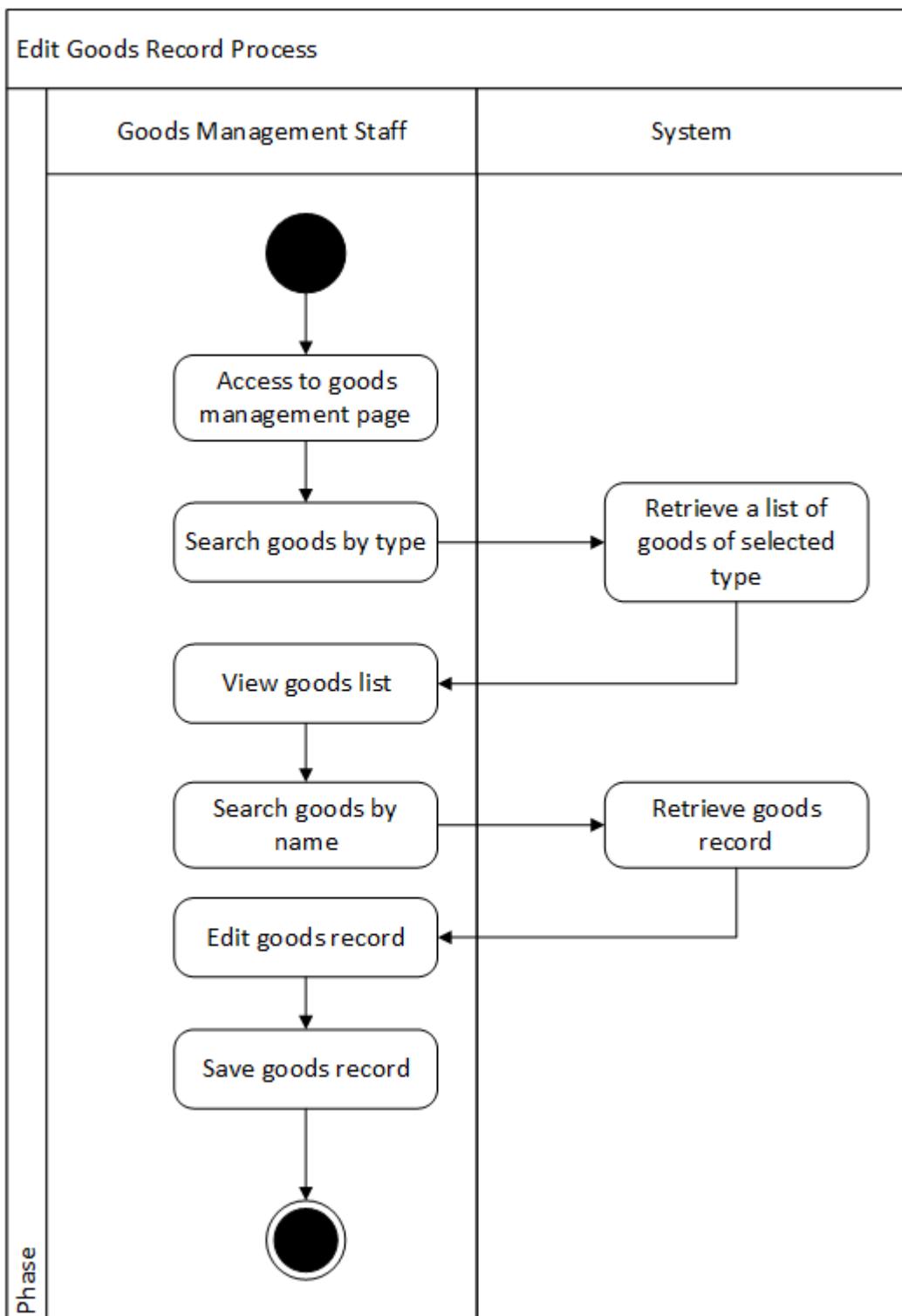
The staff needs to go to Goods Management Module page to add any new goods. The goods are categorised into three types: raw materials and parts, finished goods and retail product.

Firstly, the staff needs to specify goods type to be added. It is recommended to check against the existing goods list to make sure the goods has no existing record so that the effort of adding new record will not be wasted in the end. After entering goods detailed information including name, model, dimensions, size and colour. The staff is able to save record and also edit record whenever is necessary.

3.2.1.3.1 Activity Diagram of Add Goods Process



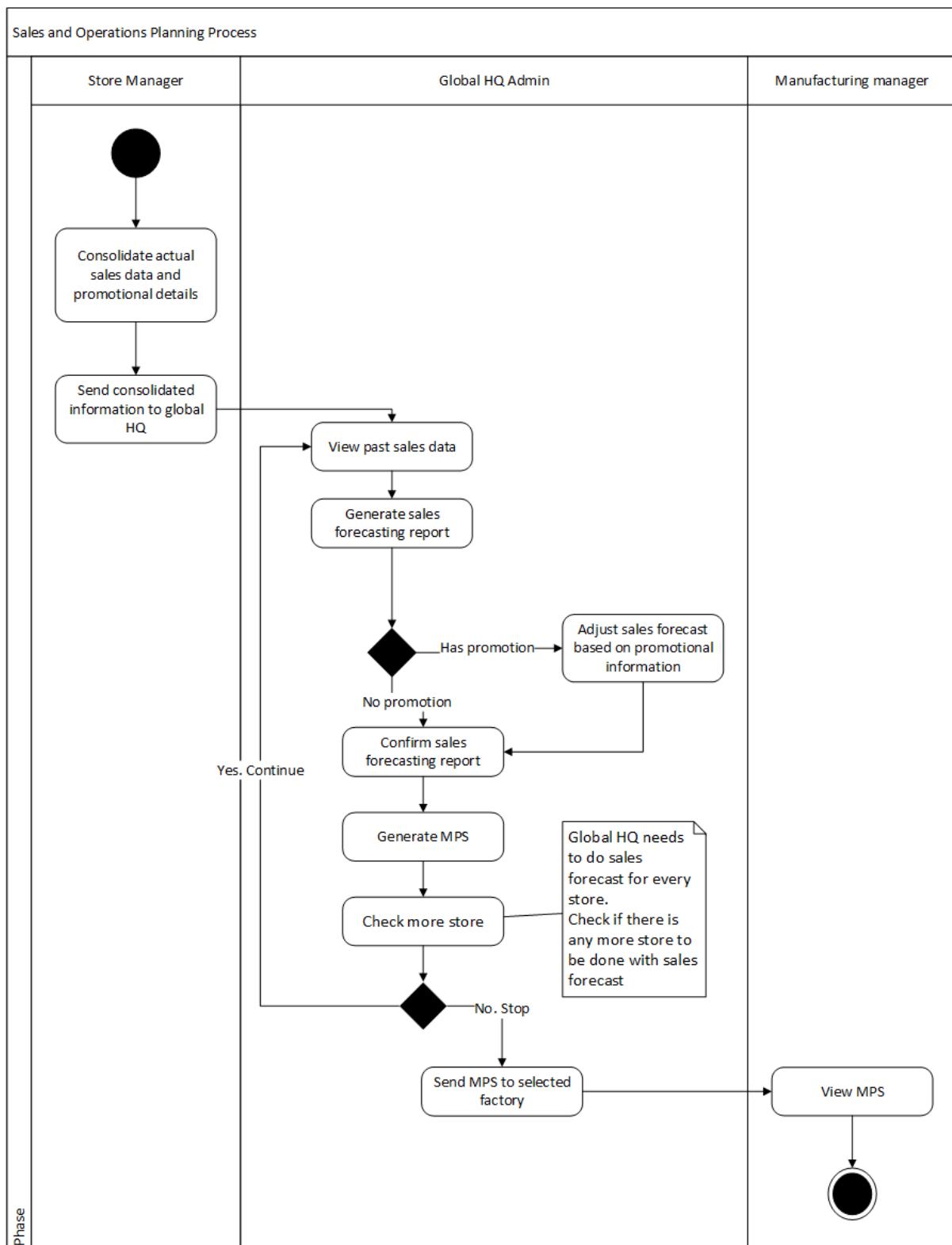
3.2.1.3.2 Activity Diagram of Edit Goods Record Process



Sales and Operation Planning

On a monthly basis, global Head Quarter (HQ) will receive the sales figures and promotional details including an estimation of any extra goods needed for promotional period from all store managers. Global HQ will generate a sales forecasting report for each of the stores from the respective sales figures. The administrator of global HQ will further verify the accuracy of the report and update the production figures with respect to any promotions claimed by individual store. The final sales forecast will be confirmed and recorded in the system to be used as input to generate Master Production Schedule (MPS).

3.2.1.3.3 Activity Diagram of Sales and Operations Planning Process



Ad Hoc Back Order Replenishment Process

When the store runs low of the stock of a popular product, once the inventory management staff updates the current inventory and the inventory is equal to or lower than the pre-set safety stock. The system will alert the manager who is in-charge of store replenishment with a pop-up window. For example, the prompt may be displayed in this way, "Safety stock level of product 1 has reached. Would you like to create an ad hoc back order?"

If the manager accepts the prompt, an ad hoc back order will be created with auto-filled product information and editable field of order quantity. After confirming the back order, the system will send directly from the store to global HQ through Operation Customer Relationship Management Subsystem (OCRM). When global HQ received the back orders from stores, a demand aggregation of each requested product will be done in a weekly basis.

HQ administrator will select the factory either by default or an alternative factory to fulfill the replenishment. To enhance the factory selection process, there will be a default factory set-up to specify a frequent factory which supplies to the store most frequently. The system will notify this particular factory about the new order via Back Order Management Module of Supply Chain Management Sub-system. This set-up is also to address the real life situation when the default factory at location A cannot fulfill the back orders, the other factories near the region will be assigned to complete the fulfilment process.

The supply chain management staff will check the incoming back order summary and check the current inventory level of the requested product in the factory warehouse. If there are sufficient inventories in factory warehouse, a goods issue will be created to transfer the correct amount of products to the requested stores, and followed by a shipping order. If there are insufficient inventories in the factory warehouse, the staff will forward the back order summary to the Order Management Module of Manufacturing Resource Planning Sub-system for production. After the production is completed, the supply chain management staff is alerted by the system to check the updated inventory level and replenish the back order immediately.

Demand aggregation can be explained in the example below:

Country A

Store 1 orders product A 20 and product B 50.

Store 2 orders product A 50 and product B 100.

Store 3 orders product A 100.

Factory 1 supplies to store 1 and store 2.

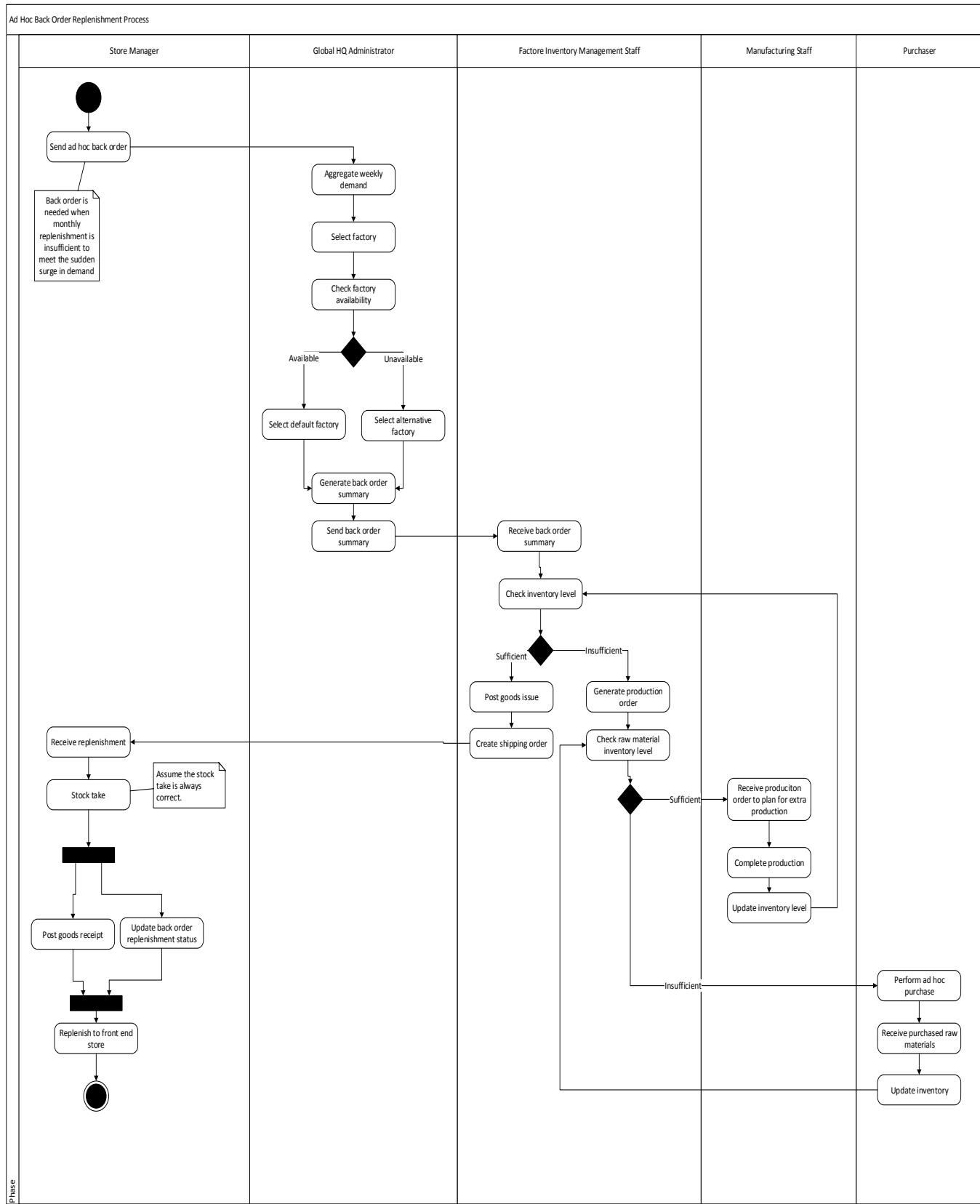
Factory 2 supplies to store 3.

Factory 1 receives total demand for product A 70 and product B 150.

Factory 2 receives total demand for product A 100.

Demand aggregation for ad hoc back orders help to reduce production costs and optimise production efficiency. In addition, it also reduces transportation cost as one truck load is fully utilized. At the same time, the ad hoc replenishment can minimise the out-of-stock cases and improve overall customer satisfaction vastly.

3.2.1.3.4 Activity Diagram of Ad Hoc Back Order Replenishment Process



3.2.2 System Requirement Analysis

3.2.2.1 Sub-system Design

The Global Head Quarter Sub-system plays an important role as a middle man between manufacturing factories and stores at market places. The sales data and promotional sales data are sent from the stores by the Operational Customer Relationship Module to the global HQ. The global HQ will extract the relevant sales data as the input to perform sales forecasting. The monthly production quantity will be deduced from sales forecast. The global HQ will assign the production order according to the default factory set-up or factory location for alternatives which could be able to complete the order most cost efficiently.

In the case of ad-hoc back orders, the store needs an urgent replenishment of certain popular products, the exact amount of products requested will be sent to the global HQ. Then, the global HQ will do a demand aggregation of all ad hoc back orders in a week for country level, and relay the total demand of requested product to the respective manufacturing facility.

From the above roles of the global HQ, we designed the sub-system into the following modules:

B.1 HQ Back Order Management Module

B.2 Sales and Operation Module

B.3 Factory Selection Module

B.4 Factory Management Module

B.5 Store Management Module

B.6 Goods Management Module

HQ Back Order Management Module

The module manages all ad hoc back orders sent from stores. The module also helps to aggregate the demand of one product in a weekly basis, and then forward the back order summary to the selected manufacturing facility to do the replenishment.

System user : Global HQ Admin

Sales and Operation Module

The module calculates sales forecasts based on the past sales data of stores which are sent every end of the month. The sales forecast is used to determine how many to produce monthly and generate a MPS.

System user : Global HQ Admin

Factory Selection Module

The module is able to provide the functionality of assigning which factory to replenish the ad hoc back orders. It allows default factory set-up to indicate the usual supplying factory to the specific store. The nearest available factory will be assigned as an alternative to the default factory.

System user : Global HQ Admin

Factory Management Module

The module maintains factory records by allowing adding, editing and deleting of factories of Island Furniture.

System user : Global HQ Admin

Store Management Module

The module maintains store records by allowing adding, editing and deleting of stores of Island Furniture.

System user : Global HQ Admin

Goods Management Module

This module adds new records for three types of goods: raw materials and parts, finished goods and retail products. It maintains the records by allowing editing, deleting and viewing. All goods are recorded according to standardized categories and naming.

System user : Global HQ Admin

3.2.2.2 List of System Functionalities

Functionality Code	Name	Remark	AAU ID
Global Headquarter Sub-system			
B.1 HQ Back Order Management Module			
B.1.1	View Ad Hoc Back Order	Get new ad hoc back order information, which is sent from the stores, including product name, amount and store requested	2
B.1.2	Aggregate Back Order Demand	Calculate total demand for products based on the ad hoc back orders received from stores within same country in a week	
B.1.3	Generate Back Order Summary	Generate a back order summary consists of the ad hoc back order information and the total demand of each individual product. One factory will receive its own back order summary	
B.1.4	Submit Back Order Summary	The back order summary is sent to the selected factory's Back Order Management Module of Supply Chain Management Sub-system	
B.1.5	View Back Order Status	The status will show if the back order is in progress or completed	
B.2 Sales and Operation Module			
B.2.1	View Sales Data	Get sales data for a particular item from the records that store sent in	2
B.2.2	Generate Sales Forecasting Report	Generate sales forecasting based on the sales data received from the stores	
B.2.3	View Promotions	Get the promotion details	
B.2.4	Edit Sales Forecasting Report	Edit the figures if some other factors might affect the sales forecast	
B.2.5	Delete Sales Forecasting Report	Delete sales forecasting report if the record is years back	
B.2.6	Generate MPS	Generate a report of monthly production quantity required based on sales forecast	

B.2.7	View Sales Forecasting Report	View list of sales forecasting reports generated	
B.2.8	Search Sales Forecasting Report	Search sales forecasting report by store name, product name and date.	
B.3 Factory Selection Module			
B.3.1	Search Factory	View the monthly production plan	
B.3.2	View Factory Availability	View factory's availability status	
B.3.3	Select Factory	Select either default factory or alternative factory	
B.3.4	View Factory Location	Get the factory location information	
B.3.5	Set Default Factory	Set a most frequent supplying factory as a default for one or more stores	
B.3.6	Set Alternative Factory	Set the factory as alternative if the default factory is unavailable	
B.4 Factory Management Module			
B.4.1	Add Factory	Add a new factory record	
B.4.2	Edit Factory	Edit a factory's information	
B.4.3	Delete Factory	Logical deletion of a factory	
B.4.4	Search Factory	Search factory to view its MPS	
B.4.5	View Factory	View the list of factories	
B.4.6	Update Factory Availability	Update factory's availability. The decision is made offline by taking into consideration of any uncertainty events such as disaster	2
B.4.7	Add Goods List	Set the list of goods that produced by a particular factory	
B.4.8	View Goods List	View the list of goods produced by a particular factory	
B.4.9	Search Goods List	Search to see if a particular product is produced by a particular factory	
B.4.10	Edit Goods List	Edit the list of goods produced by a factory	

B.5 Store Management Module		
B.5.1	Add Store	Add a new store record
B.5.2	Edit Store	Edit a store's information
B.5.3	Delete Store	Logical deletion of a store
B.5.4	Search Store	Search store based on location
B.5.5	View Store	View the list of stores
B.5.6	Add Goods List	Set the list of goods that are sold at a particular store
B.5.7	View Goods List	View the list of goods sold at a particular store
B.5.8	Search Goods List	Search to see if a particular product is sold at a store
B.5.9	Edit Goods List	Edit the list of goods sold at a store
B.6 Goods Management Module		
B.6.1	Select Goods Type	<p>Select a type of goods to perform adding.</p> <ol style="list-style-type: none"> 1. Raw materials and parts 2. Retail products 3. Finished furniture products
B.6.2	Add Goods	Add a new goods record under a selected type
B.6.3	Edit Goods	Edit a goods' information under a selected type
B.6.4	Delete Goods	Logical deletion of a goods under a selected type
B.6.5	Search Goods	Search goods based on criteria under a selected type
B.6.6	View Goods	View the list of existing goods after selected goods type

3.3 Manufacturing Resource Planning Sub-system

3.3.1 Business Requirement Analysis

3.3.1.1 Objectives

- Support the manufacturing resource planning process in the factory
- Accurately determine the weekly production planning based on the MPS
- Manage the Bill Of Material (BOM) of all finished products
- Generate Manufacturing Requirement Planning (MRP)

3.3.1.2 Assumption

- Production capacity can always meet the production requirement

3.3.1.3 Process Description

Weekly Production Planning

Once the global HQ sent MPS for one individual factory, the system will prompt the manufacture planning manager to generate a weekly production plan via Manufacturing Resource Planning Subsystem.

BOM Management

Staff may add a new BOM of a furniture product to the system record when a new product is required to be manufactured internally. When this new BOM is being added, the staff is required to enter the materials needed together with their purchase specifications (i.e. 1 chair = 4 wooden planks, 8 screws and 3 pieces of sandpapers). The staff may search through an existing list of materials or add in new material to the record to construct the BOM for a furniture item. For the former case, the staff will be given a system generated list of existing materials to browse from in order to add in a desired material to BOM. For the latter case, the staff will be directed to the Goods Management Module to create this new material based on the organization wide naming standards. For both cases mentioned, the staff has to include in the quantity required for each material being added to the BOM.

Materials Requirements Planning (MRP)

The weekly production plan will be the input to perform materials requirements planning. According to the BOM of each finished product, the Manufacturing Resource Planning subsystem will compute the total amount of each raw materials and parts to be used in the production. In order to generate the MRP report, the Manufacturing Resource Planning module will also retrieve the on hand inventory figure for the required raw material.

MRP is generated by the system with a list containing fields such as the quantity (i.e. in lot size), lead time of raw materials and parts and a table with attributes such as weekly production quantity, gross requirements in pieces, scheduled receipt in pieces, planned receipt in pieces, on hand inventory in pieces and planned order in pieces.

3.3.2 System Requirement Analysis

3.3.2.1 Sub-system Design

The Manufacturing Resource Planning Sub-system is a centralised sub-system which aims to help manufacturing staff with effective resource planning and optimise use of the production capacity.

This sub-system is partitioned into four separate modules:

C.1.1 Ad Hoc Production Order Management Module

C.1.2 Weekly Production Planning Module

C.1.3 Bill Of Materials Module

C.1.4 Materials Requirements Planning Module

Ad Hoc Production Order Management Module

This module is tightly integrated with Supply Chain Management's Back Order Management module to obtain ad hoc production orders and determine what to produce, how many to produce as well as the store information in order to accomplish the fulfillment.

System user : Manufacturing Resource Planning(MRP) Staff

Weekly Production Planning Module

This module generates the weekly production plan for all finished goods. The inputs will be automatically populated by the system based on the monthly production plan according to MPS. The output is the weekly production plan which can be used as the input to generate Materials Requirement Planning (MRP).

System user : MRP Manager

Bill Of Materials Module

This module maintains records of Bill Of Materials (BOM) for each item. BOM presents clearly in a table that which raw material and parts is required to produce an item and in what amount. The new BOM is created and the accuracy is ensured by frequent revisions.

System user : MRP Staff

Materials Requirements Planning Module

This module generates accurate MRP by populating inputs retrieved from weekly production plan. The MRP provides relevant information of gross requirements, on-hand inventory, scheduled receipts, planned receipts and planned orders.

System user : MRP Manager

3.3.2.2 List of System Functionalities

Functionality Code	Name	Remark	AAU ID
Manufacturing Resource Planning Sub-system			
C.1.1 Ad Hoc Production Order Management Module			
C.1.1.1	View Production Order	Get new production order information, which is sent from the Back Order Management Module of Supply Chain Management Sub-system, including product name, amount, store requested and deadline	3
C.1.1.2	Update Production Status	Update production status to Back Order Management Module of Supply Chain Management Sub-system when the order is finished or there is problem of finishing on time	
C.1.2 Weekly Production Planning Module			
C.1.2.1	View Inventory of Finished Good	Get the figure of current inventory level for a part	3
C.1.2.2	View MPS	Get the monthly production figures for a part	
C.1.2.3	Generate Weekly Production Plan	Generate weekly production plan based on MPS	

C.1.3 Bill Of Materials Module			
C.1.3.1	Generate BOM	Add a new BOM record	3
C.1.3.2	View BOM	View the BOM details	
C.1.3.3	Cancel/Delete BOM	Cancel when making changes to BOM. Logical deletion of a BOM	
C.1.3.4	Search BOM	Search BOM by product name	
C.1.3.5	Edit BOM	Adjust BOM of a batch of goods (e.g. replacement of raw materials)	
C.1.4 Materials Requirements Planning Module			
C.1.4.1	Generate MRP	Add a new MRP record	3
C.1.4.2	View MRP	View the MRP details	
C.1.4.3	Search MRP	Search MRP by raw materials and parts name	
C.1.4.4	Edit MRP	Edit MRP figures	

3.4 Supply Chain Management Subsystems

3.4.1 Business Requirement Analysis

3.4.1.1 Objectives

- Facilitate inbound and outbound logistics and provide traceability
- Obtain real time inventory level to support accurate planning and scheduling for inventory movement
- Improve efficiency and accuracy in procurement process by minimizing paper work
- Support just-in-time strategy whereby finished goods arrive the store warehouse as needed
- Enhance supplier intimacy to reduce bullwhip effect through smooth flow of information

3.4.1.2 Assumption

- Once finished goods left the production line and finished packing, the personnel in charge will be notified to schedule transportation and create shipping order according to the store orders
- One truck will load finished goods fully and transfer to store warehouses in a planned sequence

- Transportation scheduling is done in MRP 2
- Staffs keep a standardized goods naming list for searching purpose
- Suppliers of Island Furniture are agreed on using supplier portal to increase interconnectedness

3.4.1.3 Process Description

To enhance internal control and prevent fraud, the role of procurement is solely handled by purchasers and the roles of stock taking and updating inventory level will never be handled by the same person.

Inbound and Outbound Logistics

Inventory Control Process

The inventory management staff is required to check inventory level of raw materials and parts in a monthly basis according to periodic inventory policy, whereby the ending inventory is checked at the beginning of a month. The staff is able to view the MRP to determine if the current inventory level is sufficient for production. If there are insufficient for production taking lead time into consideration, the staff will create a purchase requisition to request for purchasing of raw materials and parts according to lot size. The purchase requisition will be viewed by purchasers to instruct them for what to purchase and how many to purchase. The purchasers are able to retrieve purchase requisition in the Procurement Module of Supply Chain Management Sub-system.

In the case of an ad hoc back orders, the staff needs to check if there are sufficient current inventories to perform the replenishment. This is explained in the Ad Hoc Back Order Replenishment Process section. If there is a need to purchase raw materials and parts, a purchase requisition for raw materials and parts will be created to signal the purchasers to replenish the raw materials and parts. Otherwise, the staff will forward the back order summary to factory at Ad Hoc Production Order Management Module of Manufacturing Resource Planning Sub-system to do necessary production planning. Once the purchased raw materials are received, the inventory level will be updated immediately. Similarly, once the ad hoc production is done, the finished goods inventory level will be updated. The staff can proceed to replenish the ad hoc back orders after checking the real-time inventory.

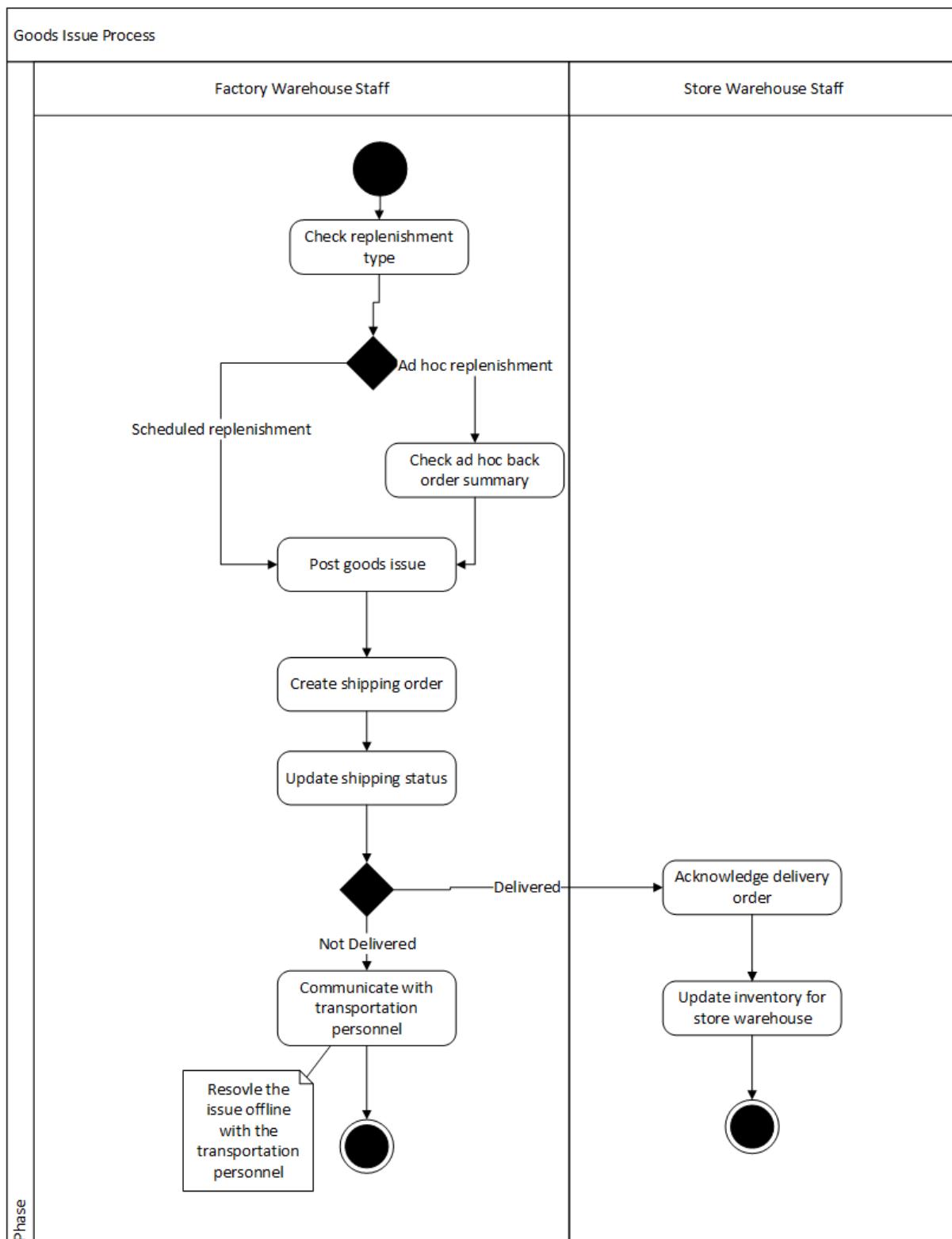
Goods Movement Process

Good Receipt : The inventory staffs at factory will receive the goods purchased by purchasers together with a delivery order from the suppliers. After the inventory staff tally the purchase order and delivery order manually, they will update the system by posting goods receipt. Good receipt is a form consisting of goods name, warehouse name, quantity and posting date. The goods received at factory are raw materials and parts and retail products.

Goods Issue : The inventory staffs at factory will follow a monthly schedule to replenish the finished goods and retail products to the stores. In the case of ad hoc back order, the staffs will view back order summary to decide on the goods issue. Then, the staffs will transfer the finished goods or retail products to the store requested. Once the goods are sent out, the staffs will create a shipping order to indicate that the goods are in-transit.

These goods movement records cannot be deleted even in the case of wrong posting, however, the system allows the staffs to mark false good issue or false goods receipt as an indication. This is to provide transparency by enhancing tracking and preventing fraud. A false good receipt is also posted when a supplier fails to deliver the promised goods.

3.4.1.3.1 Activity Diagram of Goods Issue Process



Procurement Process

Purchasers in the procurement department at a factory site will start their day by checking new purchase requisitions sent from Inventory Control Module of Supply Chain Management Sub-system. After viewing the new purchase requisitions, the purchaser needs to create purchase order or request for quotation. The purchaser is redirected to a new page to complete the creation. If the selected goods is under contract with a supplier, the system will display contract information including unit price, quantity and total amount payable. The purchaser is required to select a date of scheduled delivery from an inbuilt calendar. If the selected goods is not under contract with any supplier, the system will redirect the purchaser to rank supplier page to assist in further evaluation and supplier selection. After the selection of supplier is completed, the purchaser is able to submit a request for quotation for selected suppliers from the evaluation list. Once the quotation is submitted from supplier portal, the details of quotation can be viewed by purchaser, and purchaser can proceed to create purchase order for the final selected supplier based on the quoted price.

The confirmed purchase order is sent by procurement management module to purchasing manager for approval. The status of purchase order will be reflected immediately after approval is done. If the purchase order is approved, the approved purchase order can be retrieved at the integrated supplier portal. Once the suppliers login to the supplier portal, they will be able to view the list of approved purchase orders.

Supplier Selection Process

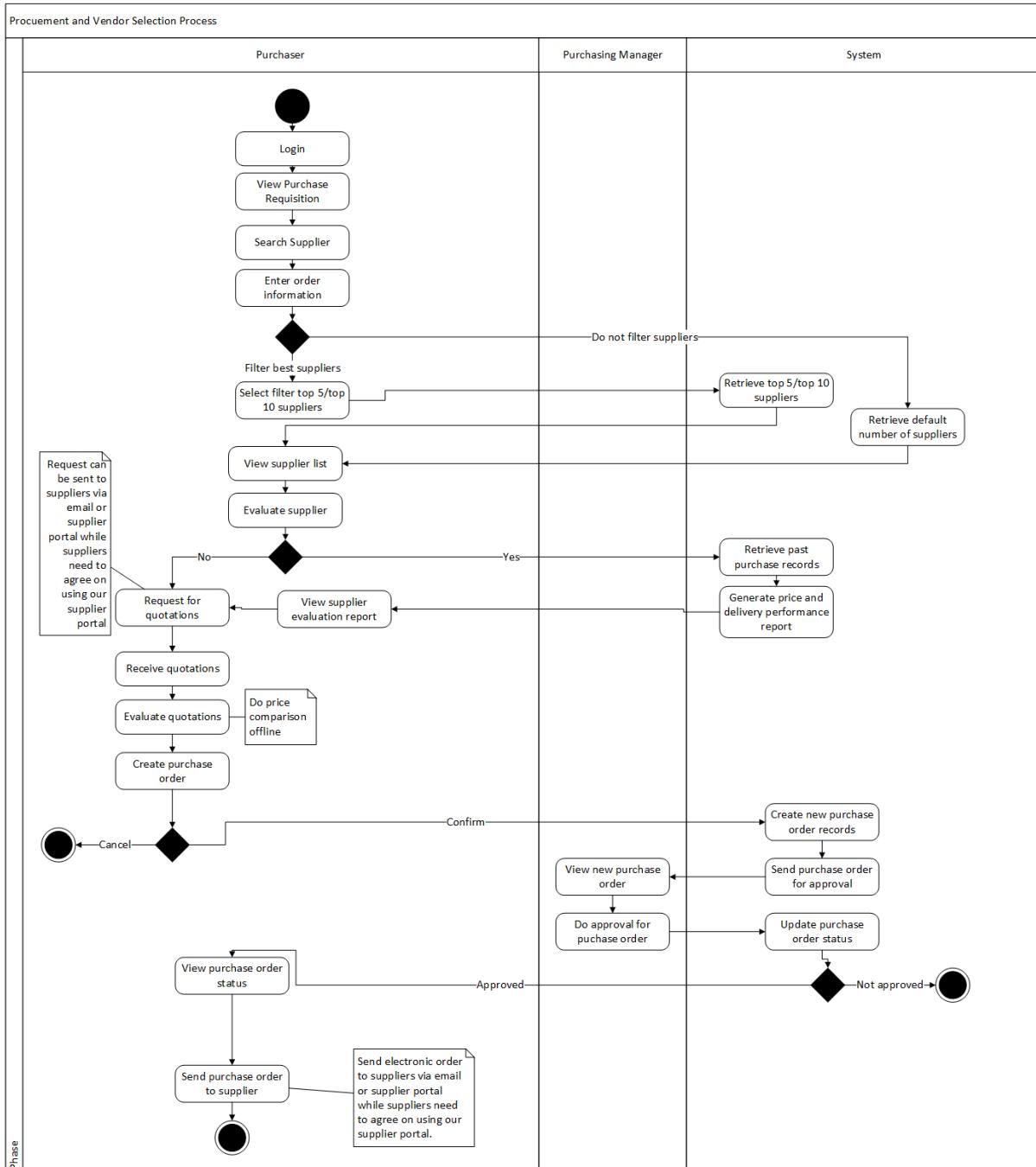
This process is to help the purchasers decide who to purchase from. A supplier list will be displayed by the system once the purchasers proceed to execute the selection. If the goods is under a contract with a contract supplier, the system will only display the supplier under contract for this goods. On the other hand, the system will display the supplier list based on the rank criteria or past deal records.

If the selected good is not under a contract, the purchaser will be redirected to choose from a list of criteria to rank suppliers, such as best delivery performance, highest average quantity purchased and best past deal price. After the selection of criteria, the system will then retrieve the Top 3/ Top 5 list of suppliers for the given criteria based on the selected good. The purchaser can select multiple suppliers from the list for further evaluation.

Supplier Portal

The suppliers, who are sourced by the purchasers in procurement department, are agreed to use our supplier portal as a collaborating channel. The suppliers are given a registered account to login to supplier portal. They can check the incoming request for quotation, create a quotation and send to the purchaser.

3.4.1.3.2 Activity Diagram of Procurement and Vendor Selection Process



3.4.2 System Requirement Analysis

3.4.2.1 Sub-system Design

The Supply Chain Management Sub-system is designed to automate many supply chain processes in order to reduce paper work and human error. This sub-system is able to efficiently manage the inbound and outbound logistics, including movement of raw materials and parts, retail products and finished goods from the warehouse to production line or production line to store warehouse. The main functions include the creation of purchase order as well as the shipping order, accessing to real-time inventory information and maintaining records of supplier information.

The sub-system uses functionalities from the following four modules :

C.2.1 Procurement Module

C.2.2 Supplier Management Module

C.2.3 Inventory Control Module

C.2.4 Goods Movement Module

C.2.5 Contract Management Module

C.2.6 Back Order Management Module

H Supplier Portal Module

Procurement Module

The module supports the entire procurement process which allows purchasers to create purchase order based on the purchase requisition created at inventory control module. The purchase orders can be amended only if the status is still “Pending”, not “Approved” or “Rejected”.

System user : SCM purchaser

Supplier Management Module

The module maintains the supplier records and provides useful information to support supplier selection process.

Supplier Information includes : company name, address, telephone, contact person, mobile phone, fax number, email address.

Taking consideration of business strategy, it is very likely that Island Furniture will negotiate best deal with suppliers in terms of contracts. Therefore, we would also like to label two types of suppliers, one being contract supplier, the other is non-contract supplier.

Contract supplier : If the goods is under contract with a supplier, when creating purchase order, the supplier field will be automatically populated. The purchaser can skip the selection of supplier process

Non-contract supplier : If the goods does not have a contract supplier, the purchaser needs to go through supplier selection process as explained in procurement process.

The request for quotation will also be sent from this module to supplier portal.

System user : SCM Admin

Inventory Control Module

The module provides real-time inventory information for the factory inventory staff to track the inventory level, and use the information to make better decisions for inbound and outbound logistics.

System user : SCM Inventory Staff

Goods Movement Module

The module records the inbound and outbound movement of all goods. The inventory staff is able to update goods receipt and goods issue so that the correct inventory movement information is recorded for tracing purpose if necessary. This information is accessible by Inventory Control Module so that inventory staff can use for verification.

System user : SCM Inventory Staff

Contract Management Module

The module allows adding of contract information which includes contract terms, dates, supplier name, unit price and goods name.

System user : SCM Admin

Supplier Portal Module

The module provides necessary tools for suppliers to communicate with purchasers. They are able to login with an account to connect to the purchasers mainly for quotation and purchase order.

System user : Suppliers of each manufacturing facility

Back Order Management Module

The module handles ad hoc back orders sent from global HQ. It provides functionalities for the ad hoc replenishment process.

System user : SCM Inventory Staff

3.4.2.2 List of Functionalities

Functionality Code	Name	Remark	AAU ID
Supply Chain Management Sub-system			
C.2.1 Procurement Module			
C.2.1.1	Retrieve Purchase Requisition	Retrieve incoming Purchase Requisition	
C.2.1.2	View Purchase Requisition	View the list of incoming Purchase Requisitions by date of creation	
C.2.1.3	Create Purchase Order	Create a new Purchase Order record for contract and non-contract suppliers.	4
C.2.1.4	Edit Purchase Order	Edit Purchase Order information	
C.2.1.5	Cancel/Delete Purchase Order	Cancellation during creation of Purchase Order and logical deletion of created Purchase Order	

C.2.1.6	Assess Purchase Order	Purchasing manager assess the purchase order by selecting the status (approved, or rejected) of the current purchase order. The default status is ‘pending approval’	
C.2.1.7	Update Purchase Order Status	System updates the status of Purchase Order (Approved, Rejected)	
C.2.1.8	View Purchase Orders	View the list of purchase orders including status information	
C.2.1.9	Search Purchase Order	Search Purchase Order based on the part name, supplier name, and purchase order status	
C.2.2 Supplier Management Module			
C.2.2.1	Add Supplier	Add a new supplier record	4
C.2.2.2	Edit Supplier	Edit a supplier's information	
C.2.2.3	Delete Supplier	Logical deletion of a supplier	
C.2.2.4	Search Supplier	Search supplier based on criteria	
C.2.2.5	Add Parts To Supplier	Add parts that are provided by the supplier	
C.2.2.6	Evaluate Supplier	Retrieve past deal price, quantity purchased, negotiation conditions and delivery performance	
C.2.2.7	Filter Top3/Top 5 Best Supplier	Retrieve a list of top ranked supplier names by best price or best delivery performance, or highest average quantity purchased	
C.2.2.8	Create Request For Quotation	Create a request for quotation to initiate deal with the supplier, and supplier can view at supplier portal (suppliers need to sign an agreement about using our collaboration channel)	
C.2.2.9	Receive Quotation	Receive quotation sent by supplier at the supplier portal.	
C.2.2.10	View Quotation	View the quotation to obtain the quoted price	
C.2.2.11	Search Quotation	Search quotation records based on part name	

C.2.3 Inventory Control Module			4
C.2.3.1	Search Inventory	Search inventory by goods name	
C.2.3.2	View Inventory Level	View the inventory level of the selected goods	
C.2.3.3	View Inventory Report	View inventory report generated monthly	
C.2.3.4	Create Purchase Requisitions	Create new purchase requisition if there is insufficient raw materials and parts	
C.2.3.5	Update Inventory Level	Update inventory level. Usually is done at the beginning of the month. Only in the case of ad hoc back order, the inventory level is updated immediately after ad hoc production is completed or replenishment is completed.	
C.2.3.6	View MRP record	View MRP record for decision making on whether to create a purchase requisition	
C.2.3.7	Delete Purchase Requisition	Logical deletion of purchase requisition	
C.2.3.8	Edit Purchase Requisition	Edit purchase requisition's details	
C.2.3.9	View Purchase Requisitions	View the list of purchase requisitions	
C.2.4 Goods Movement Module			
C.2.4.1	Post Goods Receipt	Record receipt of goods from supplier(s)	4
C.2.4.2	View Ad Hoc Back Order Summary	Retrieve the ad hoc back order summary from global HQ	
C.2.4.3	Post Goods Issue	Record issue of goods to warehouse or store	
C.2.4.4	Create Shipping Order	Create a shipping order	
C.2.4.5	Update Shipping Order Status	Update the status of shipping order	
C.2.4.6	Edit Shipping Order	Edit shipping order information	
C.2.4.7	Search Shipping Order	Search shipping order by shipping order number or date of creation	
C.2.4.8	View Shipping Order	View the shipping order details	
C.2.4.9	Cancel/Delete Shipping Order	Cancellation during creation of shipping order or logical deletion of created shipping order	

C.2.5 Contract Management Module		
C.2.5.1	Create Contract	Create a contract record
C.2.5.2	Edit Contract Information	Edit contract information including terms and conditions and supplier information.
C.2.5.3	Delete Contract	A Logical deletion of a contract record
C.2.5.4	View Contract	View contract information
C.2.5.5	Search Contract	Retrieve a list of contract by supplier name
C.2.5.6	Alert Contract Expiry	System will prompt the user if the contract has already expired
C.2.6 Back Order Management Module		
C.2.6.1	View Back Order Summary	Retrieve the back order summary records
C.2.6.2	Update Back Order Replenishment Status	Update back order replenishment status to signal whether it is accomplished
C.2.6.3	Create Ad Hoc Production Order	Create ad hoc production order based on ad hoc back order summary
C.2.6.4	Edit Ad Hoc Production Order	Edit the production order information
C.2.6.5	Send Ad Hoc Production Order	Send to Ad Hoc Production Back Order Module
C.2.6.6	Cancel/Delete Ad Hoc Production Order	Cancel the production order during creation; Logical deletion of production order.
H. Supplier Portal Module		
H.1 Supplier Quotation Management Sub-module		
H.1.1	Receive Request for Quotation	Receive request for quotation from purchaser
H.1.2	View Request for Quotation	View the list of incoming request for quotations.
H.1.3	Search Request for Quotation	Search quotation records based on quotation status
H.1.4	Create Quotation	Create a quotation with price quoted

H.1.5	Edit Quotation	Edit quotation information
H.1.6	Submit Quotation	Submit the finalised quotation to reply to purchaser
H.1.7	View Approved Purchase Order	View the list of the approved purchase order from purchaser
H.1.8	Search Approved Purchase Order	Search approved purchase order based on part name
H.2 Supplier Portal Common Infrastructure Sub-Module		
H.2.1	Login/ Logout	Login/ logout of Supplier Portal
H.2.2	Register Supplier Account	Internal purchasing manager at procurement department will register an account for each supplier. The system will automatically send the account information like username and password to the supplier's email
H.2.3	Lock Out Supplier Account	To lock an account if supplier account user have more than 3 attempts of wrong password
H.2.4	Block Supplier Account User	Block supplier portal access if supplier is not logged in
H.2.5	Hash Password	Hash password of supplier account to increase system security
H.2.6	Unblock Supplier Account	SCM Admin will unblock supplier's account for supplier portal if it is blocked due to failed attempts to log in.
H.2.7	Reset Supplier Account Password	Reset supplier account password for supplier portal.

3.5 Inventory Management Sub-system

3.5.1 Business Requirement Analysis

3.5.1.1 Objectives

- Support product items movement and allocation from the warehouse to the furniture marketplace and retail outlet
- Closely monitor the stock level of inventory in the warehouse and store
- Improve customer satisfaction by quick replenishment and reduce out-of-stock case by setting safety stock to alert the inventory staff at each store
- Support product items management in the warehouse

3.5.1.2 Assumption

- The bulky products are pre-defined by the store manager and marked as bulky item in the system. There is no need to replenish these items to frontend store as the customers are expected to self-collect, the inventory level is tracked and updated according to sales data from POS application.

3.5.1.3 Process Description

Safety Stock Management

Managers are allowed to flexibly allocate and change the safety stock level for any product items in the warehouse. The system will efficiently manage the list of products with a safety stock level. It will alert the manager when a product in the warehouse hits the safety stock level. It is recommended to create a sales order upon safety stock alert so that replenishment can be triggered in time to prevent out-of-stock situation. Thus, a win-win situation is achieved, where by the Island Furniture would not lose sales, at the same time customers are satisfied with their shopping experience.

Inventory Control (Backend warehouse and Frontend store)

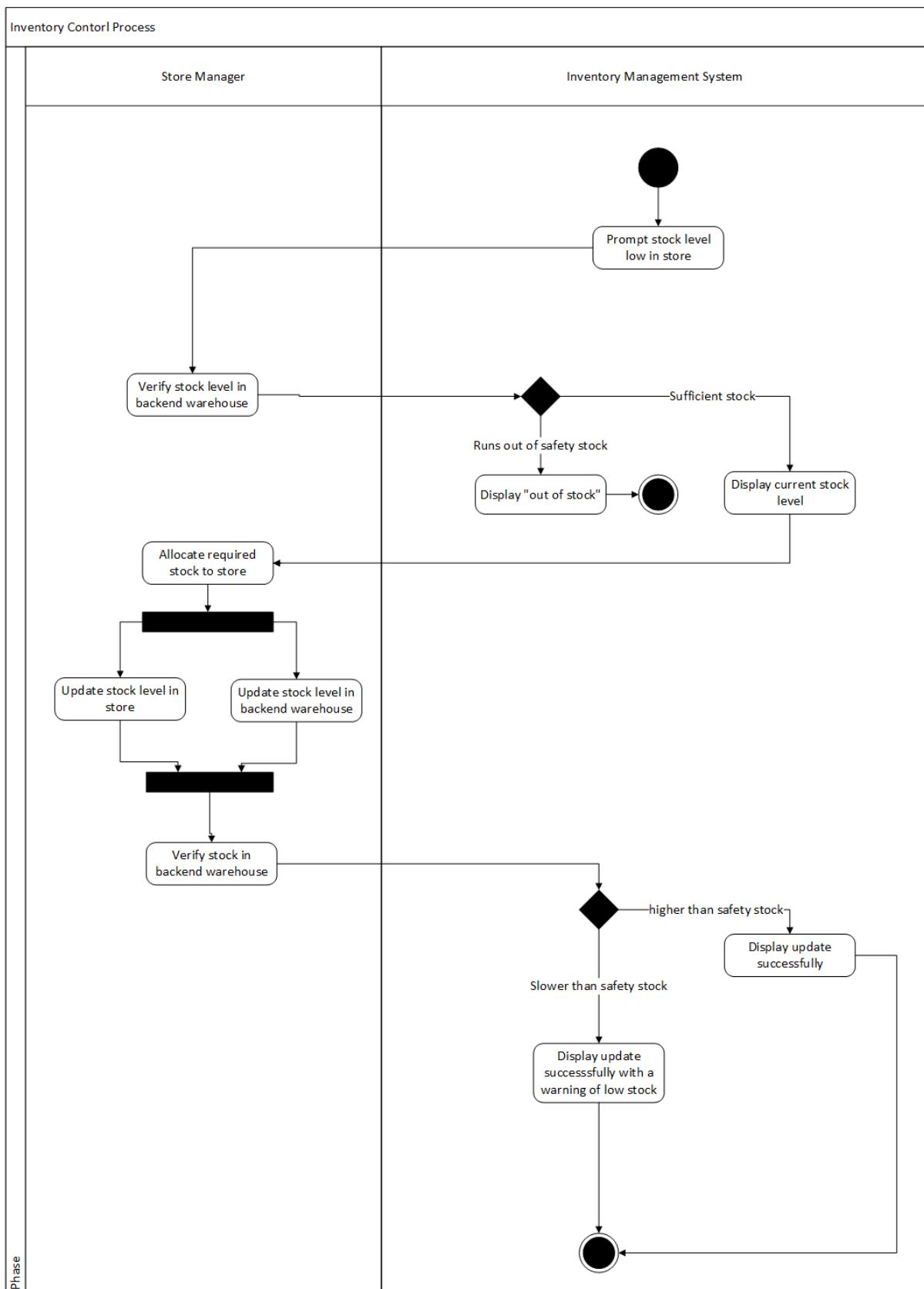
There are two groups of product in the store, one with a safety stock level and the other without. For the former, the system will alert manager of low stock once the stock level of the product in the warehouse hits the safety stock level. For the latter, the system will only sent out alert when the stock hits zero. The latter group is either no longer in production at the manufacturing sites or unpopular products that the store wishes to discontinue its retailing. The setting of safety stock also enables the system to accommodate ad hoc

purchasing of stocks from manufacturing sites rather than waiting for the monthly replenishment of stock. This is possible because once the stock of a product hits the safety level, Inventory Management can send a back order straight to global HQ to request for more products.

Inventory control process starts when a product runs low in quantity at the marketplace or outlet, the system will send out a warning to the manager. Upon receiving the warning, the manager will proceed to verify the stock of that particular product in the store warehouse against the quantity recorded in the system. If there is sufficient stock presents in the store warehouse, the manager may then transfers the required amount of stock out to the marketplace or outlet. The manager will then proceed to create an ad hoc order to global HQ to ask for replenishment.

If the stock level reaches zero or any pre-set minimum amount, the system will display that this particular product is out of stock.

3.5.1.3.1 Activity Diagram of Inventory Control Process



Inbound Inventory

Once the warehouse received a delivery from the manufacturing factories, the warehouse inventory staff will physically count the amount of goods received. If numbers doesn't tally with monthly scheduled amount or ad hoc back order, the warehouse staff should put the delivery on hold first or wait for the full delivery to arrive. If numbers tally, the warehouse staff will post goods receipt and update the record of inventory level in the system. Goods will subsequently be stored away, according to their types, into the warehouse.

Returned Goods Management

In the case of defects product that a customer purchased, the customer would want to arrange for an appointment with Island Furniture for exchange service or approach the counter personally to return it. For the former case, it only applies to bulky items like beds and sofas, contacts of Island Furniture can be found on Island Furniture's website. After an appointment has been set, Island Furniture will send movers to the customer's house to retrieve back the product. For the latter case, shop assistants will attend to customers based on a first come first serve basis at the store. For both cases, if a customer wish to return his/her product has to present his/her receipt and show proofs of actual defects before the returned good can be accepted. The effective acceptance date for return goods will be within one week of purchase. The store reserves the right to reject customers from returning their purchased goods.

After a defective good has been acknowledged by an Island Furniture store staff, the store staff will update the system record. Fields to update include reason for returning the good, and product name. The staff will then proceed to increase the number of defects for this particular product in the database. Besides that, the staff can choose to update the status of returned goods. For example, the return goods can be resold, disposed or discarded. After that, the staff will have to make an update to the Inventory Management Subsystem by decreasing the stock in the respective warehouse.

Ad Hoc Order Supporting management

If the stock of a product in the warehouse hits a level lower than the safety stock before the monthly replenishment takes place, OCRM subsystem will receive alert from the Inventory Management Subsystem to replenish the stock. However, for this kind of ad hoc replenishment, approval is still subjected to circumstances. OCRM staff will take in

considerations of how popular the product is being demanded by customers to give the final approval. Otherwise, OCRM staff may ignore the alert and wait for the monthly stock replenishment to take place.

3.5.2 System Requirement Analysis

3.5.2.1 Sub-system Design

The Inventory Management Sub-system is designed to have four modules:

D.1.1 Warehouse Management Module

D.1.2 Inventory Control Module

D.1.3 Returned Goods Management Module

Warehouse Management Module

The module allows adding of a new warehouse by entering warehouse name, location and capacity. The existing warehouses are maintained in the module. Each store maintains its own warehouse records.

The system will automatically calculate the vacant location in warehouse for the incoming inventory. The warehouse is partitioned in small items section and big items section. It is further divided into shelf units.

System user : Store Warehouse Admin

Inventory Control Module

The module provides real time inventory information of backend store warehouse and front end store. It also manages the in and out movements of inventory from one location to the other by checking against good receipt and good issue records, so that human error could be greatly reduced. The inventory report will be automatically generated to give better overview of the inventory movement.

System user : Store Warehouse Manager

Returned Goods Management Module

The module adds new records for returned goods, and maintains the records to track the returned goods from customers. There are different tags for returned goods like "damaged" and "exchanged". If the returned goods are sold at lower price or thrown away, the system will record as "sold" or "disposed" respectively for traceability and accounting purpose.

System user : Store Warehouse Admin

3.5.2.2 List of System Functionalities

Functionality Code	Name	Remark	AAU ID
Inventory Management Sub-system			
D.1.1 Warehouse Management Module			
D.1.1.1	Add warehouse	Add a new warehouse record	5
D.1.1.2	Edit warehouse	Edit a warehouse's information	
D.1.1.3	Delete warehouse	Logical deletion of a warehouse	
D.1.1.4	View warehouse	View the list of warehouses	
D.1.2 Inventory Control Management Module			
D.1.2.1	Search Inventory	Search inventory level by warehouse name, store name and product name	5
D.1.2.2	View Inventory Level	View the inventory level of a product in a specific warehouse or store location	
D.1.2.3	Update Safety Stock Level	Update the safety stock level for a selected product. The default is safety stock level is zero	
D.1.2.4	Alert Safety Stock	Alert will prompt the user that inventory level has reached the safety stock level	
D.1.2.5	Alert Out of Stock	Alert will prompt the user that zero inventory level	
D.1.2.6	Generate Inventory Report	Generate inventory report by product monthly	
D.1.2.7	Post Goods Receipt	Post goods receipt once the received goods are tallied	

D.1.2.8	View Goods Receipt	View good receipt figure to verify the inventory received		
D.1.2.9	View Goods Issue	View good issue figure to verify the inventory reduction		
D.1.2.10	Update Inventory Level	Update the current movement of the inventory into the specific storage bin of a warehouse		
D.1.2.11	Post Goods Issue	Transfer required amount of inventory from one location to the other location (backend to frontend)		
D.1.2.12	View Incoming Shipment Status	View the shipment status to track the in-transit inventory		
D.1.2.13	Create Back Order	Back order will be created only when off-line business decisions are made.		
D.1.2.14	Send Back Order	Send confirmed back order to global HQ. This order will be sent to global HQ for the relay of back order to factory	5	
D.1.2.15	Delete Back Order	Logical delete of false back order		
D.1.2.16	View Safety Stock Level	View the safety stock level for a product		
D.1.3 Returned Goods Management Module				
D.1.3.1	Add Returned Goods	Add a new returned goods record		
D.1.3.2	Edit Returned Goods	Edit returned goods information including quantity and location		
D.1.3.3	Delete Returned Goods	Logical deletion of wrong returned goods records		
D.1.3.4	Search Returned Goods	Search returned goods based on store name and item code		
D.1.3.5	View Returned Goods	View the list of returned goods		
D.1.3.6	Update Return Goods Status	Update the status of returned goods, such as "sold" and "disposed"		

3.6 Kitchen Management Sub-system

3.6.1 Business Requirement Analysis

3.6.1.1 Objectives

- Provide quick and frequent replenishment of ingredients in order to maintain freshness
- Organised and systematic recipe managements for easier references
- Up-to-date menu information to attract customers
- Accurate in replenishment quantity to reduce wastage

3.6.1.2 Assumption

- Assume that the ingredient supplier has shorter lead time as certain ingredient like fresh vegetable need to be supplied on a daily basis. Inventory review and reorder point is based on perpetual inventory policy
- At the point of creating a new ingredient item into the ingredient list, there must be a known supplier for this particular ingredient already

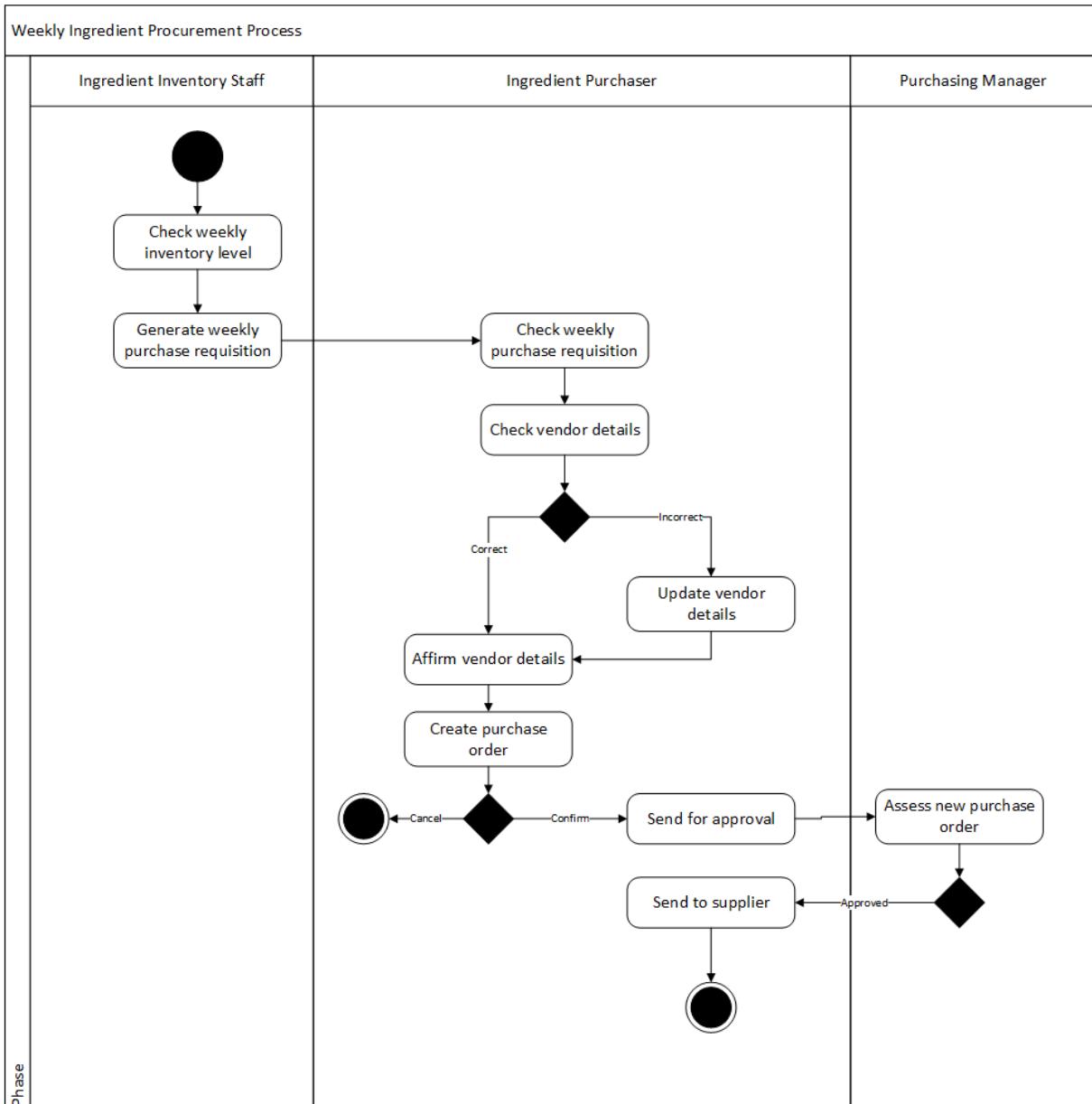
3.6.1.3 Process Description

Weekly Ingredient Procurement Process

On a weekly basis, the Kitchen Inventory Staff will check the total amount of kitchen ingredients being consumed. This amount can be computed using the POS sales figures. Thereafter, the staff will update the system to refresh the record of the amount of ingredient left for the week. In the usual case, a purchase requisition will be created for a weekly replenishment. The purchaser will check the purchase requisition and do a normal weekly purchasing of ingredients with a purchase order. The purchaser may choose to affirm the details of the suppliers or to edit the information of the supplier. For the former case, a purchase order will be placed and the requisition status will be updated accordingly. For the latter case, the staff will be guided to edit the profile of the supplier and the process is described in “Kitchen Ingredient Supplier Management Process”. Once supplier profile has been successfully updated for the latter case, system will generate the purchase order and the staff may affirm it. The staff subsequently may continue to monitor the purchase order status through the system and also check for incoming purchase requisitions.

An activity diagram is shown below to illustrate the weekly ingredient procurement process:

3.6.1.3.1 Activity Diagram of Weekly Ingredient Procurement Process



Forecasting Demand Process (Using menu item and POS information)

On a weekly basis, the staff will do a demand sales forecast for the following week. The staff will retrieve information from the POS application at restaurant to determine the exact sales figure for each menu item. Thereafter, passing this figure into the system, the system will calculate and generate out a list of ingredients required to be purchased for the coming week with reference to the purchase specifications in the recipe for each menu item. The

staff later may choose to increase the quantity of ingredients to be purchased according to any promotions which may be used to increase the demand for certain ingredient or use to minimise shortage of ingredients due to spoilage.

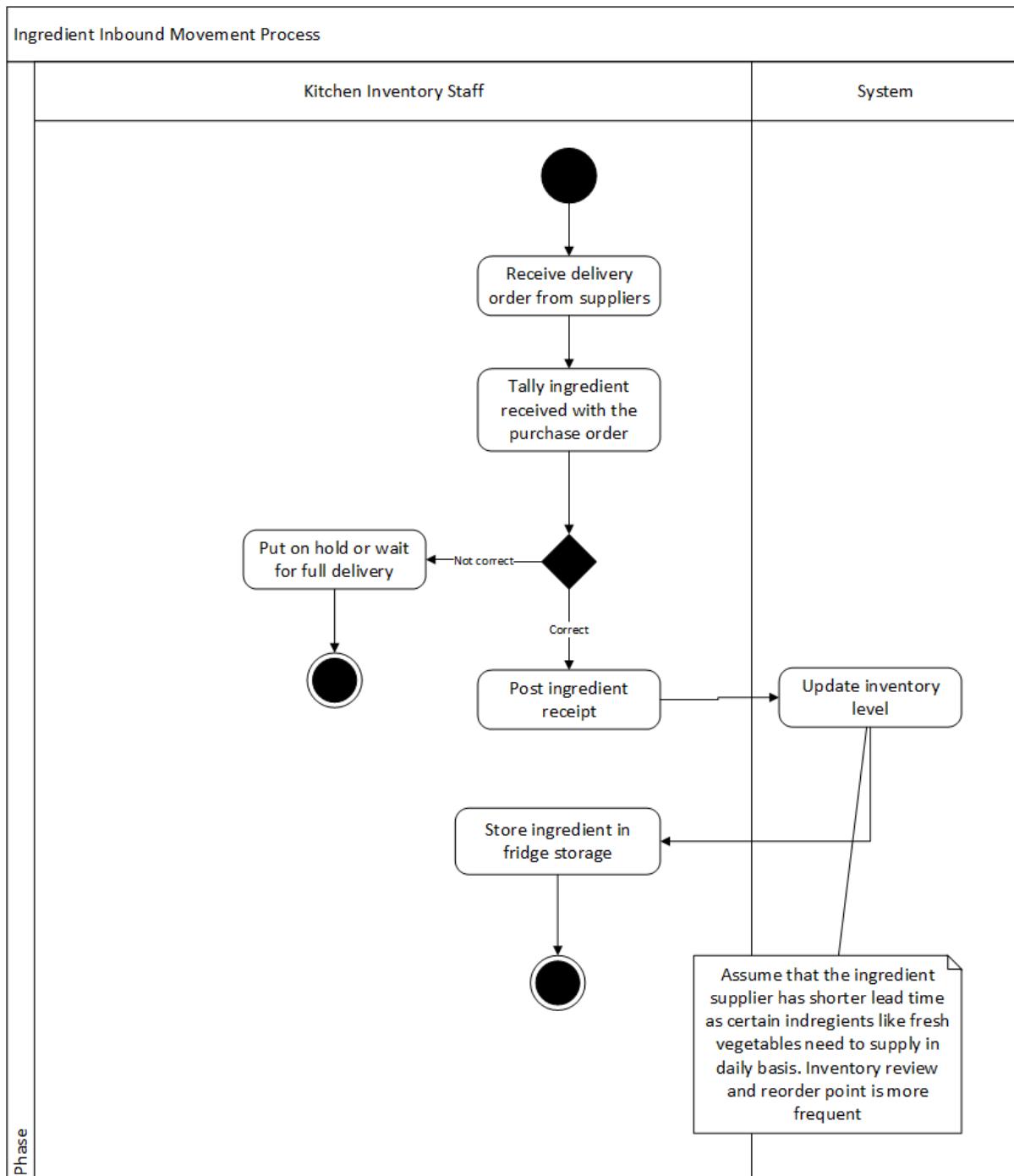
Subsequently, the staff may proceed to place order according to the “Weekly Ingredient Acquiring Process”.

Ad Hoc Kitchen Ingredient Acquiring Process

The kitchen staff will monitor the quantity of all ingredients left for each day. Thus within the week, if a popular ingredient runs out of stock from the kitchen, the kitchen staff will have to purchase more of such ingredient to satisfy the great customer demand. A purchase requisition will be created, the staff will update the system on the quantity of ingredient to acquire and then proceed on to confirm the details of the supplier. At this point, the staff may choose to affirm the details of the suppliers or to edit the information of the supplier. For the former case, a purchase order will be placed and the requisition status will be updated accordingly. For the latter case, the staff will be guided to edit the profile of the supplier and the process is described in “Kitchen Ingredient Supplier Management Process”. Once supplier profile has been successfully updated for the latter case, system will generate the purchase order and the staff may affirm it. The staff subsequently may continue to monitor the purchase order status through the system.

Ingredient Inbound Movement Process

Once the kitchen received a delivery from the supplier, the kitchen inventory staff will tally the amount of goods received with the purchase order. If numbers doesn't tally with each other, the kitchen staff should put the delivery on hold first or wait for the full delivery to arrive. If numbers tally, the kitchen inventory staff will post goods receipt and update the system inventory level. Ingredient goods will subsequently be stored up according to their types into the storage to preserve their freshness.



Ingredient Supplier Management Process

After a purchase requisition has been created from the Weekly Ingredient Acquiring Process, the kitchen admin staff may proceed to update the system for any changes to the supplier's information. The update can be a change in the supplier to a particular ingredient or a change in the particulars of certain supplier.

The kitchen staff may access the system and manually search for the supplier according to the name of the ingredient or the kitchen staff may be guided to the supplier's information page by the "Weekly Ingredient Acquiring Process". Either way, the system will generate the current supplier's information for that ingredient and the staff will have the option to edit any field in the information generated.

Once the supplier's information has been successfully updated, system will display update successful. If the kitchen staff enters into this process through the "Weekly Ingredient Acquiring Process", he/she will be guided back to continue on with the process of placing purchase order, any changes will be saved once the staff leave this process.

Ingredient Management Process

When a new ingredient is required to be added to the kitchen's ingredient list, kitchen staff may access Kitchen Management Sub-system to add this ingredient to the database. The staff will have to key in the relevant supplier's information together with the ingredient specifications (i.e. what is the market price of this ingredient? which recipe uses this particular ingredient?) to the system.

If prior to the execution of this process is the Menu Items Management Process, after this process ends, staff will be redirected back to carry on with the creation of a recipe for the new menu item.

Menu Management Process

Kitchen staff may add a new menu item to the record anytime. When this new menu item is being added, the staff is required to enter in the recipe ingredients with their purchase specifications (i.e. 1 set of chicken chop = 2 raw chicken tight, 1 side vegetable and 2 potato to order). The staff may search through an existing list of ingredients or add in new ingredient to the record to form the recipe. For the former case, the staff will be given a system generated list of existing ingredients to choose from in order to add into the recipe. For the latter case, the staff will be guided to the Ingredient Management Process to create this new ingredient. For both cases mentioned, the staff has to include in the quantity required for each ingredient that is being added to the recipe.

3.6.2 System Requirement Analysis

3.6.2.1 Sub-system Design

The kitchen Management Sub-system consists of the following modules :

D.2.1 Ingredient Procurement Module

D.2.2 Ingredient Supplier Management Module

D.2.3 Ingredient Inventory Control Module

D.2.4 Ingredient Management Module

D.2.5 Recipe Management Module

D.2.6 Menu Management Module

Ingredient Procurement Module

The module provides basic functionalities for procurement of ingredient process such as create a purchase order record.

System user : Kitchen Ingredient Purchaser

Ingredient Supplier Management Module

The module records the suppliers of the ingredients and provides purchasers a good reference when choosing suppliers.

System user : Kitchen Admin

Ingredient Inventory Control Module

The module provides real time inventory information of ingredients for kitchen operations. It provides the functionalities for inventory update, ingredient receipt record and inventory report.

System user : Kitchen Inventory Staff

Ingredient Management Module

The module records all ingredients' details for the kitchen. It provides basic functionalities for record management.

System user : Kitchen Admin

Recipe Management Module

The module records all recipes' details for the kitchen. It provides basic functionalities for record management.

System user : Kitchen Admin

Menu Management Module

The module records all menu's details for the kitchen. It provides basic functionalities for record management.

System user : Kitchen Admin

3.6.2.2 List of System Functionalities

Functionality Code	Name	Remark	AAU ID
Kitchen Management Sub-system			
D.2.1 Ingredient Procurement Module			
D.2.1.1	Create Purchase Order	Create a new Purchase Order record and categorise the record based on ingredient type	6
D.2.1.2	Edit Purchase Order	Edit Purchase Order information	
D.2.1.3	Cancel/Delete Purchase Order	Cancellation during creation of Purchase Order and logical deletion of created Purchase Order	
D.2.1.4	Assess Purchase Order	Purchasing manager assess the purchase order by selecting the status (approve, pending or reject) of the current purchase order	
D.2.1.5	Update Purchase Order Status	System updates the status of Purchase Order (Pending, Approved, Rejected)	

D.2.1.6	View Purchase Orders	View the list of purchase orders including status information	
D.2.1.7	Search Purchase Order	Search Purchase Order based on the given criteria	
D.2.2 Ingredient Supplier Management Module			
D.2.2.1	Add Supplier	Add a new supplier record	6
D.2.2.2	Edit Supplier	Edit a supplier's information	
D.2.2.3	Delete Supplier	Logical deletion of a supplier	
D.2.2.4	Search Supplier	Search supplier based on criteria	
D.2.2.5	Filter Top3/Top 5 Best Supplier	Retrieve a list of top ranked supplier names by best price or best delivery performance	
D.2.2.6	Add Ingredient to Supplier	Add ingredient to supplier	
D.2.2.7	Create Request For Quotation	Create a request for quotation for procurement	
D.2.3 Ingredient Inventory Control Module			
D.2.3.1	Search Inventory	Search inventory by ingredient name	6
D.2.3.2	View Inventory Level	View the inventory level of an ingredient in a specific kitchen fridge storage place	
D.2.3.3	Generate Inventory Report	Generate inventory report by ingredient weekly	
D.2.3.4	Add Safety Stock Level	Create a safety stock level for an ingredient. Not all ingredients need a safety stock level	
D.2.3.5	Update Safety Stock Level	Update the safety stock level for an ingredient. The default is zero.	
D.2.3.6	Alert Safety Stock	Alert will prompt the staff that inventory level has reached the safety stock level for an ingredient	
D.2.3.7	Alert Out of Stock	Alert will prompt the staff that zero inventory level for the ingredient	

D.2.3.8	View Inventory Report	View inventory report generated	
D.2.3.9	Update Inventory Level	Update the current inventory level after stock check end of a week	
D.2.3.10	Post Ingredient Receipt	Record receipt of goods from supplier(s)	
D.2.3.11	View Safety Stock Level	View the safety stock level	
D.2.4 Ingredient Management Module			
D.2.4.1	Add Ingredient	Add a new ingredient record	6
D.2.4.2	Edit Ingredient	Edit an ingredient information	
D.2.4.3	Delete Ingredient	Logical deletion of an ingredient	
D.2.4.4	Search Ingredient	Search ingredient based on criteria	
D.2.4.5	View Ingredient	View the list of ingredients	
D.2.5 Recipe Management Module			
D.2.5.1	Add Recipe	Add a new recipe record	6
D.2.5.2	Edit Recipe	Edit a recipe's information	
D.2.5.3	Delete Recipe	Logical deletion of a recipe	
D.2.5.4	Search Recipe	Search recipe based on dish name	
D.2.5.5	View Recipe	View the recipes	
D.2.6 Menu Management Module			
D.2.6.1	Add Menu	Add a new menu record	6
D.2.6.2	Edit Menu	Edit a menu information including dish name, price and promotions	
D.2.6.3	Delete Menu	Logical deletion of a Item	
D.2.6.4	Search Menu	Search Item based on criteria	
D.2.6.5	View Menu	View the menu details	

3.7 Operational CRM Sub-system

Operational CRM gathers and records down essential transactions, either sales from online or in the store. Then it will provide the data for Sales and Operation Management and analytical CRM. The sales data is used to perform sales forecast to ensure accurate production plan.

The customer transaction data will also be used to analyze and derive potential marketing strategies for improving customer relationship, enhancing customer services, retaining valuable customers and ultimately bringing the overall revenue of the company to greater height.

3.7.1 Business Requirement Analysis

3.7.1.1 Objectives

- Facilitates Island Furniture to be customer-centric
- Maintain a strong buyer-seller relationship with customers.
- Give customer a better and more rewarding shopping experience to increase their spending
- Effectively display new promotions to customers

3.7.1.2 Assumption

- The reward is in the form of cash e-voucher which requires customer to acknowledge the reward at online portal to obtain it once the loyalty points requirement has been met. Redemption of e-voucher is enabled when customer is paying for the next deal. The reward is country level standardization. Offline marketing meeting will be conducted to standardise what reward to update to the reward management sub-module at each store within same country.
- Any membership registration must be done online by creating a customer account either by store staff or customers of E-Commerce and M-Commerce. Once the customer registered with an account at online portal, the loyalty program will be associated with this customer account.
- The point policy, in other words, the real monetary amount to loyalty points conversion rate is 1 USD to 1 point. The policy is maintained at global level by the global HQ marketing staff. Since the member card is globally recognisable, the amount paid in other country's Island Furniture store will be converted to the points equivalent to the points gained in customer's registered country.

3.7.1.3 Process Description

M & E Commerce Management

For our E-commerce and M-commerce applications, we will be enabling the both online purchasing of goods and an e-shopping list. The details of activities that a customer can do on this portal are described below.

Online Purchase

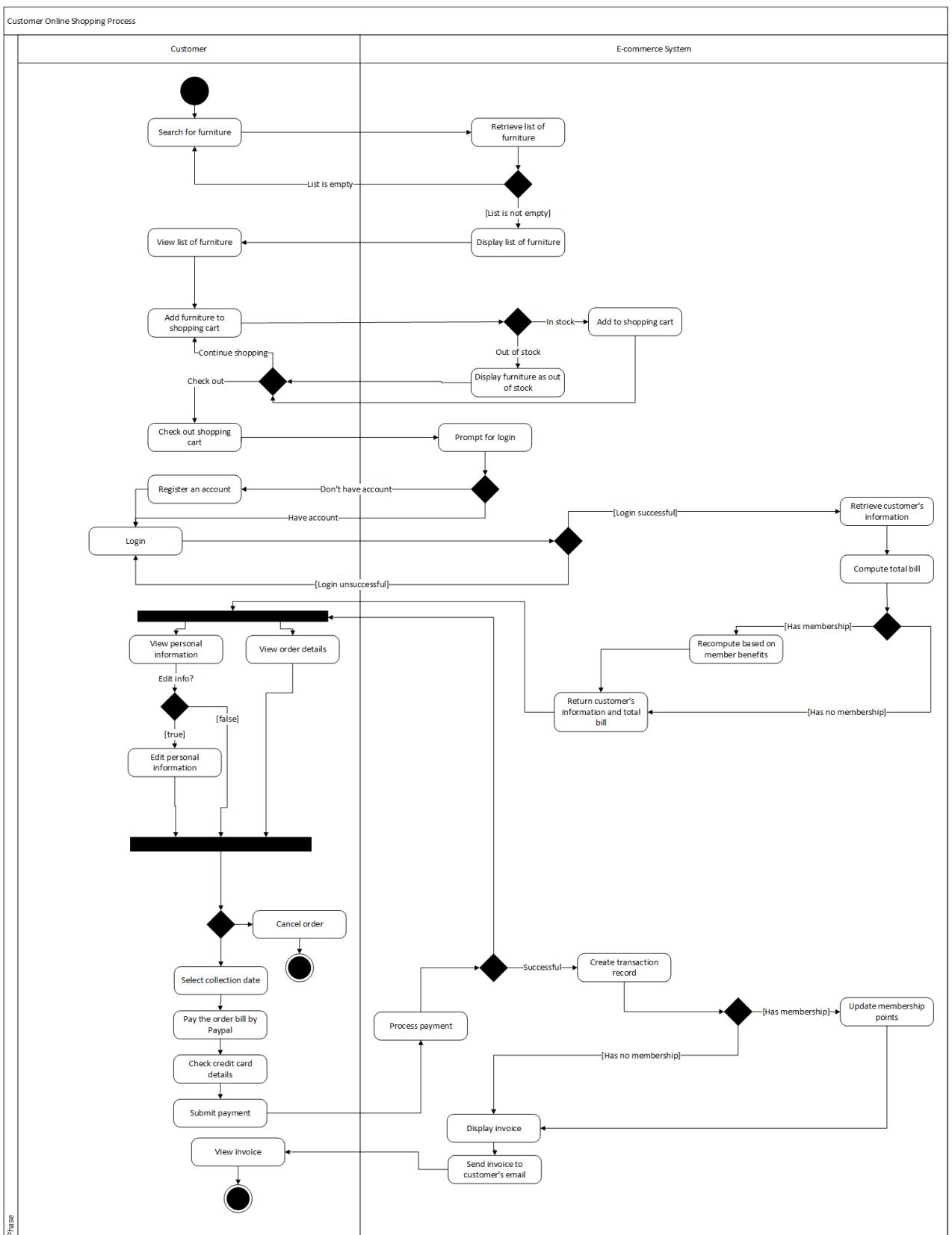
Upon entering to Island Furniture E-commerce page or opening to M-commerce application, customer may start shopping online. The customer will first choose the country that they are reside in, then the system will retrieve an interface of the selected country, a catalog of that country's store will be retrieved and displayed. Customer will choose the items he/she wants to purchase. Customer can choose to create a shopping list, or add to shopping cart for payment. For the latter case, customer will be asked to login or register an account before making payment through PayPal. If the customer is a member, the system subsequently will check whether there is any e-voucher stored in his/her account. The system will also verify whether current date falls within the member's birthday month in order to get special discount. Then the system will deduct from the total bill accordingly with regard to the above factors. The system will also require customers to state the date that they would like to collect their goods from the store so that the store can pack the products on time.

Goods are only available online for selection if stock is above the safety stock level at a selected store. This is to reserve special privilege for shoppers at the store when stock level turns low, it also prevents cases of dissatisfaction in having a good being purchased online, but due to stocks being sold out before the specified collection date, and the customer couldn't receive his/her purchased items on time.

If a customer is unable to locate an item in a specific store on the online portal, he/she may switch to a different store online or approach the physical store to check the availability of a desired product. The former case will greatly increases the likelihood for the customer to get his/her desired good.

An activity diagram of customer online shopping process is illustrated below:

3.7.1.3.1 Activity Diagram of Customer Online Shopping Process



Feedback Management

Customers may submit their valuable feedbacks via Island Furniture's online feedback channel. The feedbacks are mainly categorized into two groups, either for enquiries or to comment on the service standard of staffs at the store.

Upon login into the web portal, the customer will be guided to fill up a form with the usual emailing template containing key fields such as the sender's emailing address, receiver's email address (this will be referring to the customer service officer's email address), a title to state the issue the customer would like to highlight to Island Furniture and a blank space to input the main content of the feedback.

Upon the receipt of email, the customer service officer will try to resolve the issues that the customer is facing by providing timely and accurate replies.

Catalogue Management

For both E-commerce application and M-commerce application, customer will always get the latest update of the offers and product designs available at Island Furniture stores. Customers can view the specifications of each item that is available in the market today to make their shopping plan.

Global HQ will constantly monitor the information being published online to ensure the resources are updated.

Contacts management

The number for the customer service hotline, to talk to a customer service officer, will be made available online. Besides that, the email addresses for every store in the country may also be found together with the hotline. These contact details will facilitate better customer interaction, hence promoting good customer service.

The manager at the Global HQ will be in charge of updating the database with the newest contact information. Therefore for any change of contact information, the store will have to alert Global HQ to make the required update.

POS Application

When customer is ready to check out from the store, the cashier will scan through all the selected items' barcode to retrieve the prices from the POS system and record down these

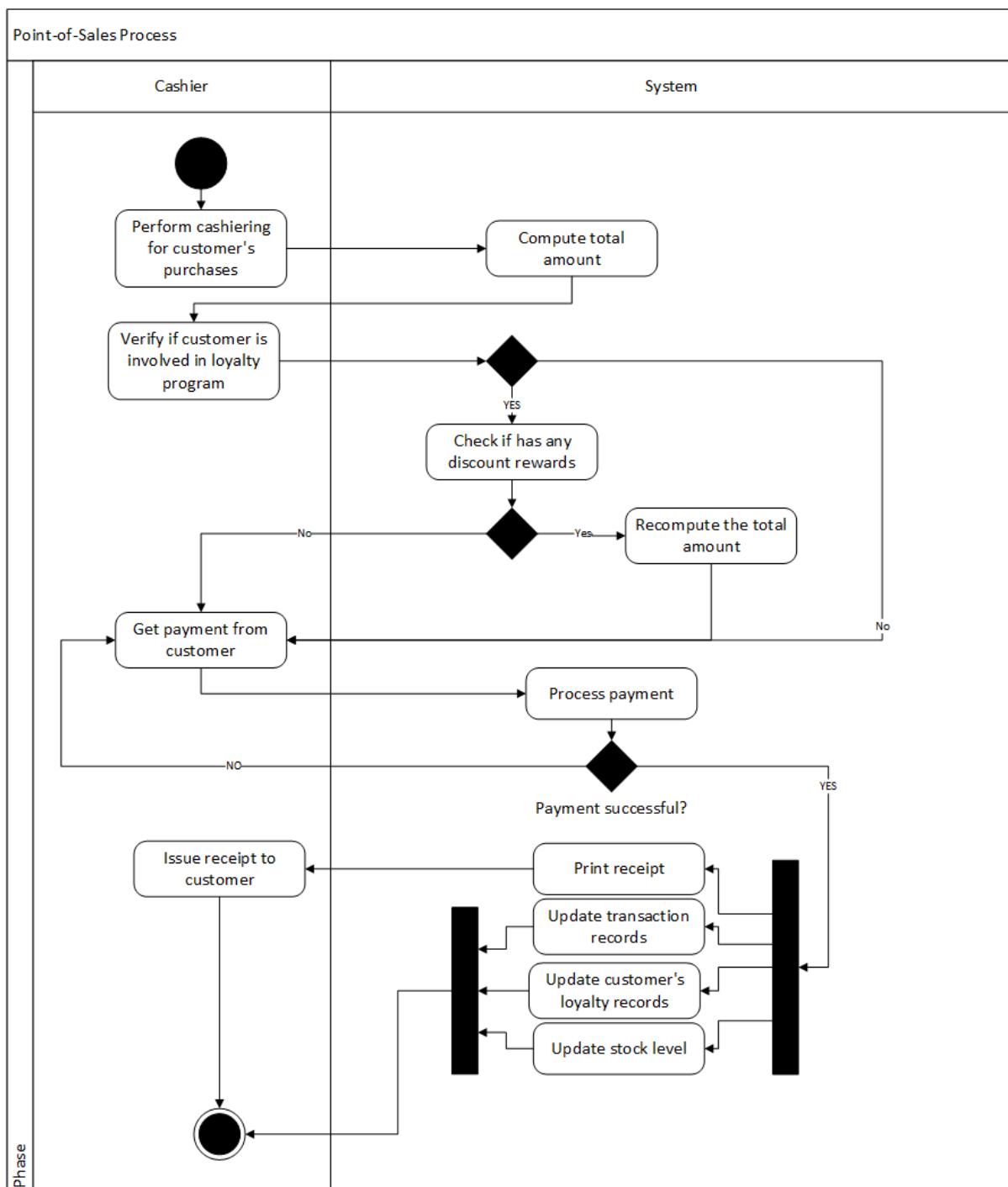
prices. The system will then compute the overall bill. At this juncture, the customer may present his/her membership card to check whether there is any e-voucher stored in his/her account and system will also verify whether current date falls within the member's birthday month in order to get special discount. Then the system will deduct from the total bill accordingly as to regard to the above factors.

After the bill has been cleared, the cashier will issue a receipt and system will credit new loyalty points to the membership account with respect to the bill.

Scenario: Customer checks out a cart of items at the counter

- 1. Cashier scan an item's bar code;**
- 2. System retrieves the price of the item;**
- 3. Repeat step 1 and 2 for all items;**
- 4. System compute and display the overall cost of the items;**
- 5. System updates the transaction**
 - a) If customer presents Loyalty membership card**
 - i. System checks for E-voucher**
 - 1) Cashier enquires whether member wants to use this voucher (if any);**
 - ii. System verifies whether date of birth falls within the month;**
 - iii. System re-computes the bill of the items after necessary discount;**
 - 6. System display the final bill of the items after deduction (if any);**
 - 7. Cashier receives the payment from the customer**
 - a) If customer is a member, system credits new loyalty points into his/her account according to the bill;**
 - b) Otherwise, transactions ends;**
 - 8. The system prints out a receipt.**

The activity diagram shown below illustrates check out transaction at POS application.



Loyalty Program

Membership Registration

Every customer can become a member of Island Furniture. Simply by registering at the online E-commerce Portal and an account user name and password information will be sent to customer's email for account activation. The customer will have to fill up an online application form with their personal particular such as their identity card number as the key attribute, and phone number, birth date, name and payment method are compulsory fields to be completed.

Subsequently, in the registration processing stage, the system will save the customer's detail into the database and he/she will be officially registered as a member. Island Furniture will then send a membership card to the customer within a week's time.

Rewards Management

Our system allows a flexible rewards system, which is highly dynamic, to continually capture customers' attention. The store marketing manager will periodically upload a new list of rewards for customers to redeem with their loyalty points. The reward policy is decided offline during country level marketing meetings, the standardization is only maintained in country level. Although the rewards are all kinds of e-vouchers, the cash value can be varied. For example, if the business is not very good during this season, the marketing managers of the same country stores will decide to give more cash incentives to boost sales. This can be illustrated using an example below :

Originally, 100 loyalty points can redeem a voucher of \$5 local currency.

For an event period of 2 weeks, every 100 loyalty points can redeem a voucher of \$10 local currency. The customer can obtain more cash vouchers with more spending.

Birthday Promotion Management

Besides the advantage of holding dynamic events as described in "Loyalty Program", the operational CRM will also be capable of managing special discounts for customers, who had signed up as members, during their birthday month. This will be a constant ongoing promotion available to all members.

Loyalty Point Management

Customer may view their loyalty points on the online customer web portal. All Loyalty points are accumulative; they can be carried over to subsequent events. However, when an event transits to the next event, a fixed percentage of points will be deducted if there is still balance of points left in the account. The reason for the deduction is to push customers to buy more, accumulate more and redeem more within the valid dates of an event. Else points will be wasted in carrying over to the following event. The ultimate goal for this is to encourage more spending.

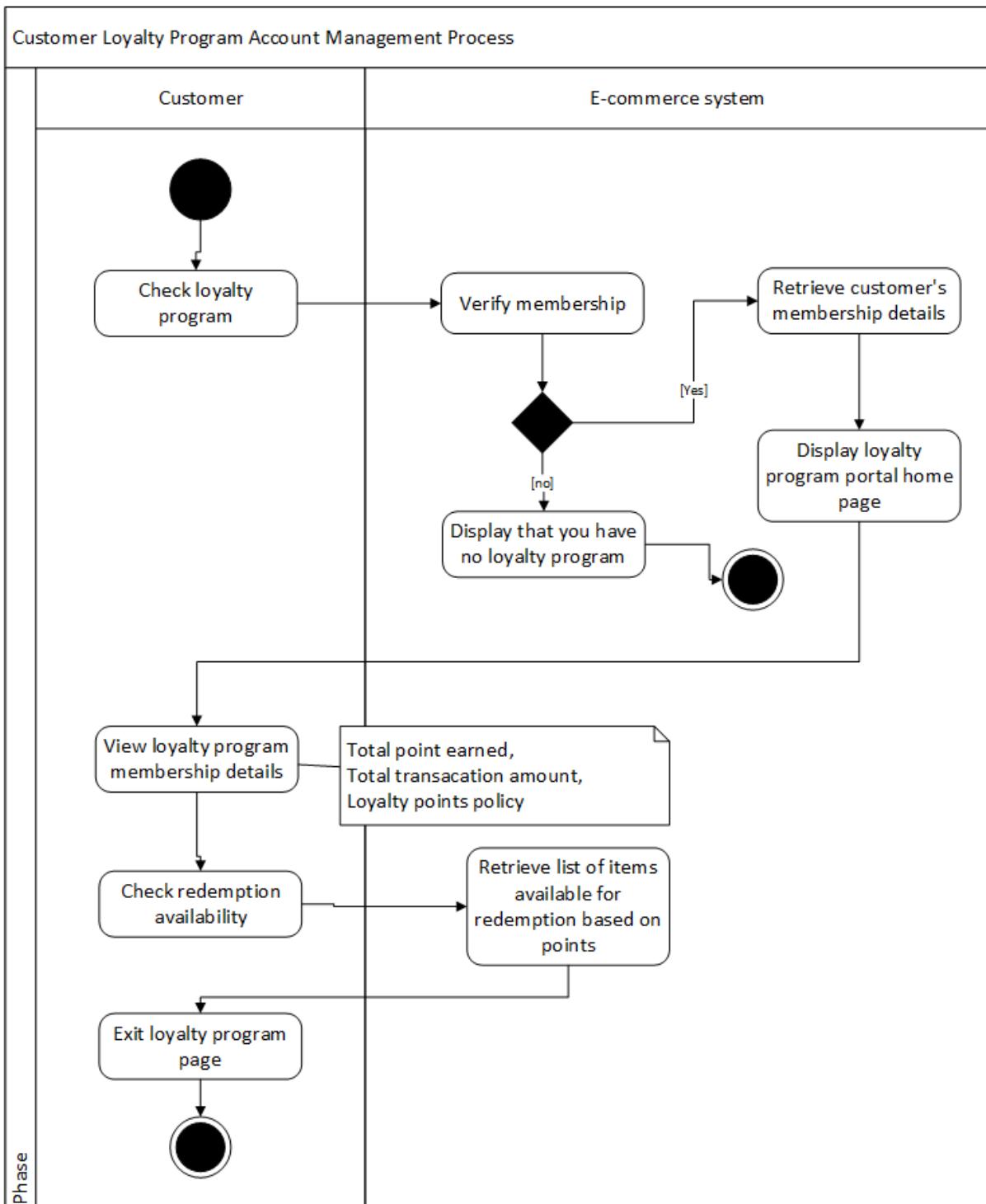
Redemption Management

Island Furniture members will log in to the online customer web portal to make their redemption of rewards. The general redemption process will follow the following steps to completion. Loyalty points will be deducted according to the points with respect to the rewards claimed.

Scenario: member visits the web portal to redeem their loyalty program reward

- 1. Member logs in;**
- 2. System verifies the login;**
- 3. System displays a list of rewards together with their individual redemption points;**
- 4. System display the reward's information that the customer has qualified;**
- 5. Customer acknowledges the receiving of the new reward;**
- 6. System recalculates the loyalty points reduction accordingly from the customer's account after receiving the reward;**
- 7. Customer may proceed to pay current bill;**
- 8. System prompts the customer number of e-vouchers have obtained that can be used to deduct total bill;**
- 9. Customer selects the quantity of e-voucher he/she wished to redeem the cash value;**
- 10. Customer affirms the quantity of cash e-vouchers he/she would like to use to deduct the current bill;**
- 11. System recalculates the total bill.**

3.7.1.3.2 Activity Diagram of Customer Loyalty Program Account Management Process



3.7.2 System Requirement Analysis

The operational CRM sub-system is designed to enhance customer relationship in the various channels. A internal operational CRM system integrates POS system to support store staff with quality services. The E-commerce and M-commerce channels also aim to connect customer better and engage customer with loyalty program. The detailed analysis is explained in this section.

3.7.2.1 Sub-system Design

D.3.1 Customer Account Management Module

D.3.2 Promotions Management Module

D.3.3 Loyalty Program Management Module

E. Point-Of-Sale Application

F. E-commerce Sales Application

G. M-commerce Sales Application

Customer Account Management Module

The module allows store staff to retrieve member information and views member account information such as loyalty points.

System user : Store Staff

Promotions Management Module

The module provides all current promotional information on the online E-commerce website , for customer reference. The staff is able to create, edit and delete the electronic records of promotions.

System user : HQ Marketing Staff

Loyalty Program Management

The module supports the loyalty program to ensure its effectiveness in engaging customers by accurate update of reward, redemption and points information. It is further designed into three sub-modules. Rewards Management Sub-module handles the creation and updates of rewards to make loyalty program more attractive. The Redemption Management Sub-

module will display redemption details and update the redemption status after the customer has performed redemption. Loyalty Points Management sub-module will calculate loyalty points and display to the customers at E-commerce and M-commerce so that the customers are able to keep track of their own progress.

System user : HQ Marketing Staff uses Loyalty Point Management. Store Marketing Staff at each store uses Customer Account Management, Promotion Management, Reward Management Sub-module and Redemption Sub-module.

Point-Of-Sale Application

The module maintains product and price information and collects customer transaction data as data inputs for Sales and Operation Management sub-system and Analytical CRM sub-system. It also uses the Unified Point Of Sales (UPOS) hardware infrastructure to scan and keep records of customer purchase. This POS application is able to configure at different sites to cater for the different needs. This application also allows the store staff to retrieve customer account information including the total points accumulated and rewards associated with the point accumulation. The store staff can also help the customer to redeem the electronic voucher (e-voucher) cash value which is stored in the customer's loyalty program when customer is paying for bill at the store POS counter.

System user : Each Store Staff

E-commerce Application

E-commerce Customer Account Management Module

The module keeps a record of all registered customers, which allows resetting password, activating initial account and editing customer profile.

System user : Customer of Island Furniture

E-commerce Sales Module

E-commerce sales module handles various online activities, such as online browsing of product catalogue, creating a shopping list and performing online purchase. This module also provides customer with a loyalty program management so that customer can view total points accumulated and rewards associated with the point accumulation. The customer can

also choose to redeem the electronic voucher (e-voucher) when making payment to the next deal.

System user : Customer of Island Furniture

M-commerce Sales Application

M-commerce functions similarly to E-commerce, while M-commerce is implemented as a mobile application which can be downloaded into android mobile phone.

System user : Customer of Island Furniture

3.7.2.2 List of System Functionalities

Functionality Code	Name	Remark	AAU ID	
Operational CRM Sub-system				
D.3.1 Customer Account Management Module				
D.3.1.1	View Account Information	View customer basic particulars		
D.3.2 Promotions Management Module				
D.3.2.1	Create New Promotion	Create a new promotion	7	
D.3.2.2	Update Promotion	Update an existing promotion		
D.3.2.3	View Promotion	View a list of current promotions		
D.3.2.4	Delete Promotion	Delete an existing promotion		
D.3.2.5	Search Promotion	Search for existing promotions		
D.3.3 Loyalty Program Management Module				
D.3.3.1 Reward Management Sub-module				
D.3.3.1.1	Create Reward	Create new reward and stores it in system		
D.3.3.1.2	Search Rewards	Retrieve a list of rewards		

D.3.3.1 .3	Edit Reward	Change reward information and update to the reward record	7
D.3.3.1 .4	Delete Reward	Logical deletion of rewards	
D.3.3.1 .5	View Reward	View a selected reward details	
D.3.3.2 Redemption Management Sub-module			
D.3.3.2.1	Make Redemption	Customer can choose if to redeem the cash value in the e-voucher when paying for the bill.	
D.3.3.2.2	View Redemption Status	System displays possible redemption status. Store staff and customer can view to verify redemption has made successfully	
D.3.3.3 Loyalty Points Management Sub-module			
D.3.3.3.1	Create Point Policy	Global HQ marketing staff adds a point policy to the record	
D.3.3.3.2	Update Point Policy	Edit/delete point policy when there is any reformation of marketing strategy and loyalty program	
D.3.3.3.3	View Point Policy	View the existing point policies	
E. Point-Of-Sales Application			
E.1	Record Sales Transaction	Record a sales transaction at furniture marketplace, restaurant and retail outlet into system	7
E.2	Print Receipt	Print out customer's receipt	
E.3	Update Member's Loyalty Points	Update loyalty points in member's account	
E.4	Update Stock Level	Update stock level of the store when an item is purchased	
E.5	Retrieve POS Interface	Retrieve POS interface based on where it is used at (furniture marketplace, restaurant and retail outlet). This is configurable	
E.6	Retrieve Member Point	If the customer presents member card, store staff can help to retrieve loyalty point information.	

E.7	Scan Barcode	Scan the barcode to add new item to bill	
E.8	Checkout	Calculate total amount and changes	

F. E-commerce Application			
F.1 E-commerce Customer Account Management Module			
F.1.1	Register Account	Register a new account for walk in customer	
F.2.1	View Account Information	View personal particulars	7
F.3.1	Edit Account Information	Edit personal particulars	
F.4.1	Reset Password	Reset account password after login	
F.5.1	Activate New Account	Activate new account by verifying the email address. The activation link will send to the email address used in account registration	
F.2 E-commerce Sales Module			
F.2.1	Search Furniture	Search for furniture based on filters, such as type and colour	7
F.2.2	Search Stock Availability	Search for stock availability in inventory for selected item	
F.2.3	Add Item To Shopping Cart	Add selected item to online shopping cart	
F.2.4	Check Out Shopping Cart	Check out online shopping cart	
F.2.5	Save Shopping Cart	Save list of items in online shopping cart	
F.2.6	Edit Payment Details	Edit payment details such as delivery address and credit card number	
F.2.7	Compute Total Bill	System computes total bill payable by customer	
F.2.8	View Shopping Cart	View online orders in shopping cart	

F.2.9	Confirm Payment	Create a new online transaction by completing payment
F.2.10	Update Loyalty Points	System updates loyalty points in member's account
F.2.11	Update Stock Level	System updates stock level in inventory for purchased items
F.2.12	Generate Invoice	System generates invoice for online purchase order
F.2.13	Submit Feedback	Customer submits feedback on products or customer service
F.2.13	Create Shopping List	Create a shopping list
F.2.14	Add Item to Shopping List	Add items to shopping list
F.2.15	Delete Item from Shopping List	Delete item from shopping list
F.2.16	View Shopping List	View the list of items in shopping list
F.2.17	Confirm Shopping List	Save shopping list record
F.2.18	Edit Item Quantity in Shopping Cart	Edit item quantity in the shopping cart
F.2.19	Edit Item Quantity in Shopping List	Edit item quantity in the shopping list
F.2.20	Receive Reward	Customer acknowledges the system prompt of a new reward is awarded to his/her account
F.2.21	Create Feedback	Customer composes feedback
F.2.22	Display Total Loyalty Points	System displays customer's total loyalty points

G. M-commerce Application				
G.1 M-commerce Customer Account Management Module				
G.1.1	Login/Logout	Customer can login/logout using existing account	7	
G.2.1	View Account Information	View personal particulars		
G.3.1	Edit Account Information	Edit personal particulars		
G.4.1	Reset Password	Reset account password after login		
G.5.1	Activate New Account	Activate new account by verifying the email address. The activation link will send to the email address used in account registration		
G.5.2	Guest Login	A customer without an registered account from e-commerce, can also use the mobile app to browse through the product catalogue		
G.2 M-commerce Sales Module				
G.2.1	Search Furniture	Search for furniture based on filters, such as type and colour		
G.2.2	Search Stock Availability	Search for stock availability in inventory for selected item		
G.2.3	Add Item To Shopping Cart	Add selected item to online shopping cart		
G.2.4	Check Out Shopping Cart	Check out online shopping cart		
G.2.5	Save Shopping Cart	Save list of items in online shopping cart		
G.2.6	Edit Payment Details	Edit payment details such as delivery address and credit card number		
G.2.7	Compute Total Bill	Compute total bill payable by customer		
G.2.8	View Order Details	View online order details		
G.2.9	Confirm Payment	Create a new online transaction		

G.2.10	Update Loyalty Points	Update loyalty points in member's account	
G.2.11	Update Stock Level	Update stock level in inventory for purchased items	
G.2.12	Generate Invoice	Generate invoice for online purchase order	
G.2.13	Create Shopping List	Create a shopping list	
G.2.14	Add Item to Shopping List	Add items to shopping list	
G.2.15	Delete Item from Shopping List	Delete item from shopping list	
G.2.16	View Shopping List	View the list of items in shopping list	
G.2.17	Confirm Shopping List	Save shopping list record	
F.2.18	Edit Item Quantity in Shopping Cart	Edit item quantity in the shopping cart	
F.2.19	Edit Item Quantity in Shopping List	Edit item quantity in the shopping list	
G.2.18	Receive Reward	Customer acknowledges the system prompt of a new reward is awarded to his/her account	
G.2.19	Display Total Loyalty Points	System displays customer's total loyalty points	

3.8 Analytical CRM Sub-system

3.8.1 Business Requirement Analysis

3.8.1.1 Objectives

- Understand and segment customer
- Identify most profitable customers by assessing net worth
- Increase spending through cross-selling and up-selling
- Retain customers by offering their preferences and using suitable marketing campaign
- Enhance Loyalty Program by promoting the appropriate incentives to the right customers

3.8.1.2 Assumption

- Data Cleaning process has been done by data analytics before inputting into the analytical CRM sub-system

3.8.1.3 Process Description

Generate Statistical Results for Analysis

This sub-system makes use of customer data collected from POS and E-commerce transactions to analyse customer behavior to optimise the marketing effectiveness. The manager can gain relevant information like customer net worth and customer churn rate to make better decisions.

Market basket analysis is used to perform cross-selling and up-selling by understanding the purchase behavior. The manager is able to use the results to design sales promotions and loyalty program incentives in order to communicate with customers and also increase the profit of the company.

The manager can use our system to generate trends and patterns, perform predictive analysis by using regression models and segment customers. With the aid of analytical CRM, the manager is able to increase customer satisfaction, acquire new customers, and retain repeated visiting customers to maintain a good relationship with the customers.

3.8.2 System Requirement Analysis

3.8.2.1 Sub-system Design

D.4.1 Customer Analytics Module

3.8.2.2 List of System Functionalities

Functionality Code	Name	Remark	AAU ID
Analytical CRM Sub-system			
D.4.1 Customer Analytics Module			
D.4.1.1	Generate Trends	Generate a general trend from the sales data collected	8
D.4.1.2	Segment High Net Worth Customer	Identify the most profitable customers by calculating their net worth and segment them in a group	
D.4.1.3	Segment Low Net Worth Customer	Identify the less profitable customers by calculating their net worth and segment them in a group	
D.4.1.4	Perform Predictive Analytics	Perform predictive analytics based on built in models such as Market Basket and Regression model	
D.4.1.5	Retrieve Customer Transaction Data	Get customer transaction data from POS	

4. High-Level System Architecture

This section shows the high level system architecture by first listing of all proposed sub-systems and followed by a visual table of content.

A. Common Infrastructure

B. Global Headquarter Sub-system

C. Manufacturing Facilities

C.1 Manufacturing Resource Planning Sub-system

C.2 Supply Chain Management Sub-system

D. Store Facilities

D.1 Inventory Management Sub-system

D.2 Kitchen Management Sub-system

D.3 Operational Customer Relationship Management Sub-system

D.4 Analytical Customer Relationship Management Sub-system

E. POS Application

F. E-commerce Application

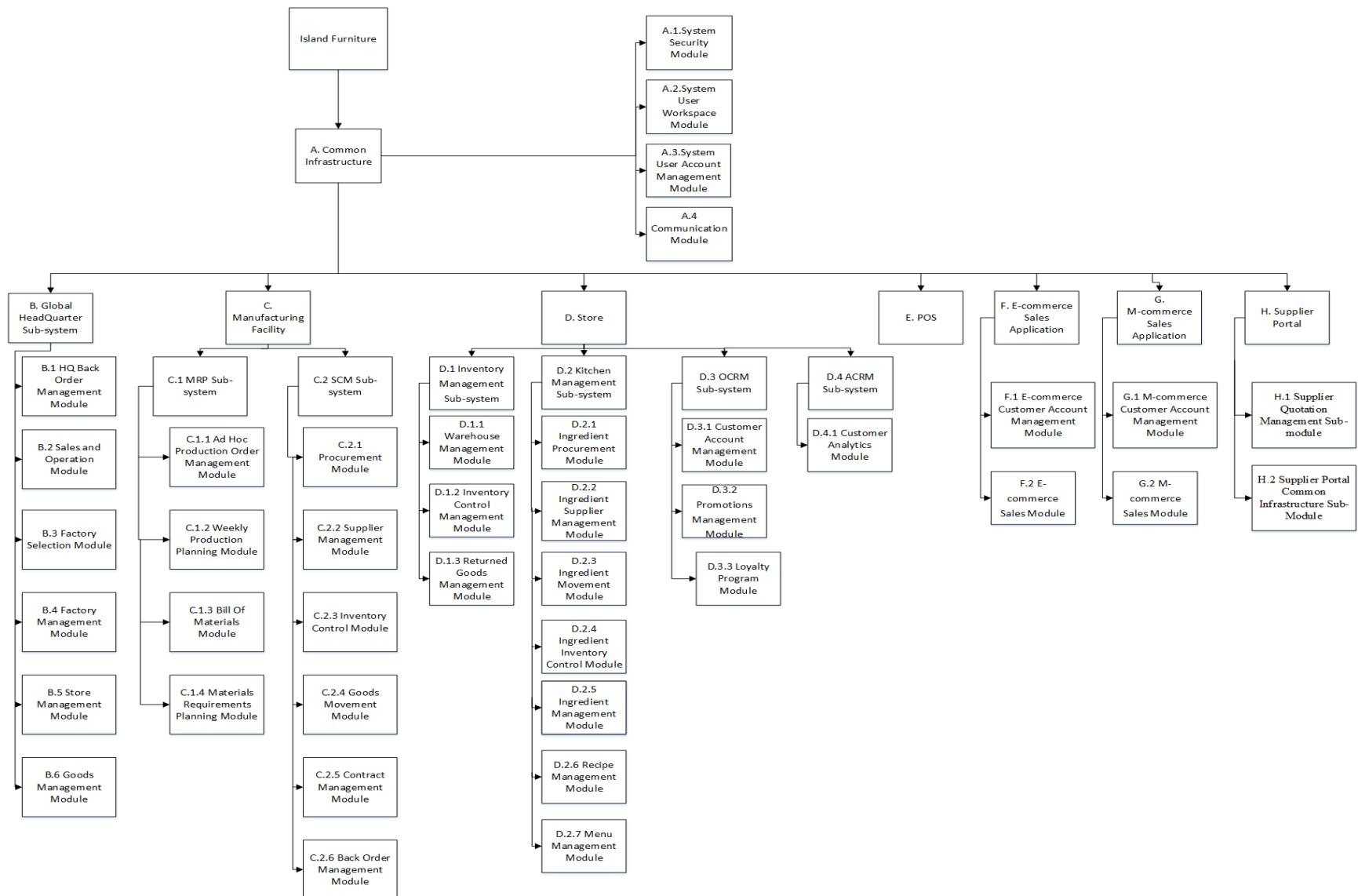
G. M-commerce Application

H. Supplier Portal

4.1 Simple Table Visual of Content

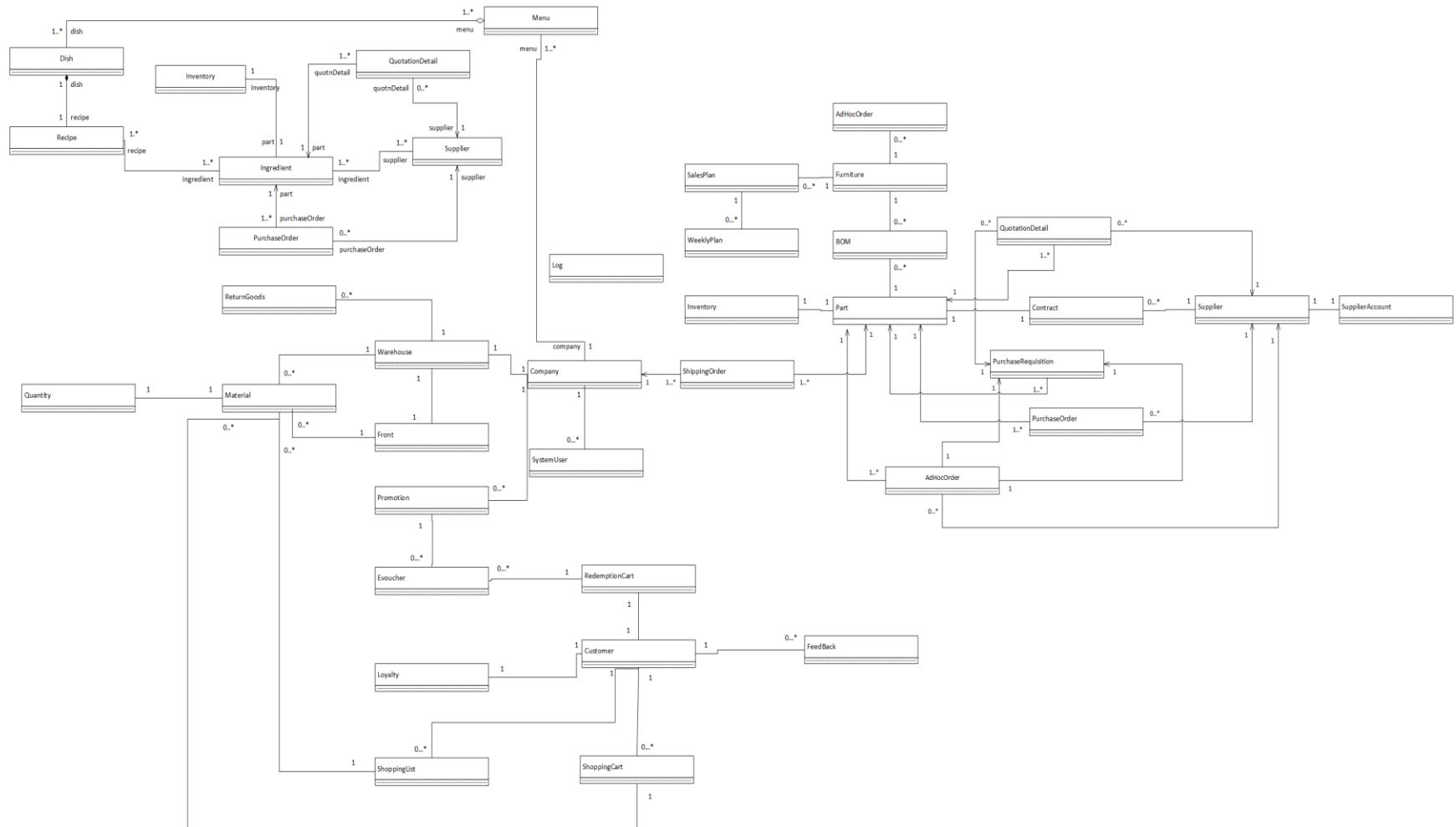
The simple table visual of content below is to show the high-level system architecture.

Table 1. High-Level System Architecture



The diagram below shows an overview of high level class diagram of entire ERP system.

Table 2. High Level Class Diagram



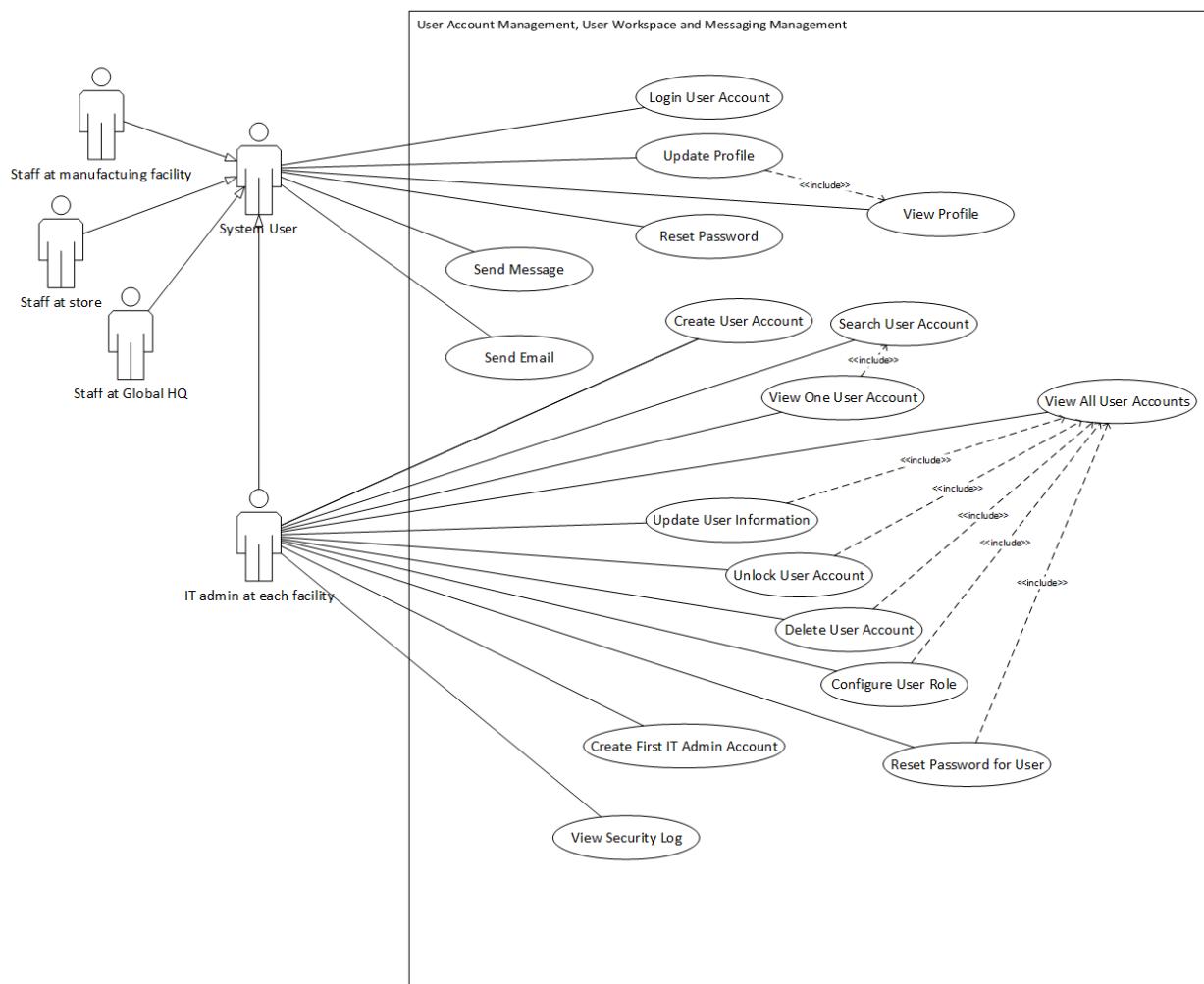
5. Functional Modules Design

5.1 Common Infrastructure

5.1.1 User Account Management, User Workspace and Messaging Management Modules

This functional design includes modules A.1 System Security, A.2 System User Workspace, and A.3 System User Account Management, and A.4 Messaging.

5.1.1.1 Use Case Diagram



5.1.2 Use Case Description

Use Case Description 1

Use case Name	1. Reset Password for user
Description	When a staff forgets his/her password during login, the staff may approach/contact the System Admin (SA) on site to reset his/her account's password.
Actors	Staff (HQ, Store, Manufacturing Sites)
Triggers	Staff forgets his/her password or the system had blocked his/her account, thus staff wants to reset his/her password.
Goals	Reset password for the particular staff
Pre-conditions	<ol style="list-style-type: none"> 1. Staff must have a registered account. 2. SA must have the access right to change the password for the staff.
Post-conditions	<ol style="list-style-type: none"> 1. Password successfully changed. 2. Staff received their new password through an email. 3. SA will not be able to know what is this new password, the new system generated password will be kept confidential and only the staff who had requested it will have access to it.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Include (View All User Accounts). 2. Staff request for a password change. 3. SA log in to the system. 4. SA selects the “user account management” tag. 5. SA search for the Staff using his/her username. 6. System displays the Staff’s account information. 7. SA selects the reset password tag under the staff’s account information. 8. System resets the staff’s password to a system-generated password.

	<p>9. System sends an email, attached with the new password, to the staff's registered email.</p> <p>10. Staff log in with this new password.</p>
Alternative Courses	<p>6a. If the status of the account is “blocked”:</p> <ol style="list-style-type: none"> 1. SA resets the account’s status to “active”. 2. Continue at step 7.
Exceptional courses	

Use Case Description 2

Use case Name	2. Login User Account
Description	User with an Island Furniture account wants to log into the system to manage their account.
Actors	User – Customer, Staff (HQ, Store, Manufacturing site), Supplier
Triggers	User wants to log into system
Goals	To login successfully
Pre-conditions	1. User must have a registered account.
Post-conditions	1. Login successful, system automatically directs the user to homepage that has been customized according the user’s role.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User accesses Island Furniture Portal. 2. User keys in essential login details: <ol style="list-style-type: none"> a. Username b. Password 3. User submits login detail. 4. System validates the detail. 5. System checks for access rights of the user account. 6. System directs user to respective customized workspace according to their registered role.

Alternative Courses	4a. If username or password does not tally: 1. System prompts staff to re-enter username and password. 2. Continue at Step 2. 6a. If user is a customer, system will direct the user to the homepage of Island Furniture website.
Exceptional courses	4b. If validation failed for three times: 1. User's account will be blocked. 2. Use case terminates.

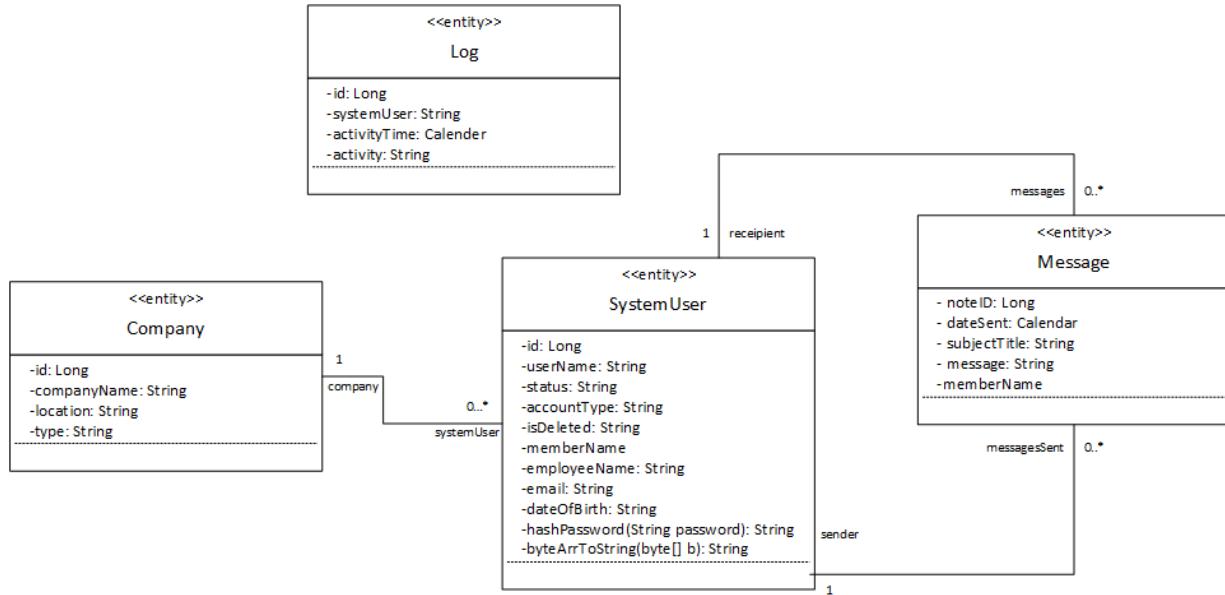
Use Case Description 3

Use case Name	3. Retrieve security log
Description	System administrator wants to retrieve and view the security log for a specific user
Actors	System administrator (SA)
Triggers	SA accesses the system to retrieve security log.
Goals	Retrieve the relevant security log of a user to the SA
Pre-conditions	1. SA must have a registered account. 2. SA has to log in to the system. 3. SA must have the access right to view user's log record.
Post-conditions	System returns the requested security log of a specified account.
Extension points	
Basic Course	1. SA clicks on "view log" tag. 2. System displays a list of past login information by all users. 3. SA search for a specific user by entering his/her username. 4. System retrieves past logged information regarding the specified user. 5. System displays the list of information about the

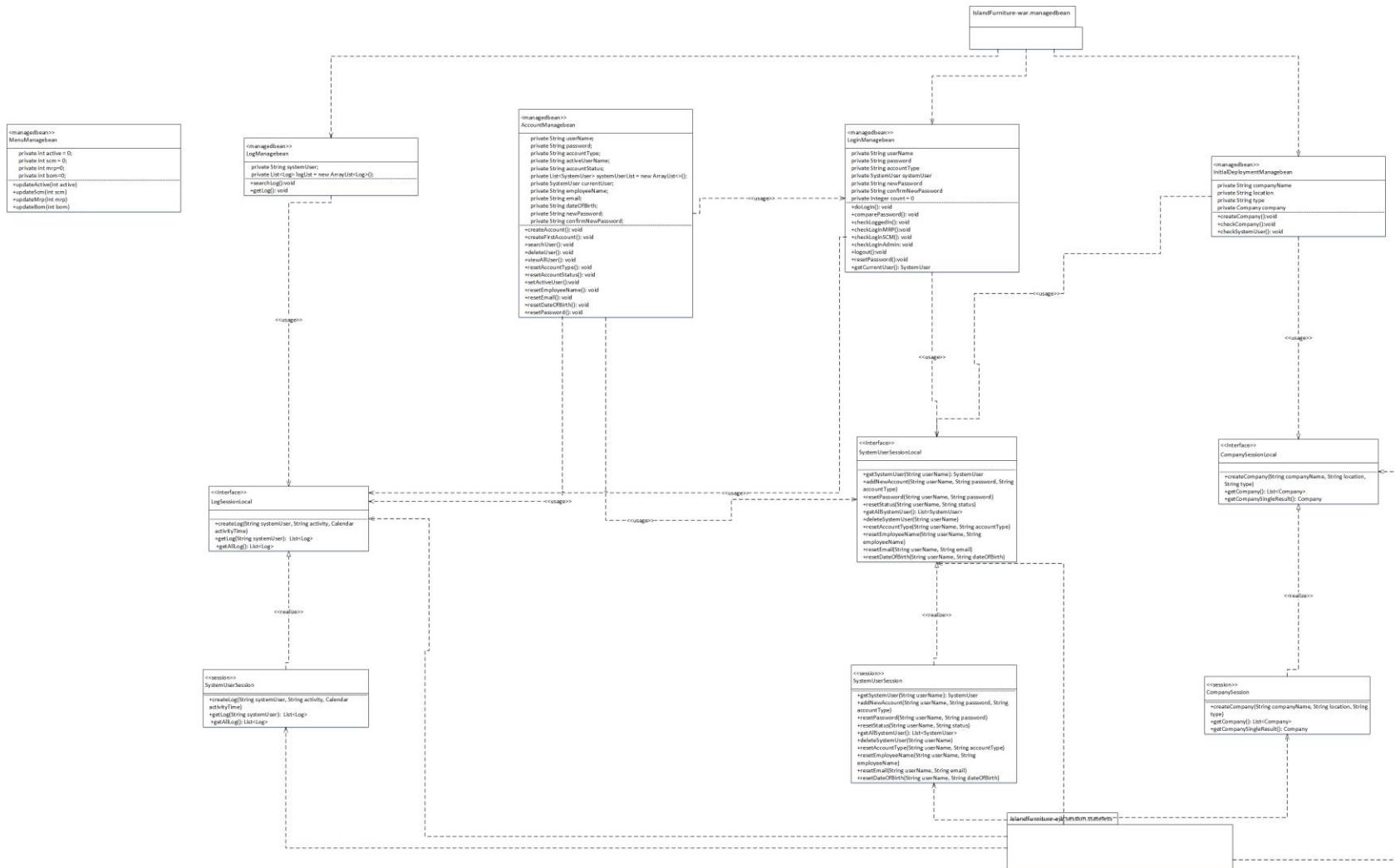
	specified user.
Alternative Courses	
Exceptional courses	

5.1.3 Class Diagram

Entity Class Diagram

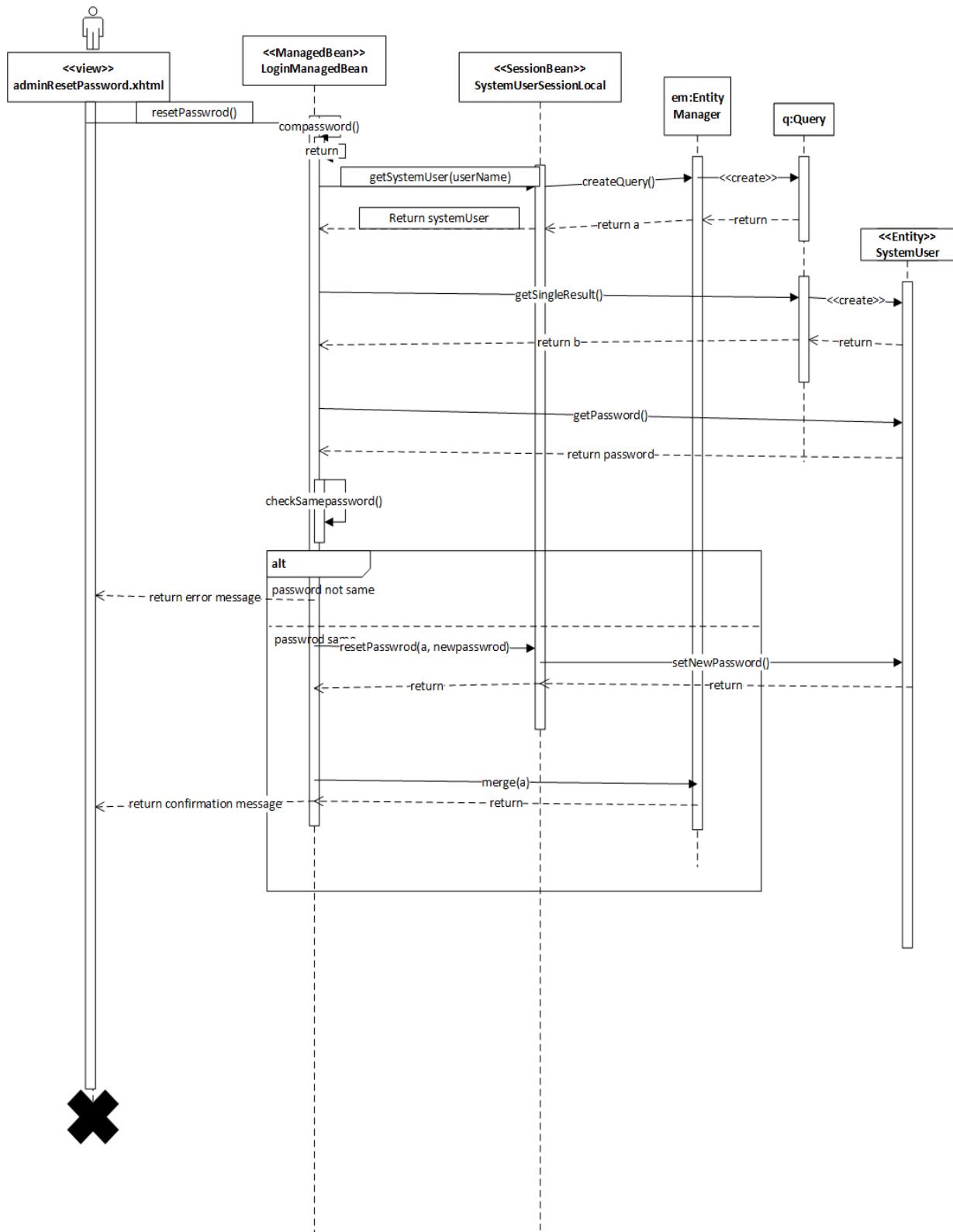


Non-Entity Class Diagram



5.1.4 Sequence Diagram

This diagram shows "Reset Password" use case.

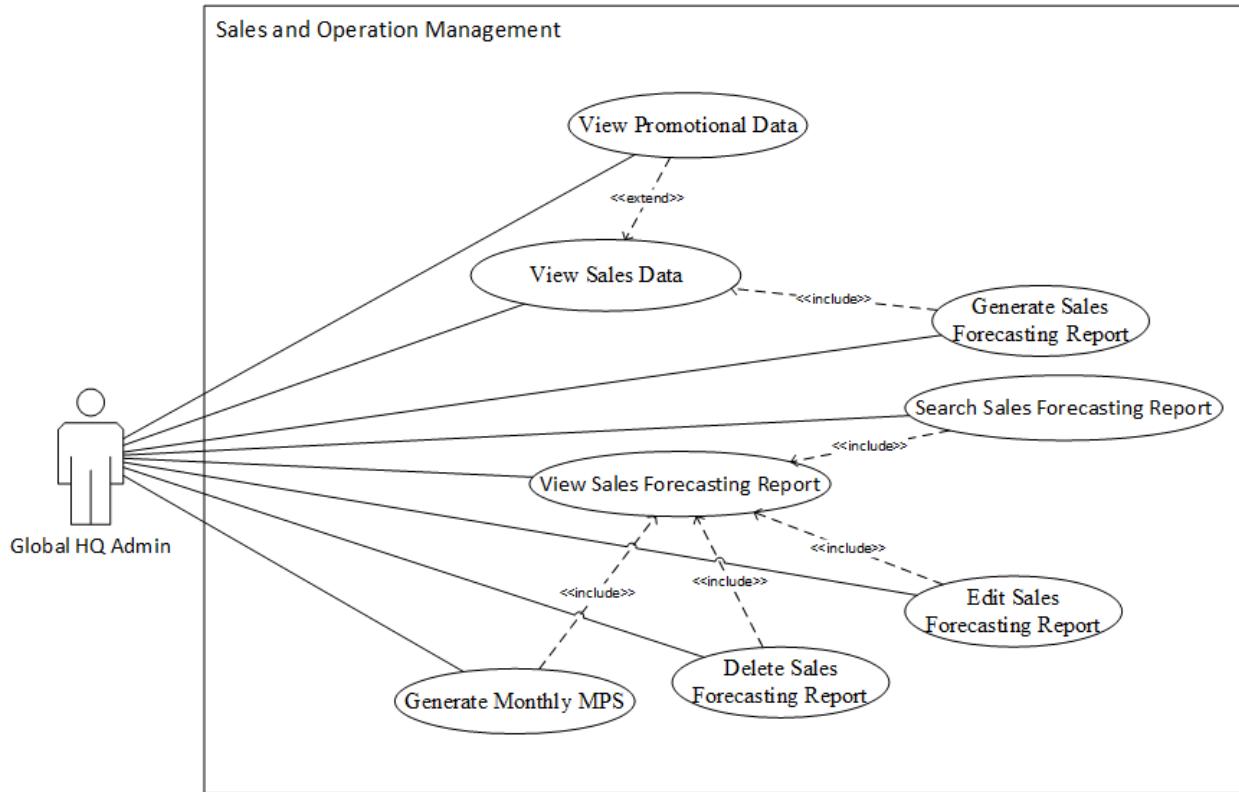


5.2 Global HQ Sub-system

5.2.1 Sales and Operation Module

The functional design of B.2 sales and operation module is shown below :

5.2.1.1 Use Case Diagram



5.2.1.2 Use Case Description

Use Case Description 1

Use Case Name	View Sales Data
Description	The global HQ admin views sales data of a furniture for a store at a specific period
Actors	Global HQ admin
Triggers	Global HQ admin accesses system to view sales data
Goals	Generate a sales forecast report to predict demand and plan for monthly production
Preconditions	<ol style="list-style-type: none">1. User has logged into the system2. User has view the sales data by retrieving sales transaction records
Postconditions	A sales forecast report has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ol style="list-style-type: none">1. User clicks "View Sales Data" button2. System retrieves sales data from transaction records3. System displays sales data successfully
Alternative Courses	Nil
Exceptional Courses	Nil

Use Case Description 2

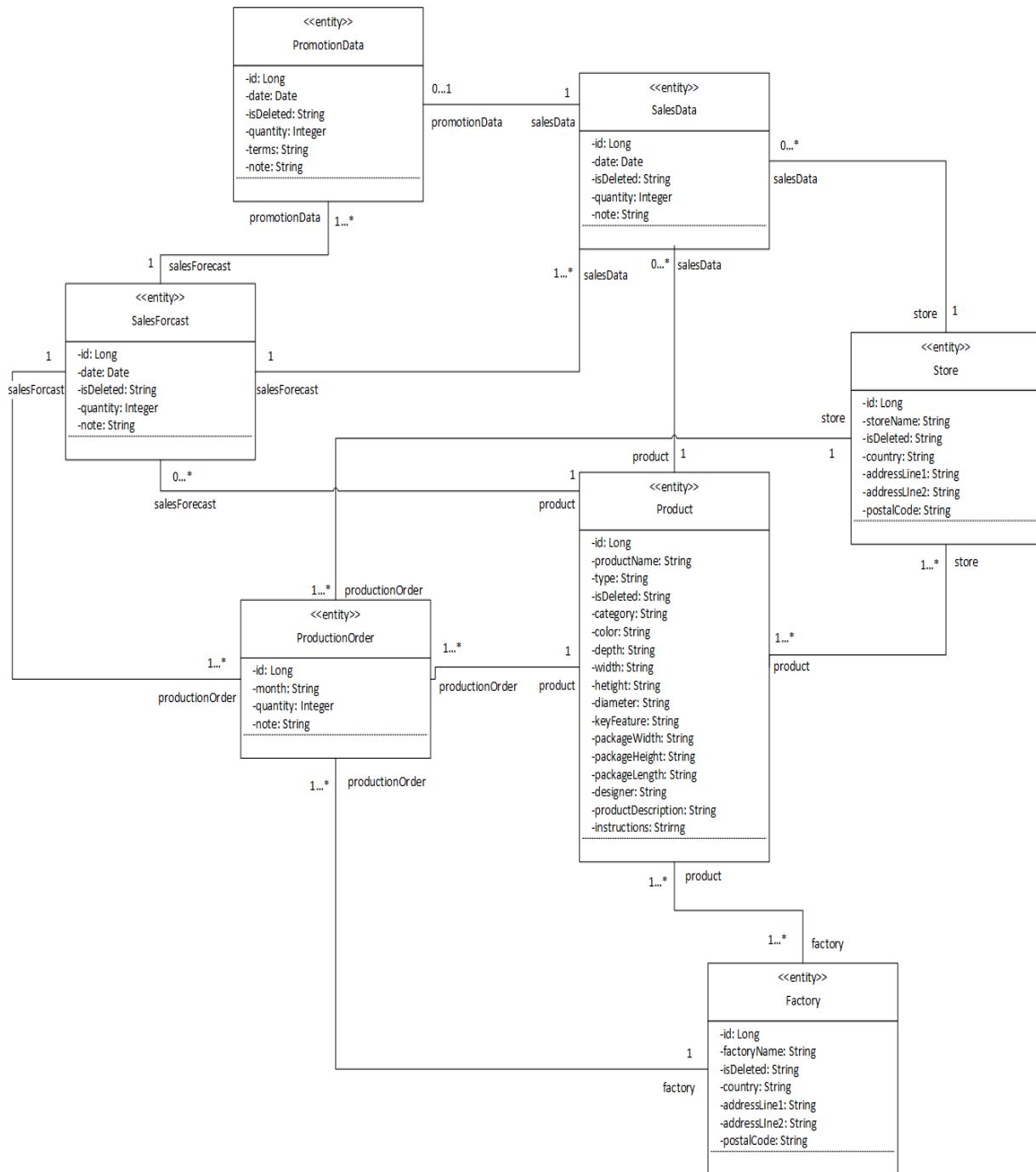
Use Case Name	Generate Sales Forecasting Report
Description	The global HQ admin generates sales forecast report of a furniture for a store at a specific period
Actors	Global HQ admin
Triggers	Global HQ admin accesses system to generate sales forecast report
Goals	Generate a sales forecast report to predict demand and plan for monthly production
Preconditions	<ul style="list-style-type: none"> 1. User has logged into the system 2. User has view the sales data by retrieving sales transaction records from the store facility
Postconditions	A sales forecast report has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ul style="list-style-type: none"> 1. Include (View Sales Data) 2. User clicks "Generate Sales Forecast Report" button 3. System checks for sales forecast report conflicts 4. System generates sales forecast of the furniture for the selected store based on sales forecast formula and forecast techniques 5. System display a sales forecast report successfully
Alternative Courses	Nil
Exceptional Courses	<p>3a. Sales Forecast Report of same furniture, same store or same period detected :</p> <ul style="list-style-type: none"> 1. System pops up warning message 2. Use case terminates

Use Case Description 3

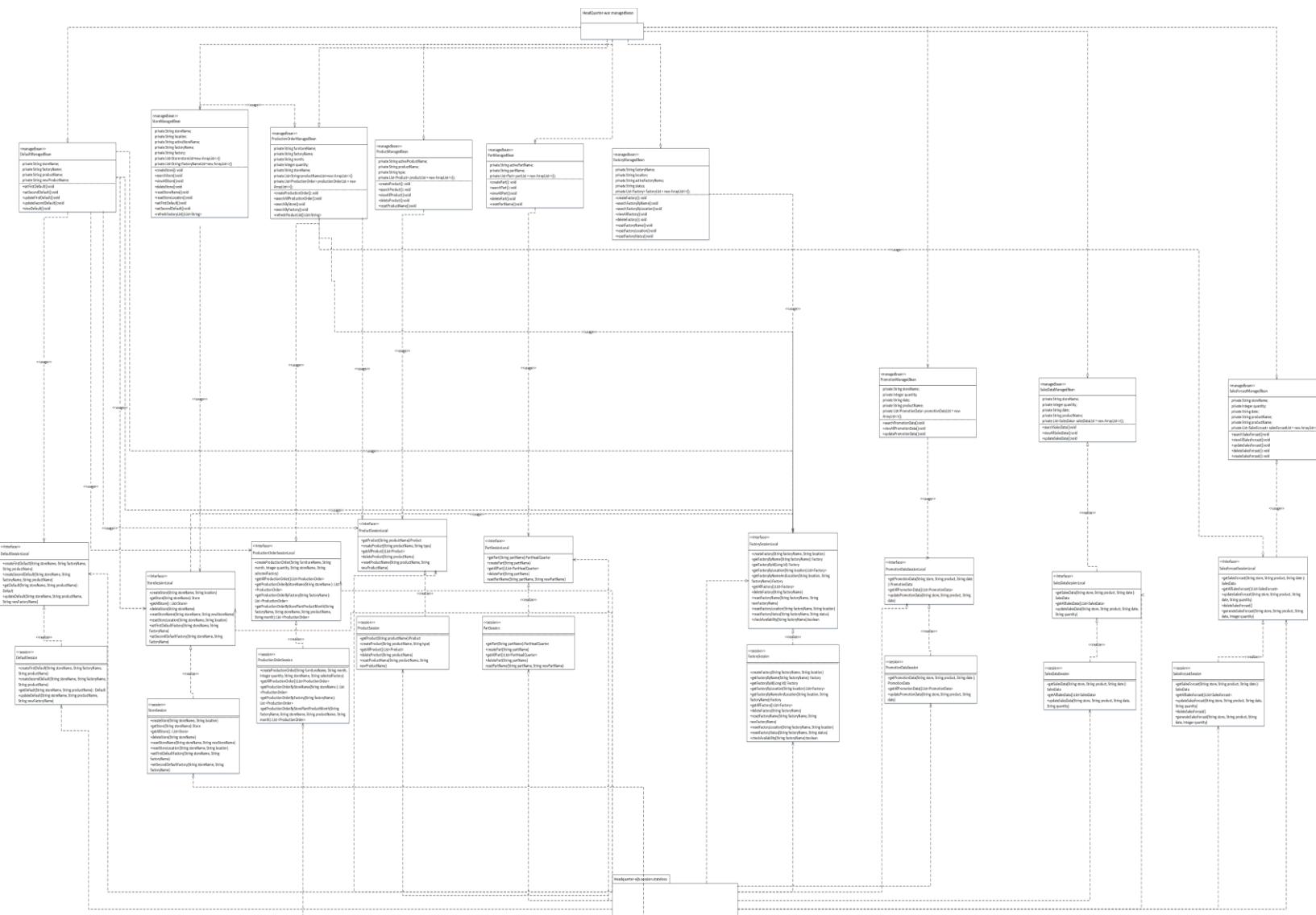
Use Case Name	Generate Monthly MPS
Description	The global HQ admin creates monthly MPS based on the sales forecasting report
Actors	Global HQ admin
Triggers	Global HQ admin accesses system to generate monthly MPS for scheduled production plan
Goals	Generate a monthly MPS for manufacturing resource planning
Preconditions	<ul style="list-style-type: none"> 1. User has logged into the system 2. Sales forecasting report has been generated
Postconditions	A new monthly MPS record has been generated successfully without any duplications
Extension Points	Nil
Basic Course	<ul style="list-style-type: none"> 1. Include (View Sales Forecasting Report) 2. User clicks "Generate monthly MPS" button 3. System checks for monthly MPS record conflicts 4. System saves new monthly MPS record and returns a success message
Alternative Courses	Nil
Exceptional Courses	<p>3a. Same monthly MPS record conflict detected, record of same furniture at the same store and period has existed :</p> <ul style="list-style-type: none"> 1. System pops up warning message 2. Use case terminates

5.2.1.3 Class Diagram

Entity Class Diagram

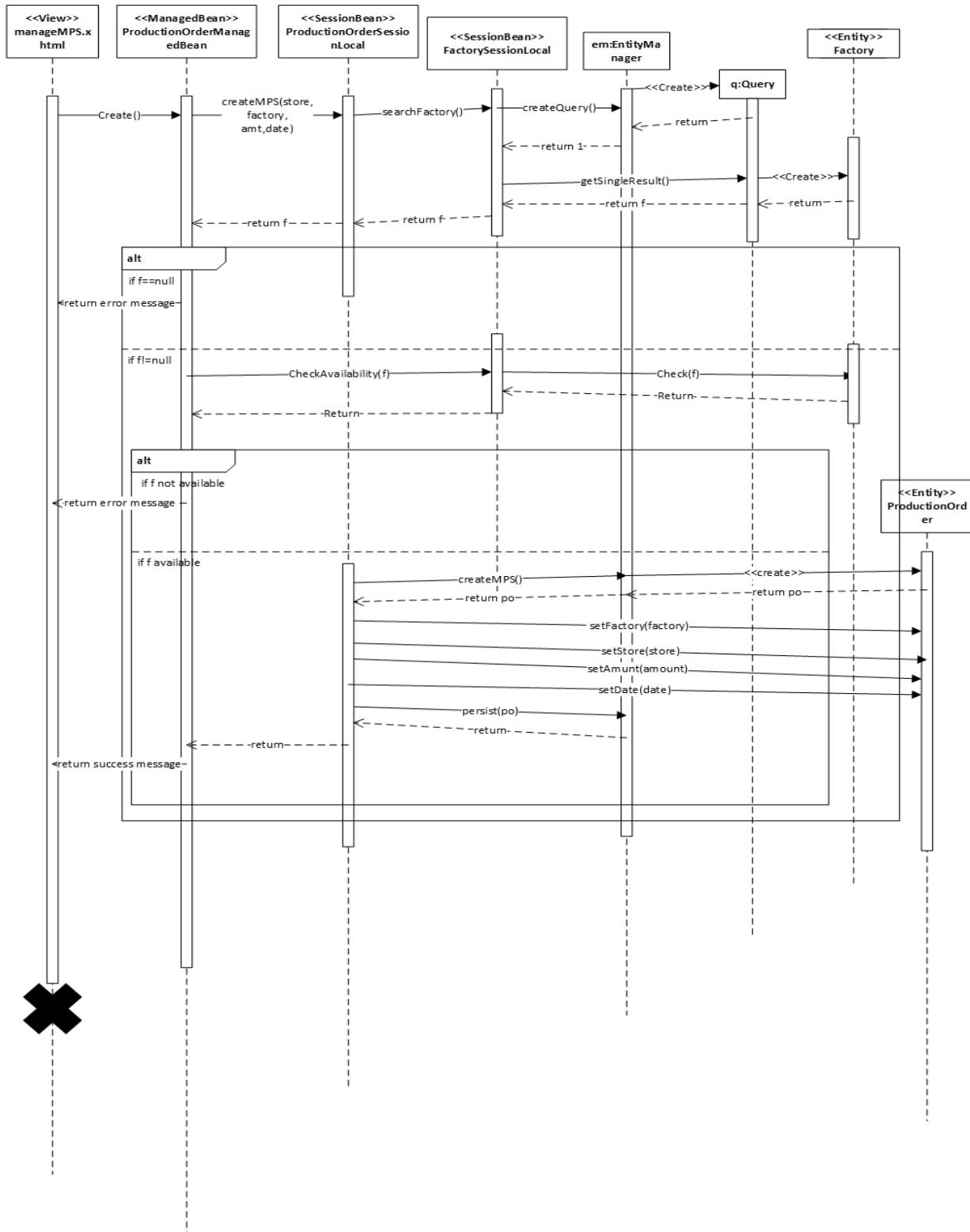


Non-Entity Class Diagram



5.2.1.4 Sequence Diagram

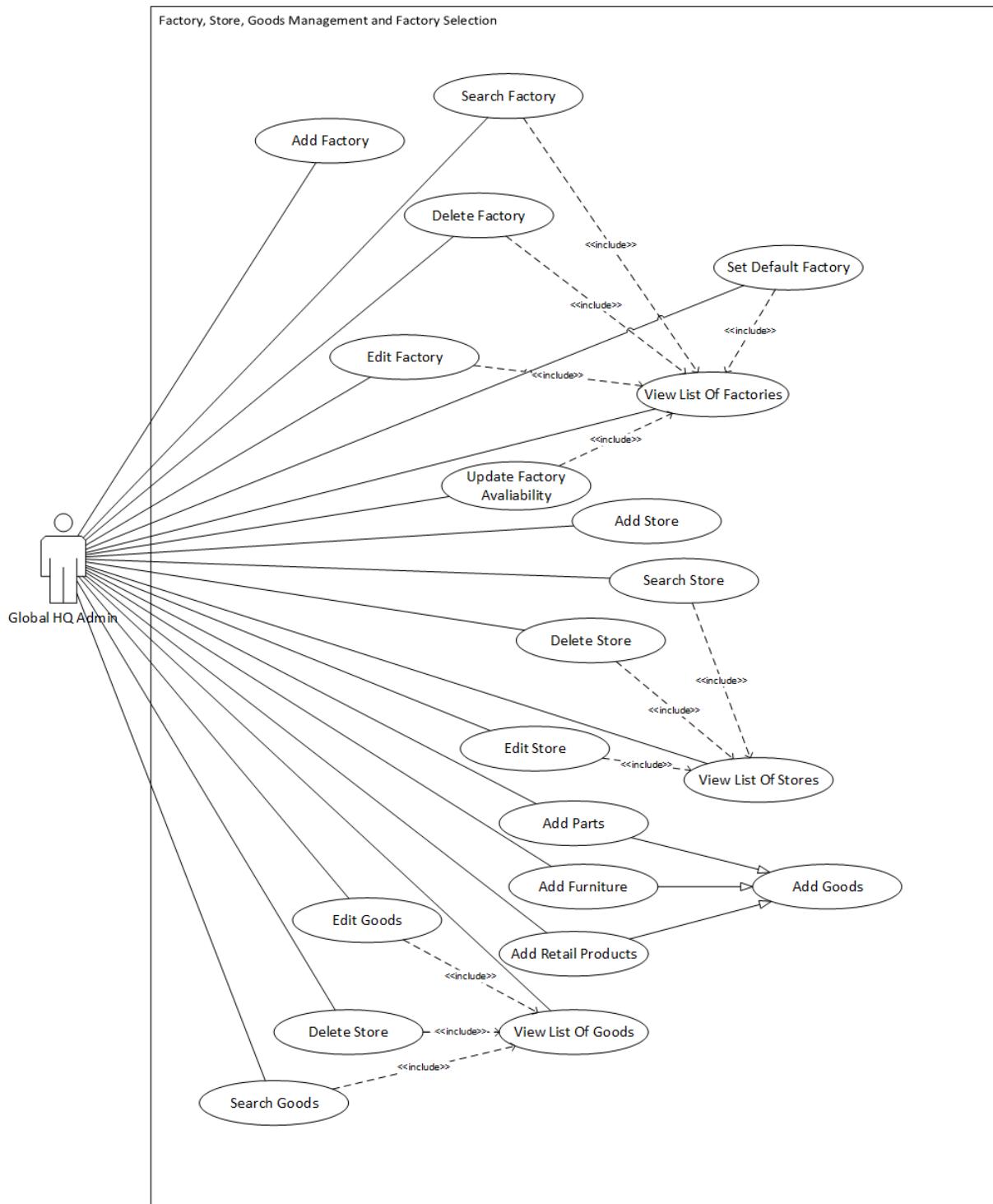
This diagram shows "Generate Monthly MPS" use case.



5.2.2 Factory Management and Selection, Store Management and Goods Management Modules

The functional design of B.3 Factory Selection Module, B.4 Factory Management Module, B.5 Store Management Module and B.6 Goods Management Module is shown below :

5.2.2.1 Use Case Diagram



5.2.2.2 Use Case Description

Use Case Description 1

Use Case Name	Add Factory
Description	The global HQ admin creates a new factory record for each manufacturing facility across the globe that is owned by Island Furniture
Actors	Global HQ admin
Triggers	Global HQ admin accesses system to add a new factory
Goals	Add a new factory record for integrated data flow and production order relay to each manufacturing facility
Preconditions	1. User has logged into the system
Postconditions	A new factory record has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ol style="list-style-type: none"> 1. User clicks "Create Factory" button 2. User enters new factory details <ol style="list-style-type: none"> a. Factory Name b. Factory Location 3. User clicks "Save" button 4. System checks for factory name conflicts 5. System saves new factory record and returns a success message
Alternative Courses	Nil
Exceptional Courses	4a. Factory name conflict detected : <ol style="list-style-type: none"> 3. System pops up warning message 4. Use case terminates

Use Case Description 2

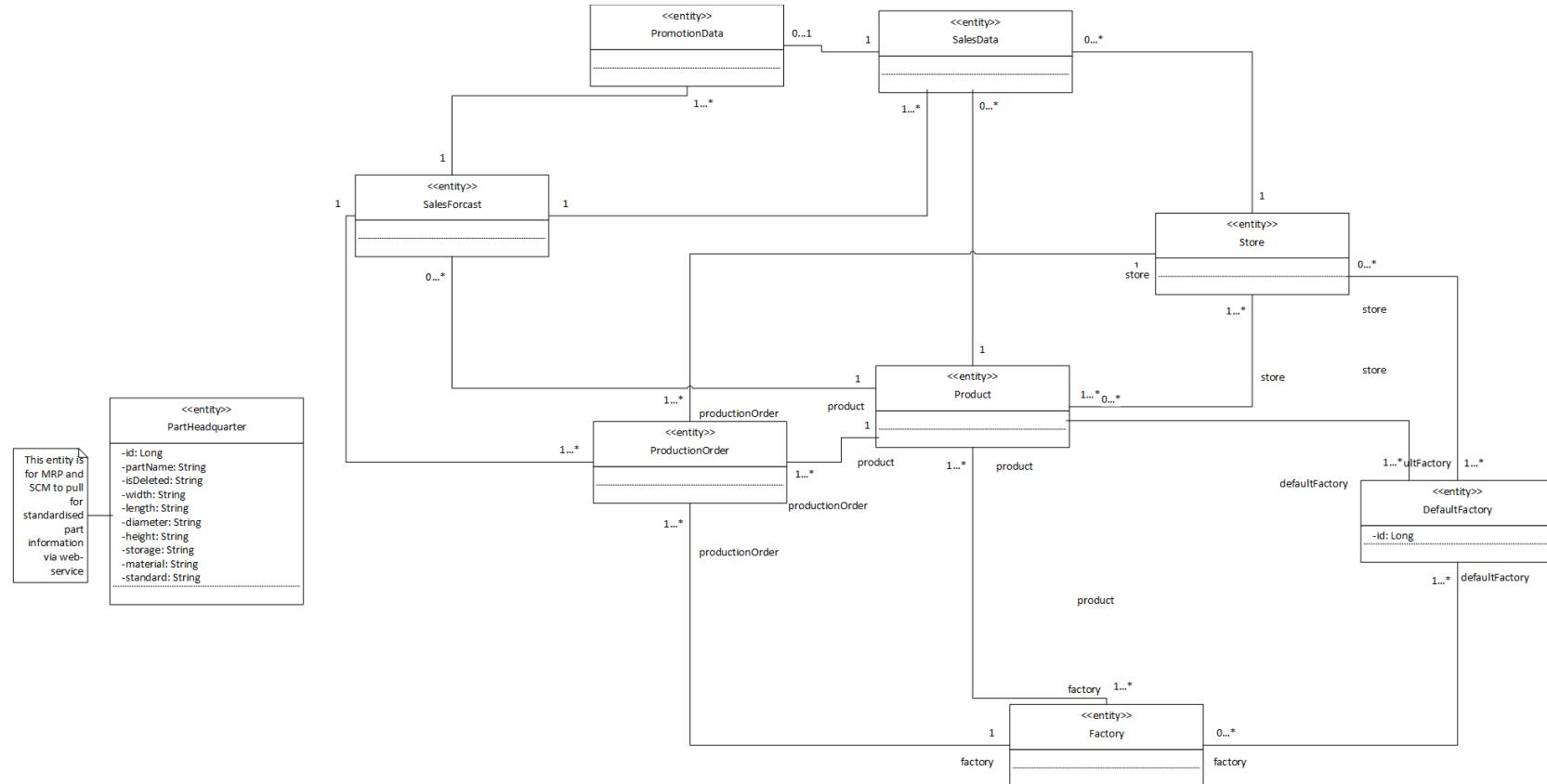
Use Case Name	Add Store
Description	The global HQ admin creates a new store record for each store facility across the globe that is owned by Island Furniture
Actors	Global HQ admin
Triggers	Global HQ admin accesses system to add a new store
Goals	Add a new store record for integrated data flow for demand forecast and relay of production order request
Preconditions	1. User has logged into the system
Postconditions	A new store record has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ol style="list-style-type: none"> 1. User clicks "Create Store" button 2. User enters new store details <ol style="list-style-type: none"> a. Store Name b. Store Location 3. User clicks "Save" button 4. System checks for store name conflicts 5. System saves new store record and returns a success message
Alternative Courses	Nil
Exceptional Courses	<p>4a. Store name conflict detected :</p> <ol style="list-style-type: none"> 1. System pops up warning message 2. Use case terminates

Use Case Description 3

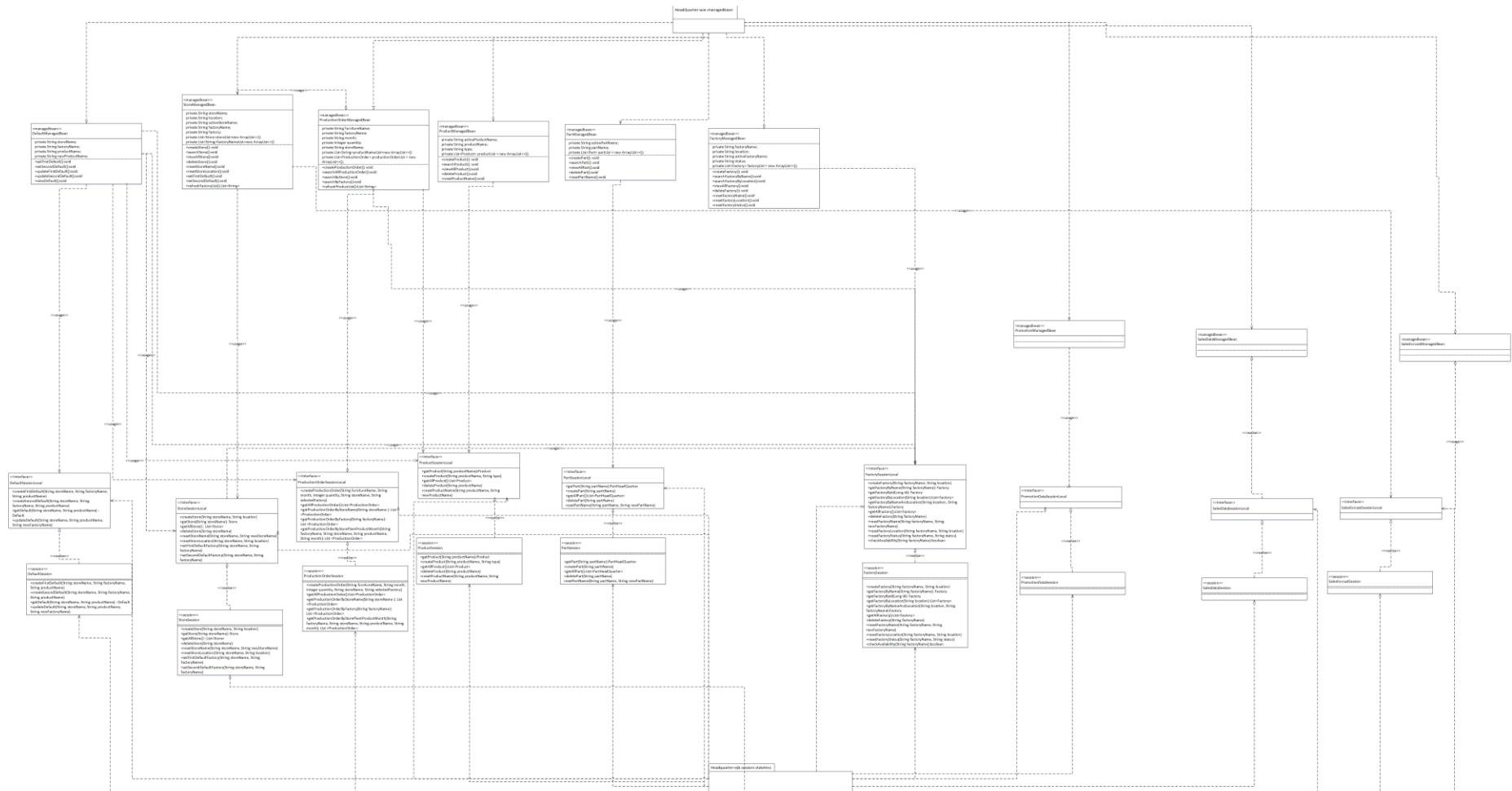
Use Case Name	Add Furniture
Description	The global HQ admin creates a new furniture record for Island Furniture
Actors	Global HQ admin
Triggers	Global HQ admin accesses system to add a new furniture
Goals	Add a new furniture record for integrated data flow and production order relay to each manufacturing facility
Preconditions	1. User has logged into the system
Postconditions	A new goods record has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ol style="list-style-type: none"> 1. User clicks "Create Furniture" button 2. User enters new furniture details <ol style="list-style-type: none"> a. Furniture Name b. Furniture Colour c. Furniture Dimension 3. User clicks "Save" button 4. System checks for furniture name conflicts 5. System saves new furniture record and returns a success message
Alternative Courses	Nil
Exceptional Courses	4a. Furniture name conflict detected : <ol style="list-style-type: none"> 1. System pops up warning message 2. Use case terminates

5.2.2.3 Class Diagram

Entity Class Diagram

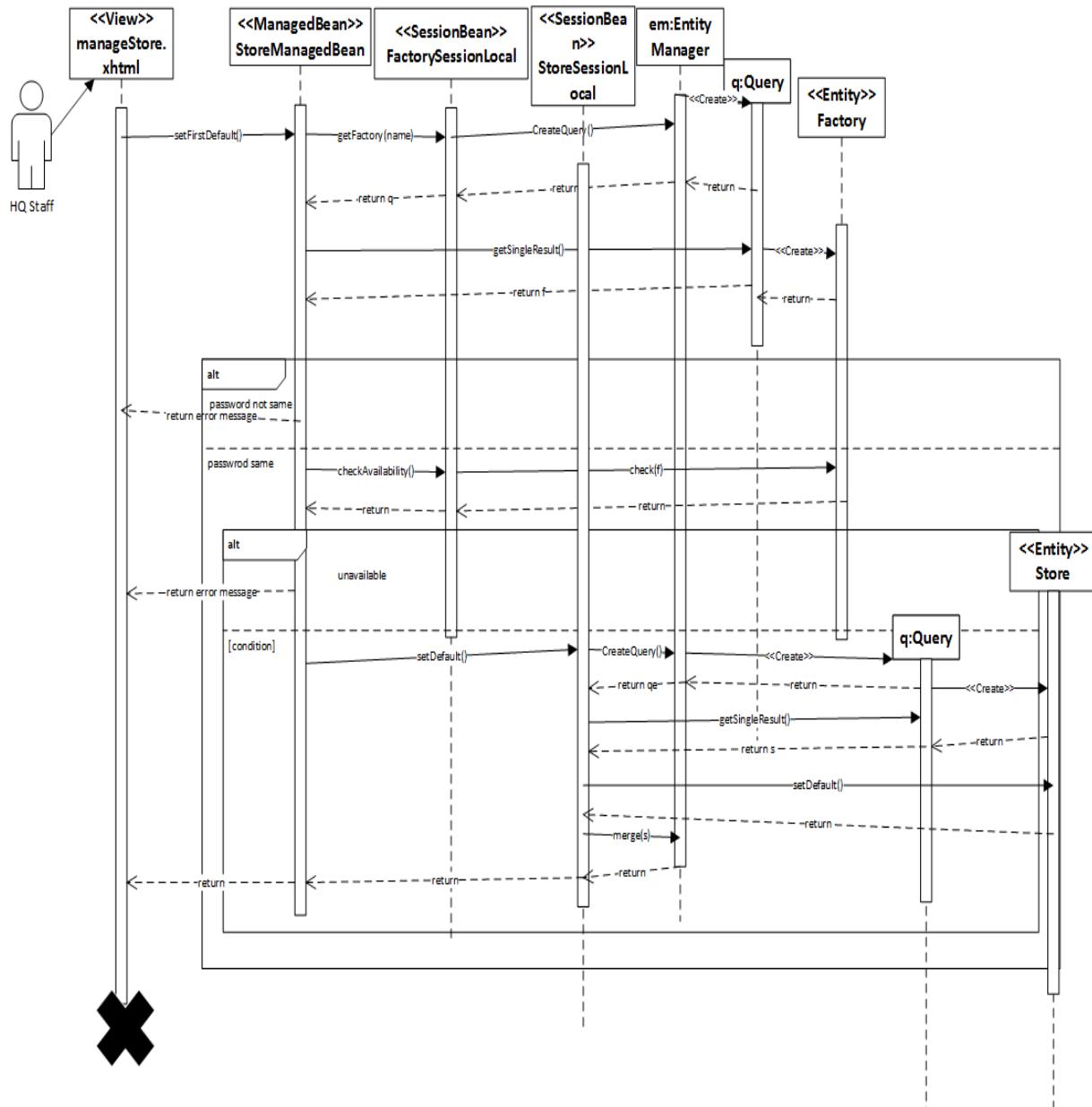


Non-Entity Class Diagram



5.2.2.4 Sequence Diagram

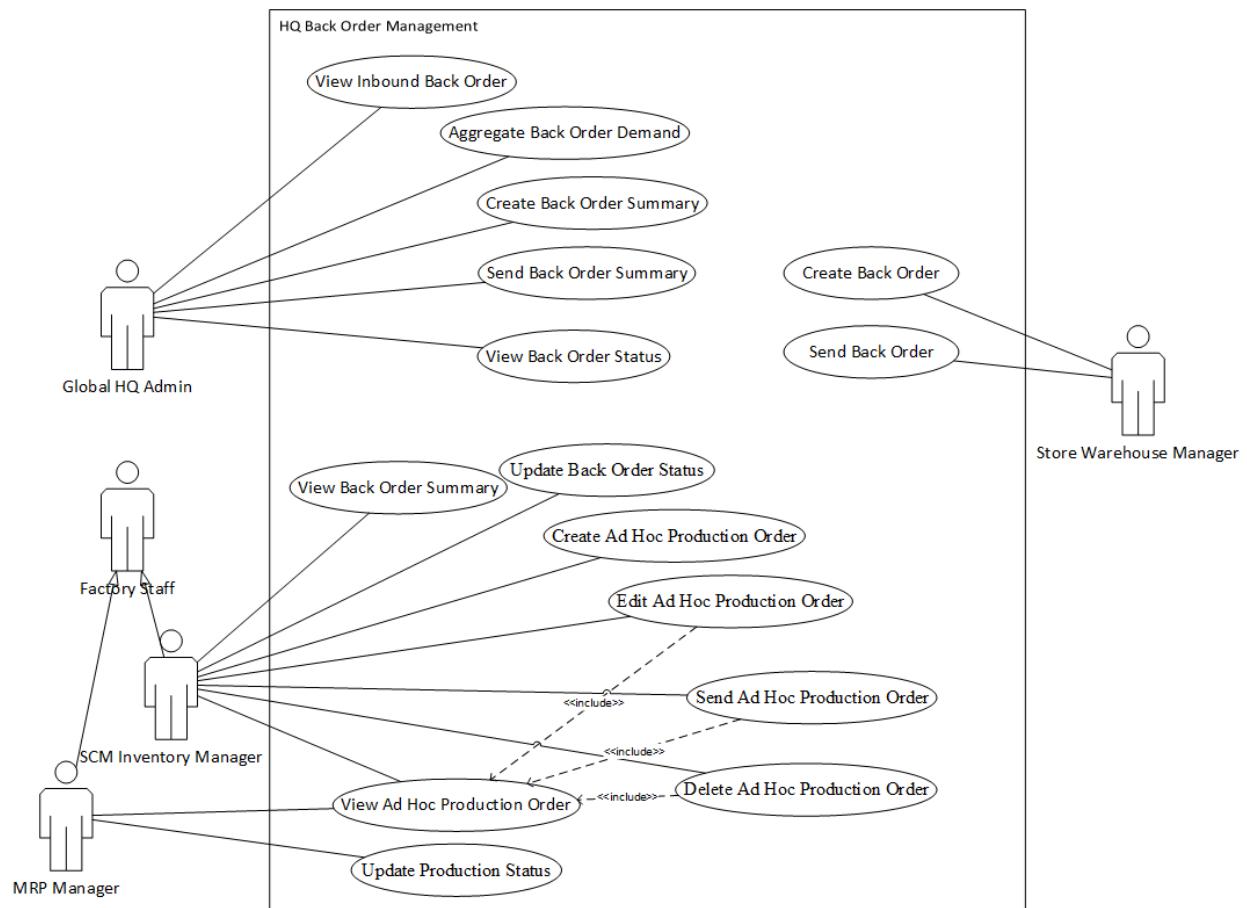
This diagram shows "Set Default Factory" use case.



5.2.3 Ad Hoc Back Order Management Modules

The functional design of B.1 HQ Back Order Management Module, C.1.1 Ad Hoc Production Order Management Module, C.2.7 Back Order Management Module is shown below :

5.2.3.1 Use Case Diagram



5.2.3.2 Use Case Description

Use Case Description 1

Use Case Name	Create Back Order
Description	Store warehouse manager creates a new back order record of the furniture requested to be replenished
Actors	Store warehouse manager
Triggers	Store warehouse manager accesses system to create back order
Goals	A back order record is created to be sent to global HQ
Preconditions	1. User has logged into the system
Postconditions	A new back order record has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ol style="list-style-type: none"> 1. User clicks "Create Back Order" button 2. User fills in the following fields <ol style="list-style-type: none"> a. Furniture Name b. Quantity c. Deadline d. Store Name 3. User clicks "Save" button 4. User needs to verify a confirmation message <ol style="list-style-type: none"> a. If same furniture name has detected by checking furniture names of back orders created within the same day 5. User confirms the creation of a new back order 6. System saves new back order record and returns a success message
Alternative Courses	Nil
Exceptional Courses	Nil

Use Case Description 2

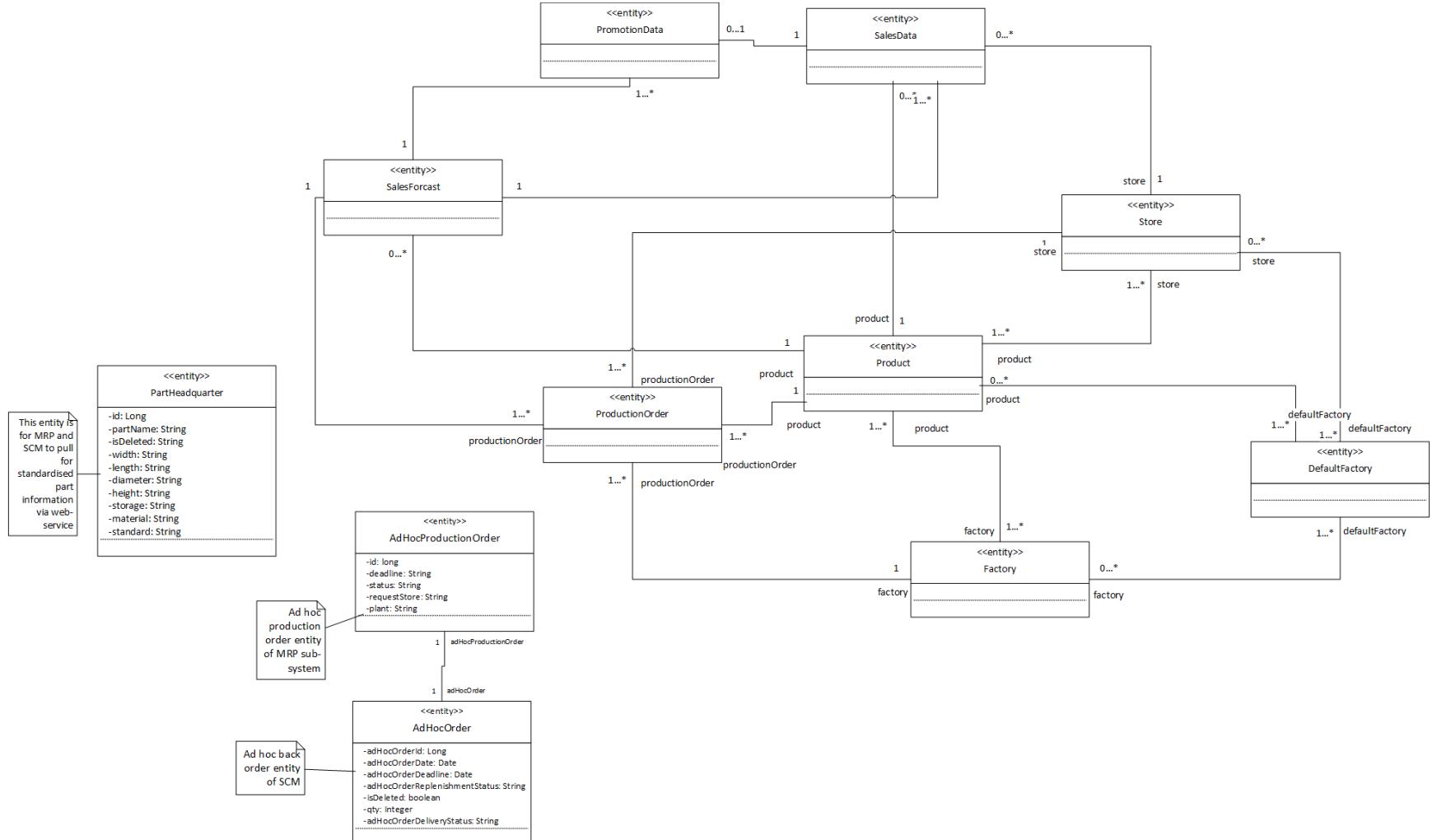
Use Case Name	Create Back Order Summary
Description	The global HQ admin creates a new back order summary record of furniture requested to be replenished
Actors	Global HQ admin
Triggers	Global HQ admin accesses system to create back order summary
Goals	A back order summary record is created
Preconditions	1. User has logged into the system
Postconditions	A new back order summary record has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ol style="list-style-type: none"> 1. User clicks "Create Back Order Summary" button 2. User fills in the following fields <ol style="list-style-type: none"> a. Store Name b. Period 3. User clicks "Next" button 4. System populates the all furniture requested in back order and the aggregated quantities into back order summary fields 5. User verifies the furniture details, quantity and deadline 6. User clicks "Save" button 7. System checks for back order summary conflicts 8. System saves new back order summary record and returns a success message
Alternative Courses	Nil
Exceptional Courses	<p>7a. Same store name and period conflict detected :</p> <ol style="list-style-type: none"> 1. System pops up warning message 2. Use case terminates

Use Case Description 3

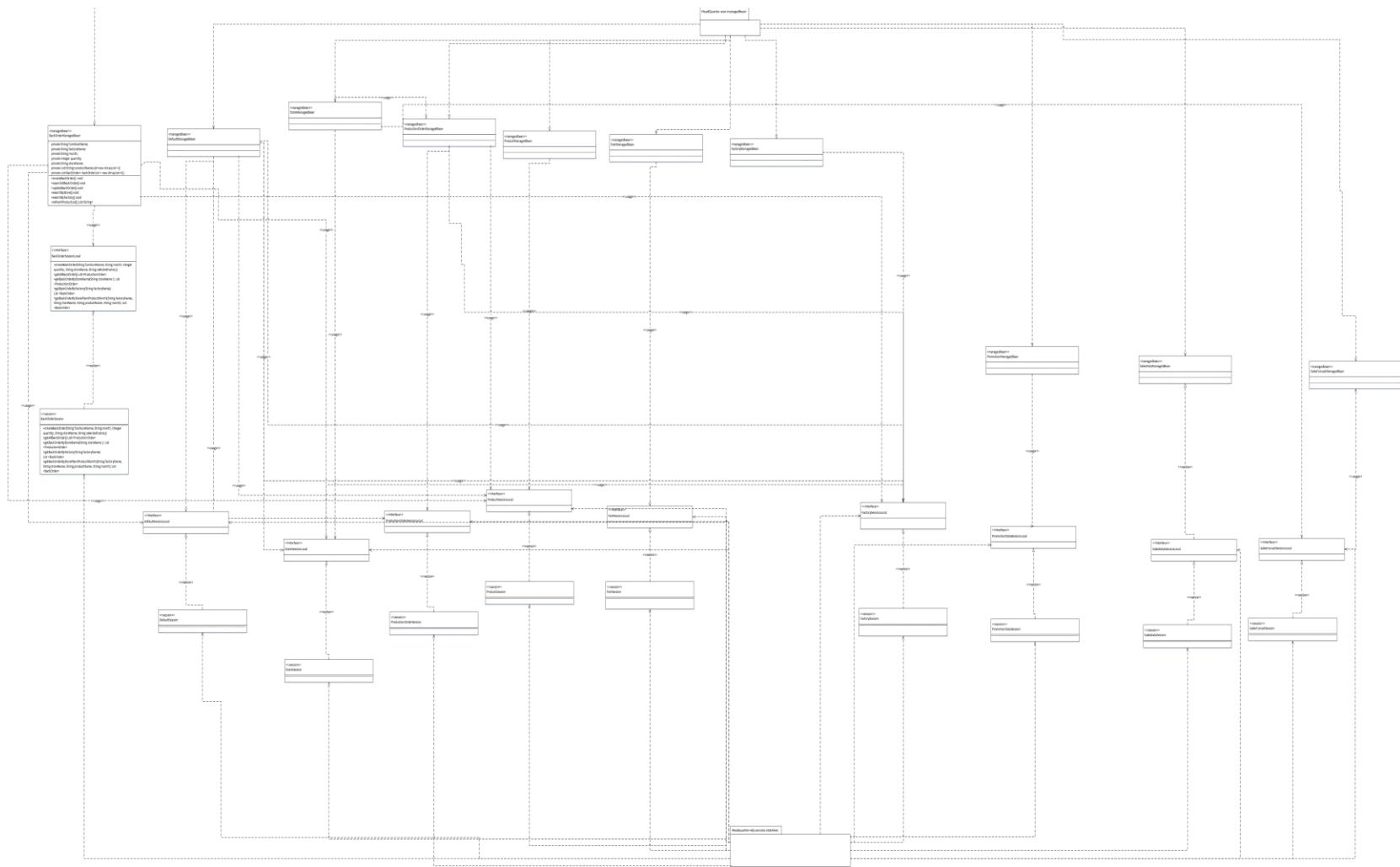
Use Case Name	Create Ad Hoc Production Order
Description	SCM inventory manager creates a new ad hoc production order record for ad hoc replenishment
Actors	SCM inventory manager
Triggers	SCM inventory manager accesses system to create ad hoc production order
Goals	A new ad hoc production order record is created
Preconditions	<ul style="list-style-type: none"> 1. User has logged into the system 2. A inbound back order summary is retrieved
Postconditions	A new ad hoc production order record has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ul style="list-style-type: none"> 1. User clicks "Create Ad Hoc Production Order" button 2. User fills in the following fields <ul style="list-style-type: none"> a. Furniture Name b. Quantity c. Store Name 3. System populates a new ad hoc production order with deadline retrieved from back order summary 4. User verifies the furniture name, quantity, store name and deadline 5. User clicks "Save" button 6. System checks for ad hoc production order conflicts 7. System saves new ad hoc production order record and returns a success message
Alternative Courses	Nil
Exceptional Courses	<p>6a. Same store name, furniture name and deadline conflict detected :</p> <ul style="list-style-type: none"> 1. System pops up warning message 2. Use case terminates

5.2.3.3 Class Diagram

Entity Class Diagram

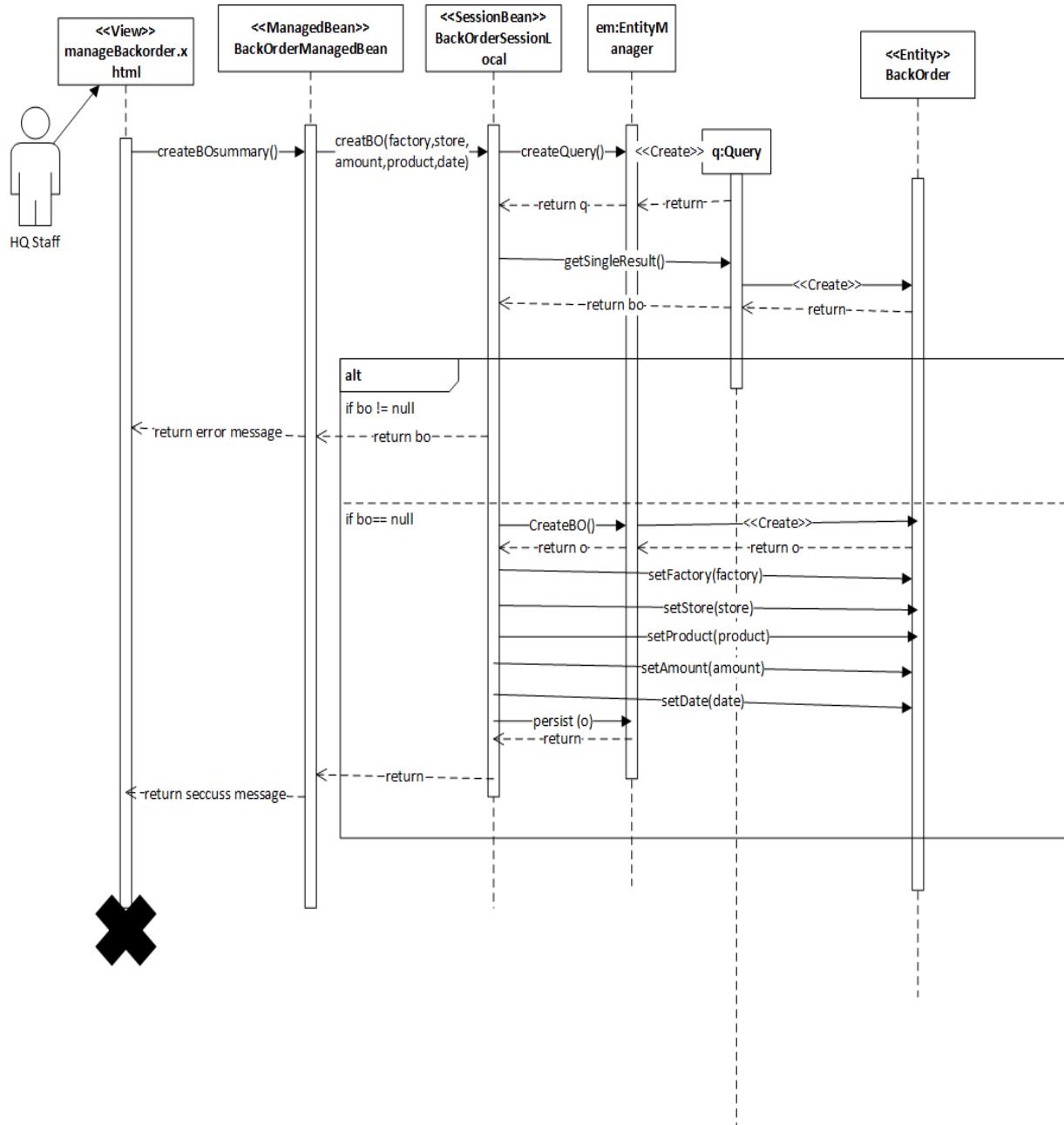


Non-Entity Class Diagram



5.2.3.4 Sequence Diagram

This diagram shows "Create Back Order Summary" use case.

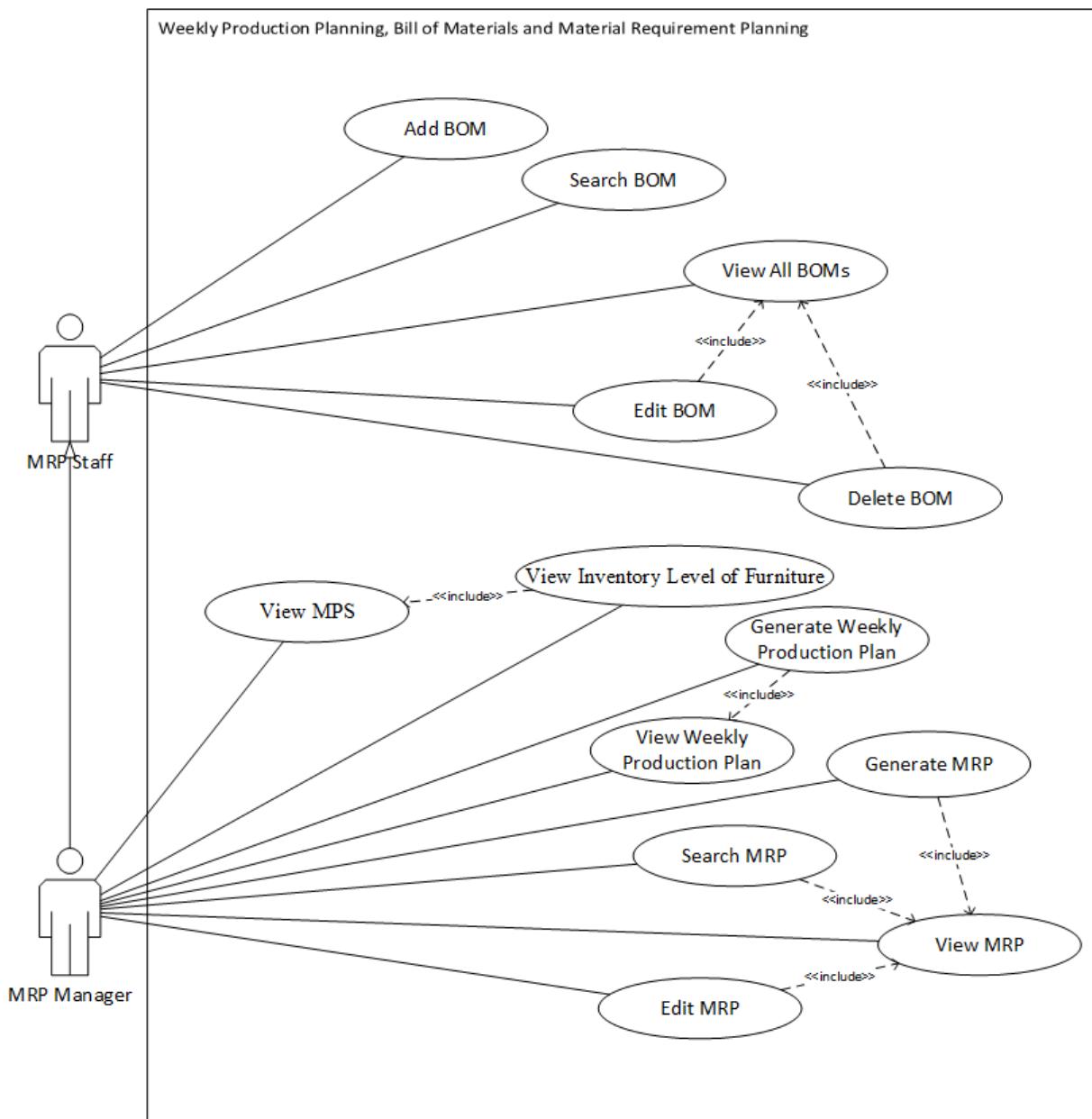


5.3 MRP Sub-system

5.3.1 Weekly Production Planning, Bill of Materials and Materials Requirements Planning Modules

The functional design of C.1.2 Weekly Production Planning Module, C.1.3 Bill Of Materials Module and C.1.4 Materials Requirements Planning Module is shown below

5.3.1.1 Use Case Diagram



5.3.1.2 Use Case Description

Use Case Description 1

Use case Name	Add Bill Of Material (BOM)
Description	MRP Staff adds a new BOM for furniture that the manufacturing site will be producing.
Actors	MRP staff
Triggers	MRP staff accesses the system to add new BOM.
Goals	Add a new BOM to the system record with no duplicated copies present in the system.
Pre-conditions	<ol style="list-style-type: none"> 1. MRP staff login to the system. 2. Staff has the access right to update new BOM. 3. Material to be added to the BOM has been decided. 4. List of furniture and parts are loaded into system.
Post-conditions	<ol style="list-style-type: none"> 1. New BOM added successfully to the system without any duplicated copies.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. MRP staff clicks ‘Add BOM’. 2. MRP staff enters in the details of BOM: <ol style="list-style-type: none"> i. Furniture ii. Part iii. Quantity 3. MRP staff clicks ‘Add’. 4. System updates the database with this new BOM. 5. System displays BOM record for furniture successfully added.
Alternative Courses	<p>2a. If the furniture does not exist within the database:</p> <ol style="list-style-type: none"> 1. System prompts staff to key in a valid name for furniture. 2. Staff keys in a valid name. 3. Continue at step 2ii.

	<p>2b. If a part does not exist within the database:</p> <ol style="list-style-type: none"> 1. System prompts staff to key in a valid name for part. 2. Staff keys in a valid name. 3. Continue at step 2iii.
Exceptional courses	<p>4a. If system verifies that there is a duplicated record present in the database:</p> <ol style="list-style-type: none"> 1. System prompts user that update is unsuccessful due to duplicated record. 2. Use case terminates.

Use Case Description 2

Use case Name	View Master Production Schedule (MPS)
Description	Manufacturing Resource Planning (MRP) staff views the monthly MPS for furniture sent from HQ to the manufacturing sites.
Actors	MRP staff
Triggers	MRP staff accesses system to view the monthly MPS.
Goals	Views the MPS for furniture stored in the system.
Pre-conditions	<ol style="list-style-type: none"> 1. Monthly MPS for different furniture loaded into the system. 2. MRP staff login to the system.
Post-conditions	<ol style="list-style-type: none"> 1. Monthly MPS successfully retrieved from the system. 2. System displays the MPS report together with the inventory level of the requested furniture.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. MRP staff clicks on ‘view MPS’. 2. MRP staff enters MPS detail: <ol style="list-style-type: none"> i. Furniture name ii. Time 3. MRP staff clicks ‘view’.

	<p>4. System accesses the database.</p> <p>5. System displays the monthly MPS and inventory level of the furniture.</p>
Alternative Courses	<p>2a. If the furniture name entered is not stored in the database:</p> <ol style="list-style-type: none"> 1. The system prompts that there is no such production schedule being sent from HQ. 2. MRP staff enters in a new furniture name that is found within the database. 3. Continue at step 2ii. <p>2b. If the time is entered in the wrong format:</p> <ol style="list-style-type: none"> 1. The system prompts that there is formatting error. 2. MRP staff enters in a new time period in the right format. 3. Continue at step 3.
Exceptional courses	

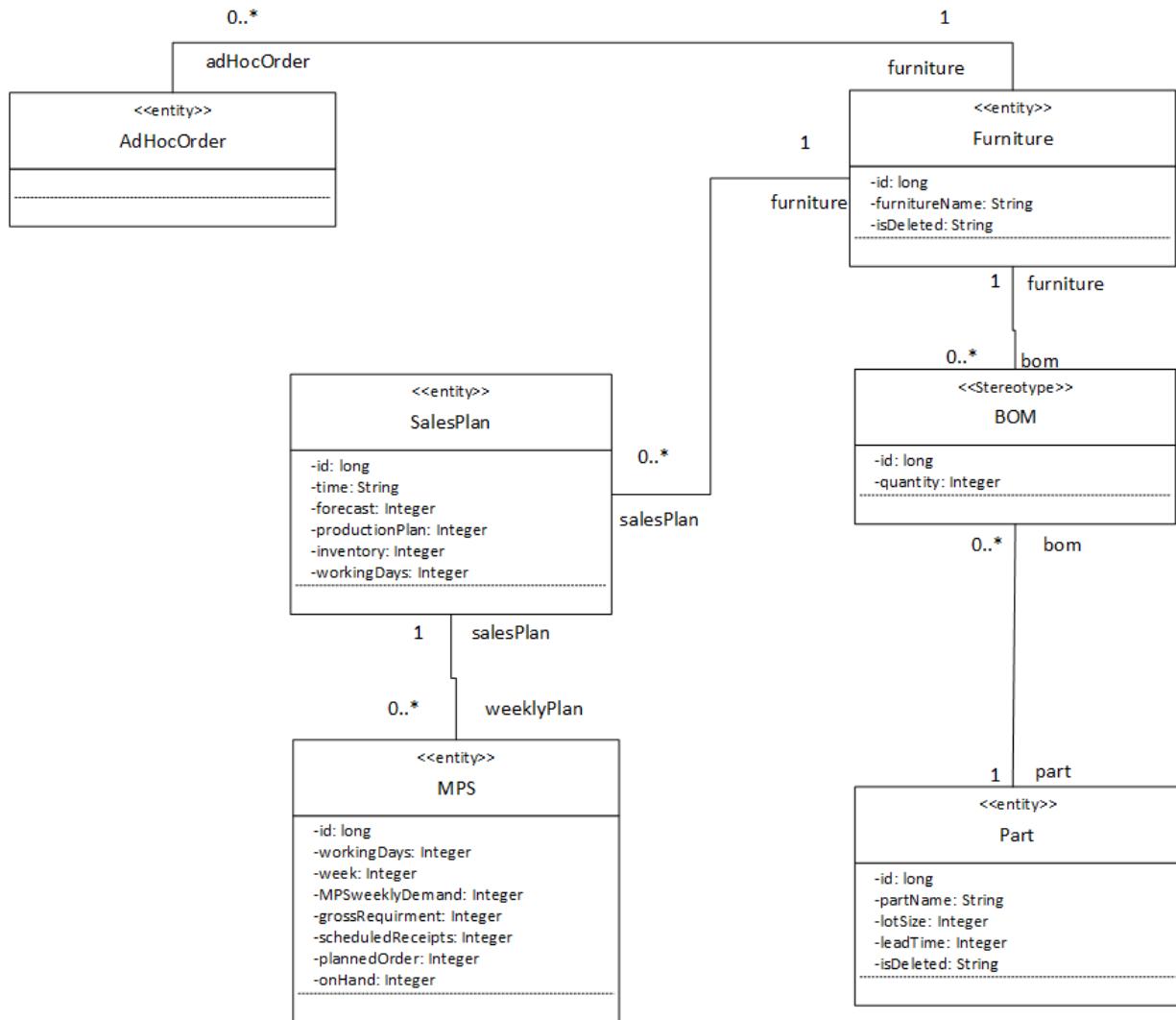
Use Case Description 3

Use case Name	Generate Materials Requirements Planning (MRP)
Description	Manufacturing Resource Planning staff uses the system to generate the Material Requirement Planning from the Weekly Production Plan, which was derived from the Master Production Schedule created in HQ. The MRP will be used by the manufacturing site to manage its' materials requisition from the supplier.
Actors	Manufacturing Resource Planning Manager
Triggers	User accesses system to generate the Materials Requirements Plan after the Weekly Production Plan had been scheduled.
Goals	Generate MRP report using the Weekly Production Plan.
Pre-conditions	<ol style="list-style-type: none"> 1. User has the access right to generate the MRP. 2. User login to the system.

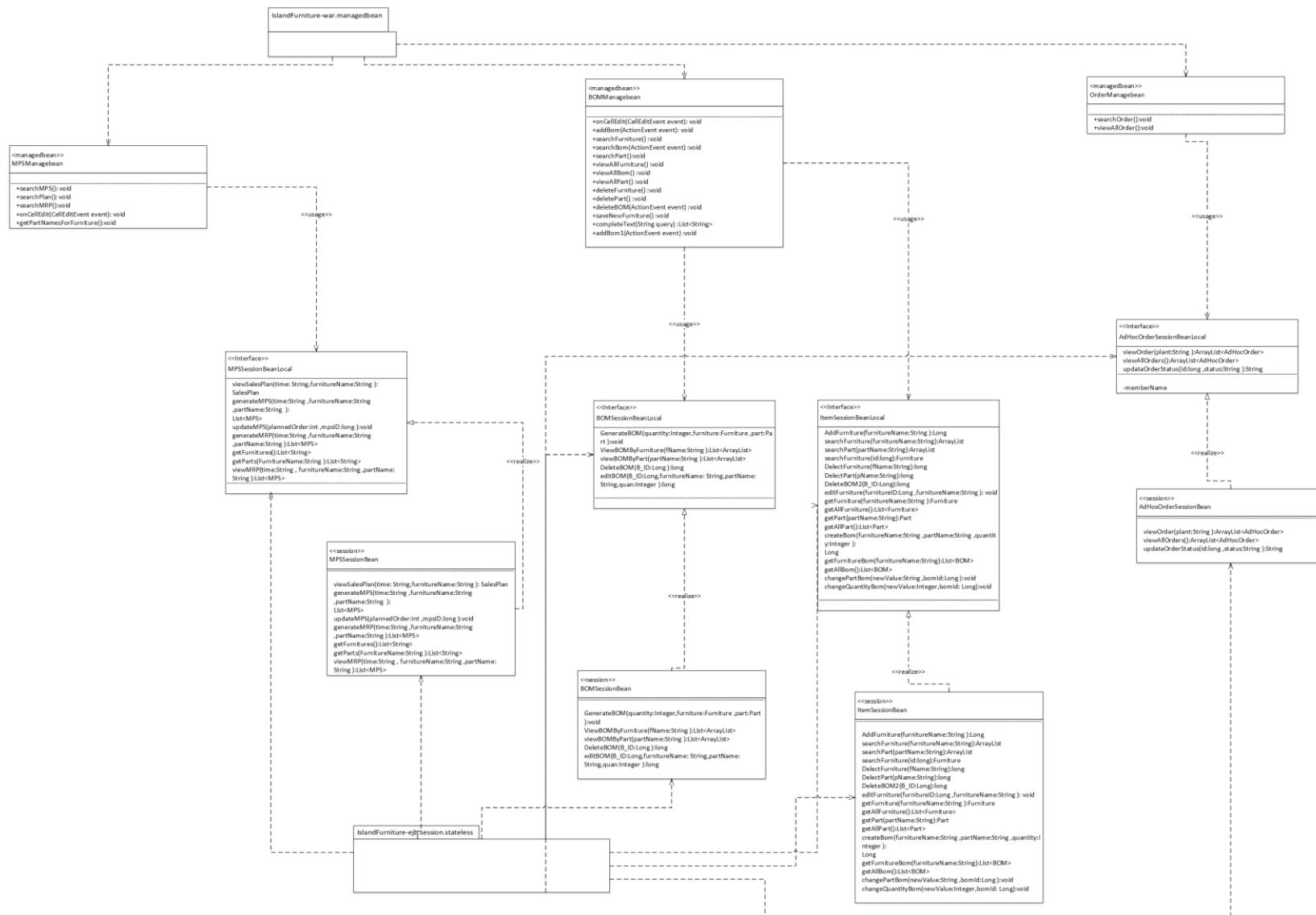
	<ul style="list-style-type: none"> 3. List of furniture and its' BOM loaded into the system. 4. Manufacturing site has received the Master Production Schedule from HQ. 5. The Weekly Production Plan was loaded in the system.
Post-conditions	<ul style="list-style-type: none"> 1. MRP report successfully generated and display.
Extension points	
Basic Course	<ul style="list-style-type: none"> 1. Include (View MRP). 2. User clicks 'Manage MRP'. 3. User fills in the required fields to generate the MRP: <ul style="list-style-type: none"> I. Furniture Name II. Part Name III. Time 4. User clicks on 'Generate Weekly MRP'. 5. System accesses the necessary information in the database. 6. System computes the weekly MRP through the information retrieved from the database. 7. System displays the weekly MRP in a table.
Alternative Courses	<p>3a. If the time is entered in the wrong format:</p> <ul style="list-style-type: none"> 1. The system prompts that there is a formatting error. 2. User enters in a new time period in the right format. 3. Continue at step 4.
Exceptional courses	

5.3.1.3 Class Diagram

Entity Class Diagram

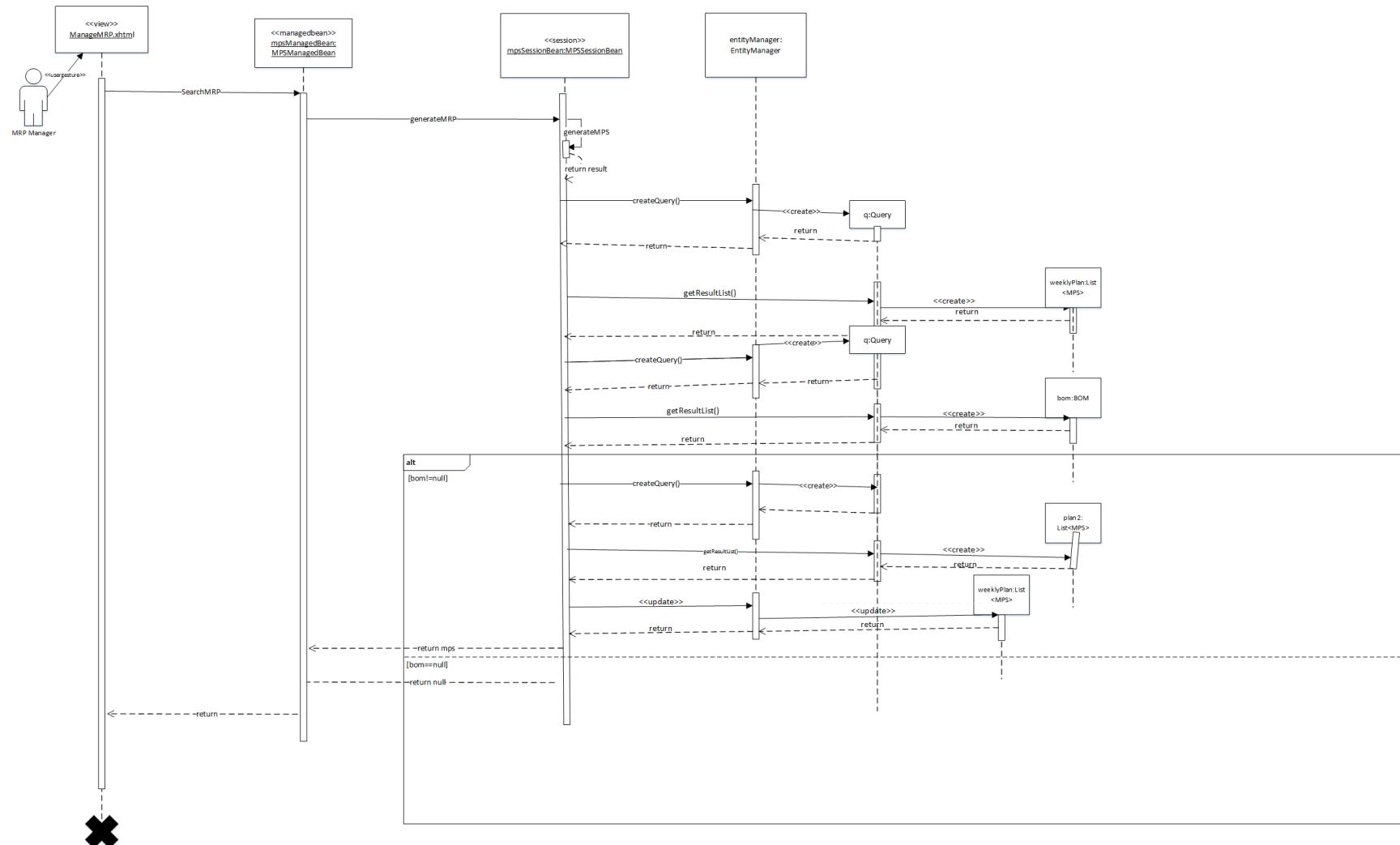


Non-Entity Class Diagram



5.3.1.4 Sequence Diagram

This diagram shows "Generate MRP" use case.

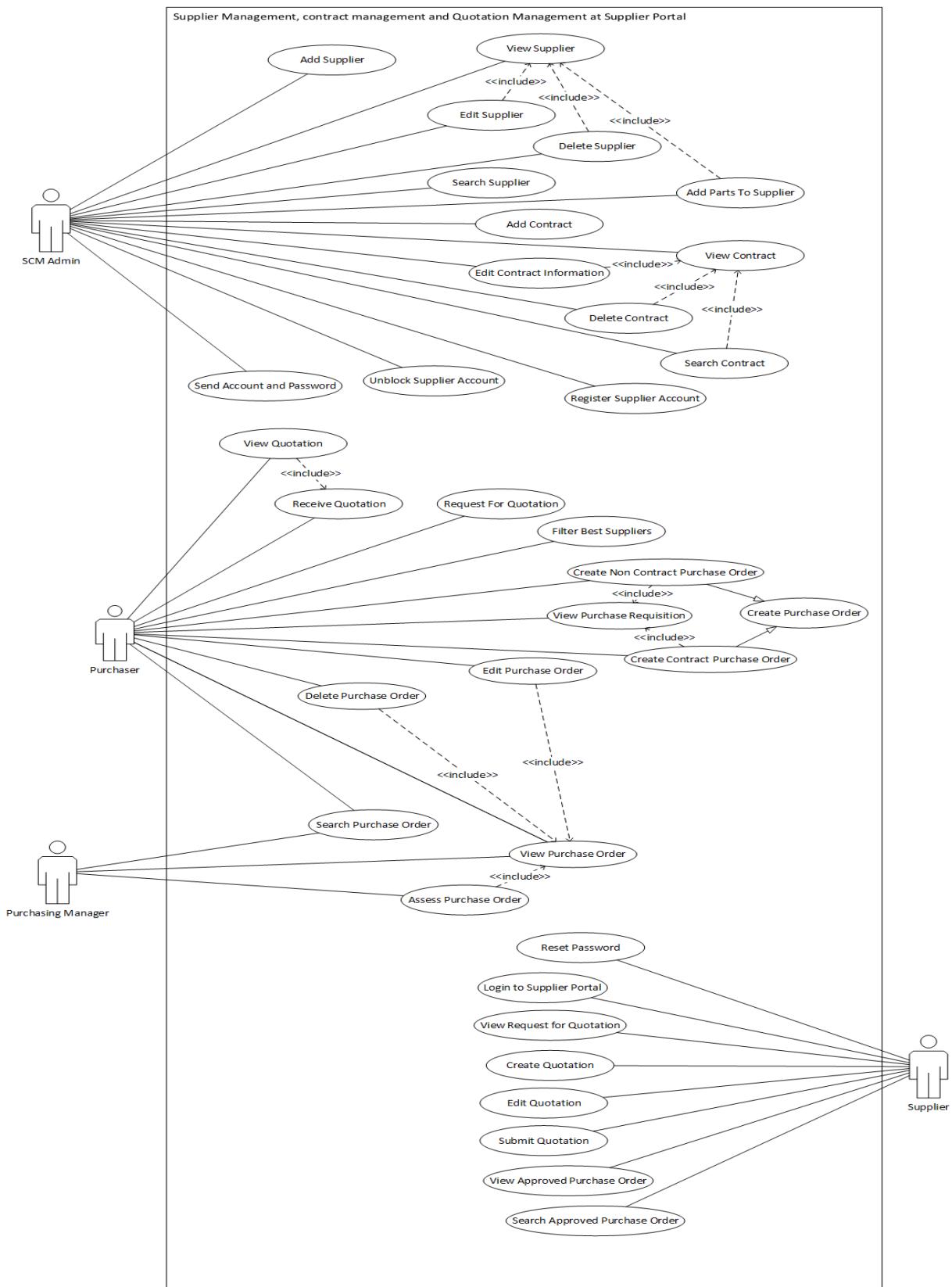


5.4 SCM Sub-system

5.4.1 Procurement, Supplier Management, Contract Management and Supplier Portal Modules

The functional design of C.2.1 Procurement Module, C.2.2 Supplier Management Module, C.2.5 Contract Management Module and C.2.6 Supplier Portal Module is shown below :

5.4.1.1 Use Case Diagram



5.4.1.1 Use Case Description

Use Case Description 1

Use case Name	Add Supplier
Description	A SCM staff wants to update the supplier's record with a new supplier of parts. The system will be updated with all the essential information of the supplier such as address, contact (mobile, fax telephone), supplier name, contact person and email address.
Actors	SCM staff
Triggers	Staff accesses the system to add detail of a new supplier of parts to the database.
Goals	Add a new supplier of parts to the record
Pre-conditions	<ol style="list-style-type: none"> 1. SCM staff must have a registered account. 2. SCM staff must log in to the system. 3. SCM staff must have the authority to insert in new suppliers to the system.
Post-conditions	<ol style="list-style-type: none"> 1. Supplier detail successfully saved. 2. System displays the new supplier record.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. SCM staff clicks on “Add Supplier”. 2. SCM staff enters new supplier detail: <ol style="list-style-type: none"> i. Supplier name ii. Supplier Address iii. Telephone Number iv. Contact Person v. Mobile Number vi. Fax Number vii. Email Address 3. SCM staff clicks on “save”. 4. System updates the record into the database.

	<p>5. System displays the new supplier record.</p>
Alternative Courses	<p>2a. If Supplier name exists in the database:</p> <ol style="list-style-type: none"> 1. System will prompt that supplier with the same name already exist in the database. 2. Staff re-enters a name that is not recorded in the database. 3. Continue at step 2ii. <p>2b. If address key in is less than 4 letter:</p> <ol style="list-style-type: none"> 1. System will prompt staff to key in a longer address. 2. Staff re-enters a longer address. 3. Continue at step 2iii. <p>2c. If staff keys in alphabets:</p> <ol style="list-style-type: none"> 1. System does not allow any alphabets to be entered. 2. Staff enters in numbers. 3. Continue at step 2iv. <p>2d. If staff enters in more or less than 8 digits:</p> <ol style="list-style-type: none"> 1. System prompts staff that the length is wrong. 2. Staff enters in an 8 digits number. 3. Continue at step 2iv. <p>2e. If the name of contact person entered is less than 4 letters:</p> <ol style="list-style-type: none"> 1. System will prompt the staff to key in a longer name. 2. Staff enters in a longer name. 3. Continue at step 2v. <p>2f. If staff keys in alphabets:</p> <ol style="list-style-type: none"> 1. Repeat step 2c.1 and 2c.2. 2. Continue at step 2vi.

	<p>2g. If staff enters in more or less than 8 digits:</p> <ol style="list-style-type: none"> 1. Repeat step 2d.1 and 2d.2 2. Continue at step 2vi. <p>2h. If staff keys in alphabets:</p> <ol style="list-style-type: none"> 1. Repeat step 2c.1 and 2c.2. 2. Continue at step 2vii. <p>2i. If staff enters in more or less than 8 digits:</p> <ol style="list-style-type: none"> 1. Repeat step 2d.1 and 2d.2 2. Continue at step 2vii. <p>2j. If staff enters in the wrong email format:</p> <ol style="list-style-type: none"> 1. System prompts user to enter his/her email in the right format. 2. Staff enters in the right email. 3. Continue at step 3. <p>3a. If any of the required fields are not filled:</p> <ol style="list-style-type: none"> 1. System will highlight the field in red. 2. Go back to step 2. 3. Staff fills up these required fields. 4. Continue at step 3.
Exceptional courses	

Use Case Description 2

Use case Name	Add Contract
Description	Manufacturing site wants to establish a long-term business relationship with a supplier of parts through signing of contract. The relationship will persist until the contract expires.

Actors	SCM Staff
Triggers	Staff accesses the system to add a new contract
Goals	Add a new contract with a logical valid date range
Pre-conditions	<ol style="list-style-type: none"> 1. Contract terms and effective start and end date of the contract are settled with supplier. 2. Staff has the authority to add new contract to the database. 3. Staff login to the system. 4. System has a record of all the parts that the supplier is supplying to the manufacturing site.
Post-conditions	<ol style="list-style-type: none"> 1. New contract added successfully to the system with a valid range of effectual binding date. 2. At any point of time, System only allows contract of a part to be formed with one supplier.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Staff clicks on “Add Contract”. 2. Staff enters new contract details: <ul style="list-style-type: none"> a. Start date b. End date c. Supplier d. Part e. Unit price f. Remark 3. Staff clicks on “Create Contract”. 4. System validates the input. 5. System updates the new contract into the database. 6. System displays contract successfully created.
Alternative Courses	<p>4a. If start date is before current date:</p> <ol style="list-style-type: none"> 1. System prompts that start date must be after current date. 2. Proceed back to step 2. 3. Staff enters in a new date.

	<p>4. Continue at step 3.</p> <p>4b. If end date is the same as or before the start date:</p> <ol style="list-style-type: none"> 1. System prompts that the end date must be after the start date. 2. Proceed back to step 2. 3. Staff enters in a new date. 4. Continue at step 3. <p>4c. If unit price entered is not a number or it's entered without a currency sign:</p> <ol style="list-style-type: none"> 1. System prompts of format error. 2. Proceed back to step 2. 3. Staff enters the right value in the right format. 5. Continue at step 3.
Exceptional courses	<p>4c. If the selected part has another contract with another supplier:</p> <ol style="list-style-type: none"> 1. System prompts that contract with another supplier already exists. 2. Use case terminates.

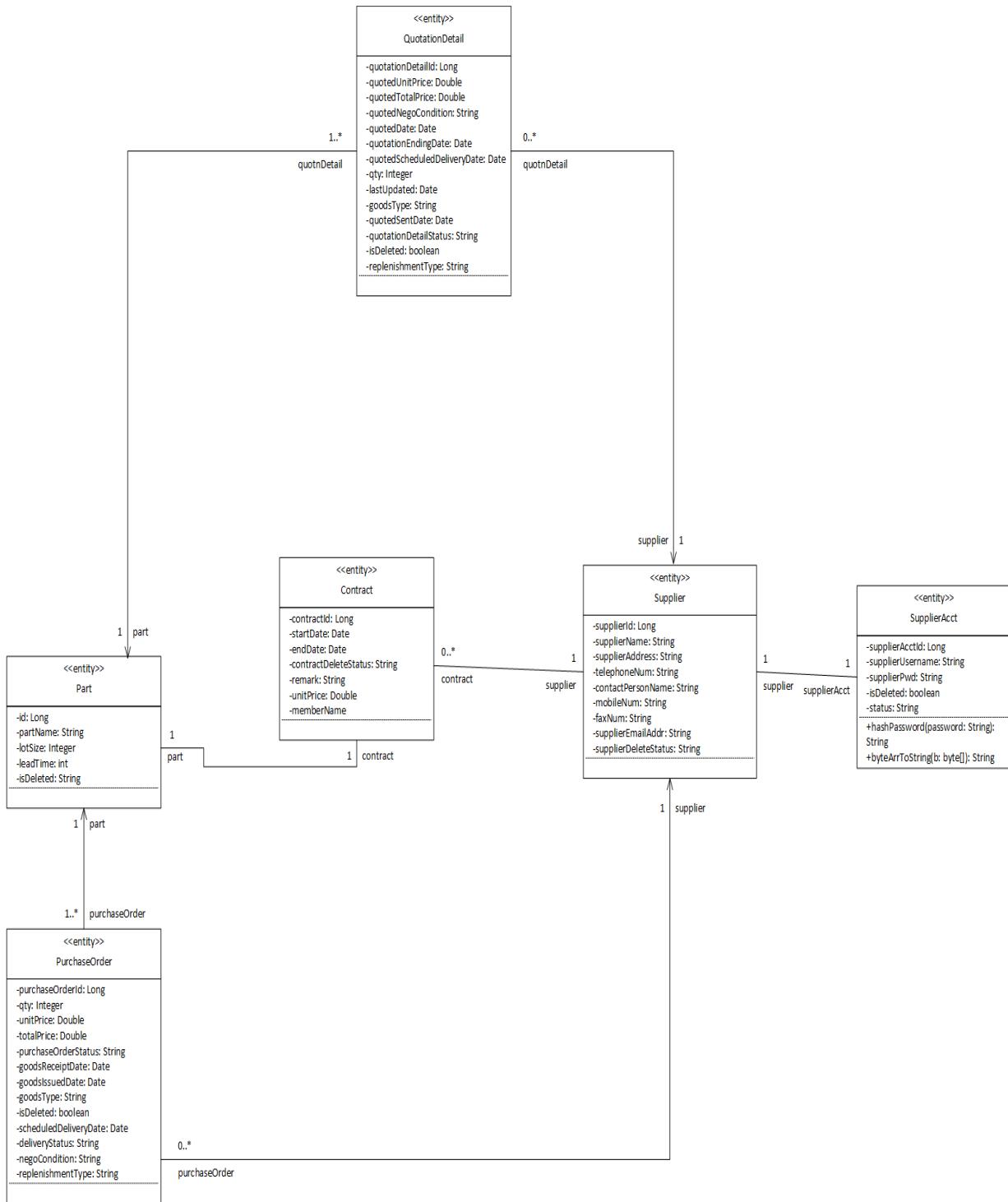
Use Case Description 3

Use case Name	Add Parts to Supplier
Description	There are new parts to be supplied by a supplier. SCM staff wants to store the information into the system to keep a record of it.
Actors	SCM Staff
Triggers	User accesses the system to add parts to a supplier.
Goals	Add parts to a supplier.
Pre-conditions	1. Suppliers' information loaded into the system.

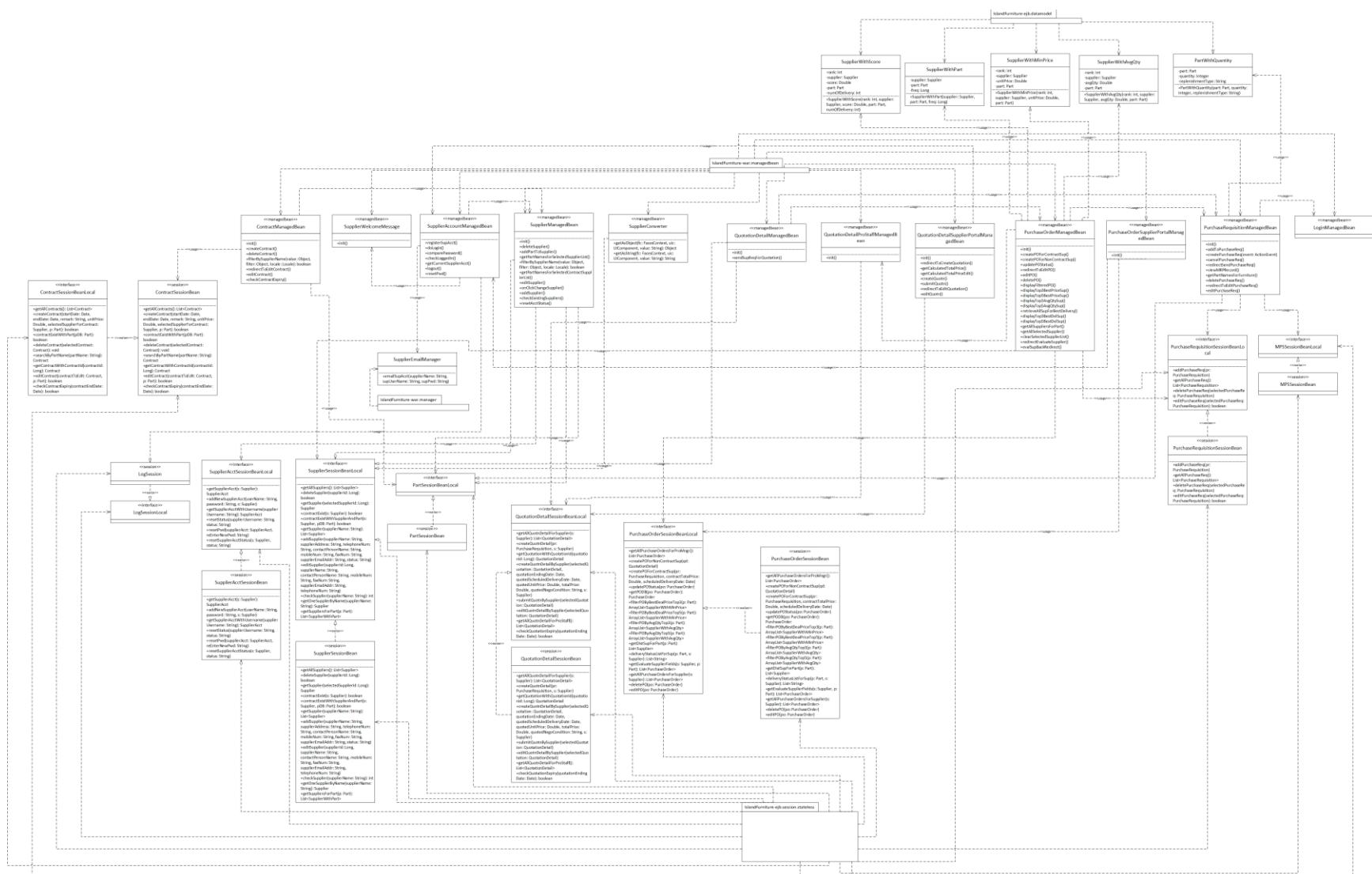
	<ol style="list-style-type: none"> 2. List of parts needed by the manufacturing site loaded into the system. 3. SCM staff login to the system. 4. Only one supplier can be added at a time. 5. Multiple suppliers may supply for the same part.
Post-conditions	<ol style="list-style-type: none"> 1. Parts successfully added to a supplier. 2. System prompts of successful addition.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Include (View Supplier). 2. User clicks ‘Add Parts to Supplier’. 3. System displays a drop down list of suppliers stored in the database. 4. User selects a supplier. 5. System displays a drop down list of all parts stored in the database. 6. User selects parts to be added under the supplier. 7. User clicks ‘Add part to Supplier’. 8. System updates parts under the supplier in the database. 9. System displays update successful.
Alternative Courses	<p>7a. If any of the parts chosen had already been added to the supplier:</p> <ol style="list-style-type: none"> 1. System will display an error message to prompt that part already exists. 2. Return to step 5. 3. User selects parts that are new to the supplier. 4. Continue at step 7.
Exceptional courses	

5.4.1.2 Class Diagram

Entity Class Diagram

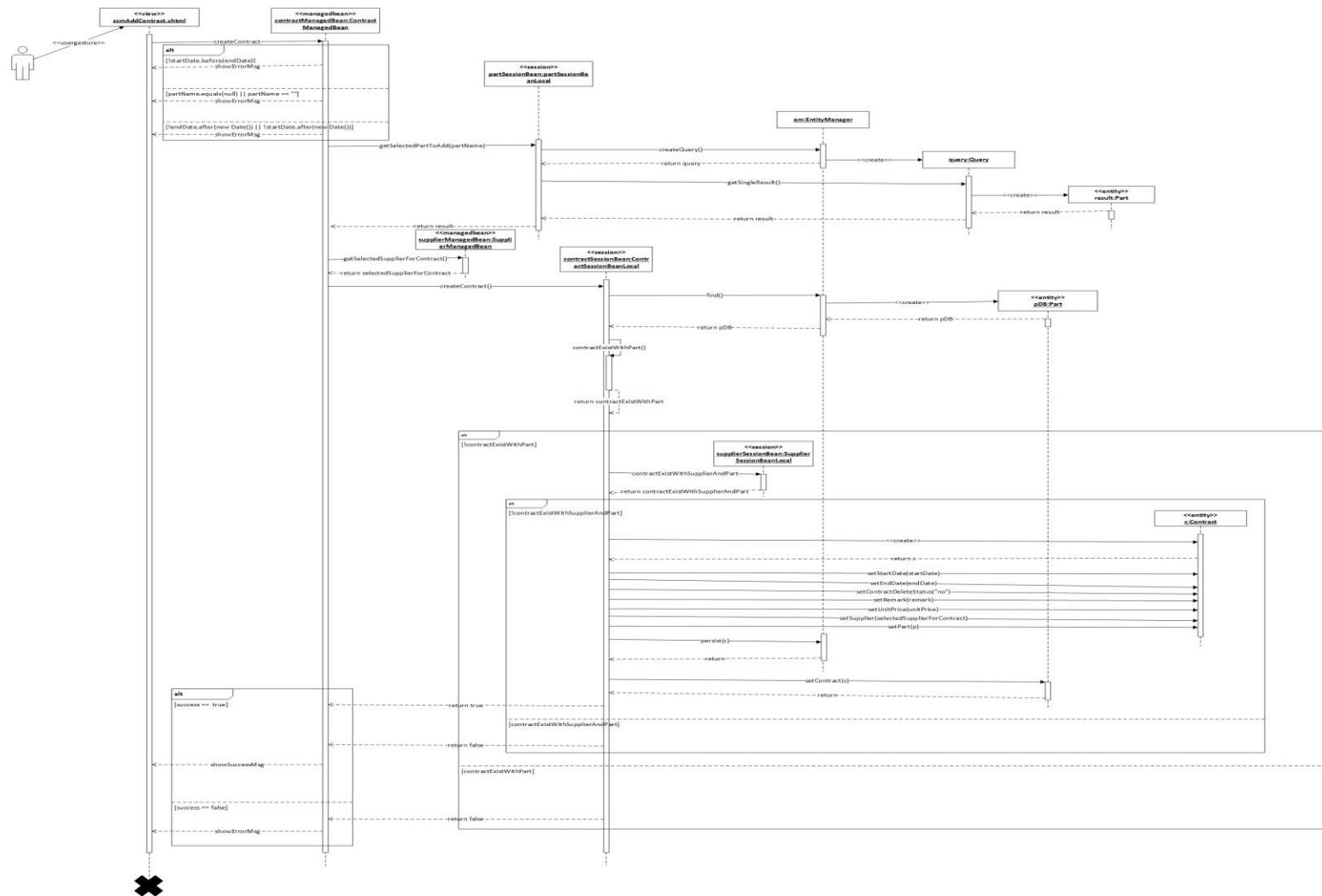


Non-Entity Class Diagram



5.4.1.3 Sequence Diagram

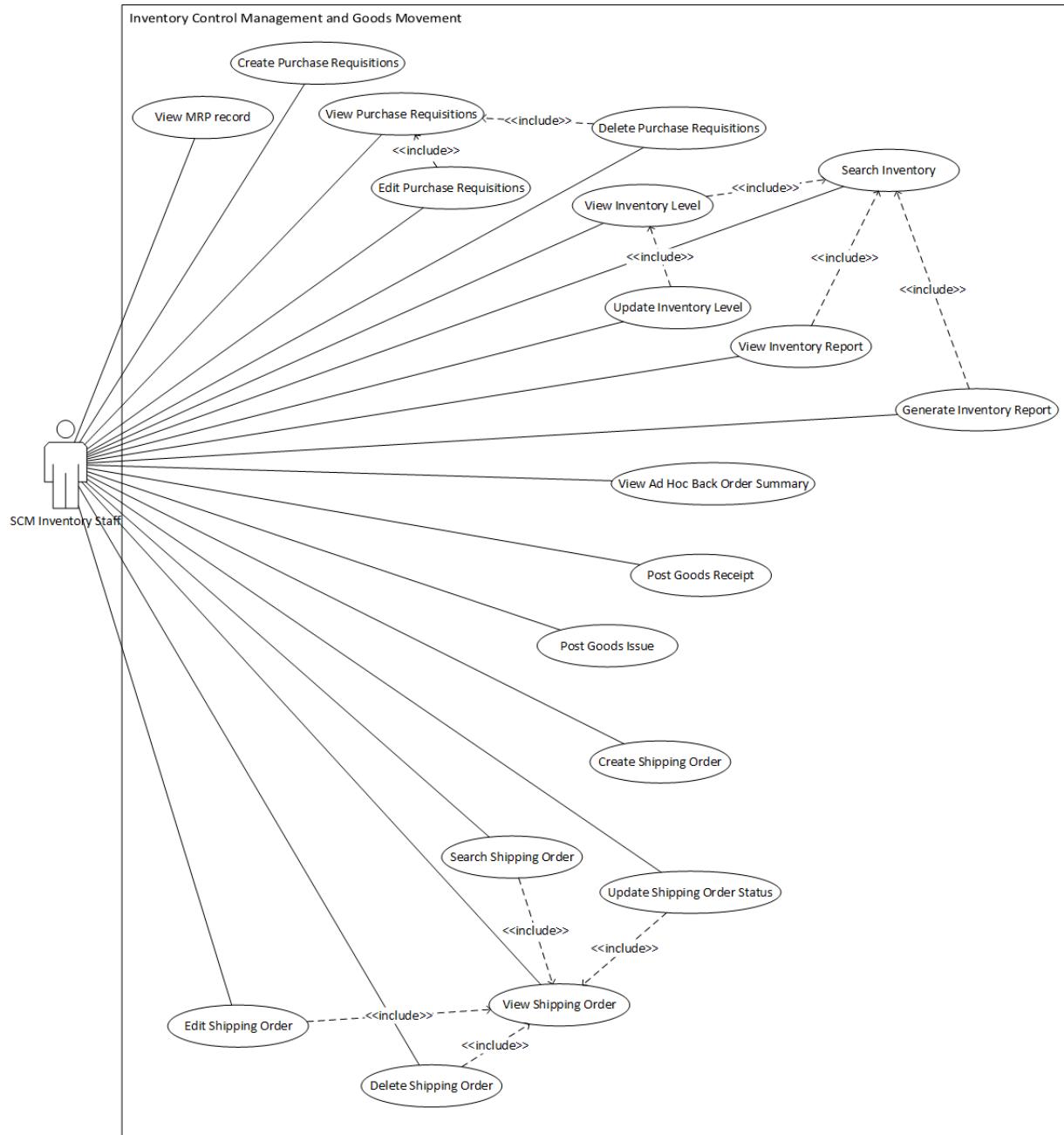
This diagram shows "Add Contract" use case.



5.4.2 Inventory Control and Goods Movement Modules

The functional design of C.2.3 Inventory Control Module and C.2.4 Goods Movement Module is shown below :

5.4.2.1 Use Case Diagram



5.4.2.2 Use Case Description

Use Case Description 1

Use case Name	Update Inventory Level
Description	SCM inventory staff wants to update the level of inventory at the manufacturing site in accordance to the level of stock they have.
Actors	SCM inventory staff
Triggers	SCM inventory staff access the system to update the inventory level
Goals	Update the new stock level of the inventory at the manufacturing site
Pre-conditions	<ol style="list-style-type: none"> 1. SCM inventory staff has already confirmed the level of inventory stock and is ready to insert into the database. 2. SCM inventory staff has the access right to make changes to the old stock level. 3. SCM inventory staff login to the system. 4. List of inventories loaded into the system.
Post-conditions	<ol style="list-style-type: none"> 1. New inventory level successfully updated to the system. 2. User able to view the new updated inventory level.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Include (View Inventory Level). 2. Staff selects the inventory to be updated. 3. Staff clicks on the 'View Inventory' button. 4. System prompts the user to enter in the quantity amount to be updated. 5. Staff enters in the quantity. 6. Staff clicks 'update'. 7. System updates the new quantity into the database. 8. System displays the new quantity amount of the selected inventory in the table.
Alternative Courses	

Exceptional courses	
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Use Case Description 2

Use case Name	Search Inventory
Description	Staff wants to access an inventory in the database to check it's details and manage the inventory.
Actors	SCM inventory staff
Triggers	SCM inventory staff logs in to the system to search for an inventory.
Goals	Retrieve information of the desired inventory according to the name entered.
Pre-conditions	<ol style="list-style-type: none"> 1. User login to the system. 2. List of inventories loaded into system.
Post-conditions	1. Information of requested inventory returned successfully to the user.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User enters the name of the inventory. 2. System accesses the database. 3. System filters the database for the inventory with the name entered. 4. System displays the result from the filtering process. 5. User access the results displayed.
Alternative Courses	<p>1a. If user entered a string that is part of an inventory's name:</p> <ol style="list-style-type: none"> 1. System accesses the database. 2. System filters the database for a list of inventories containing the string entered. 3. Continue at step 4.
Exceptional courses	<p>4a. If no inventories contain the specified inventory name or the specified string entered:</p> <ol style="list-style-type: none"> 1. System displays that the database contains no such

	<p>inventory.</p> <p>2. Use case terminates.</p>
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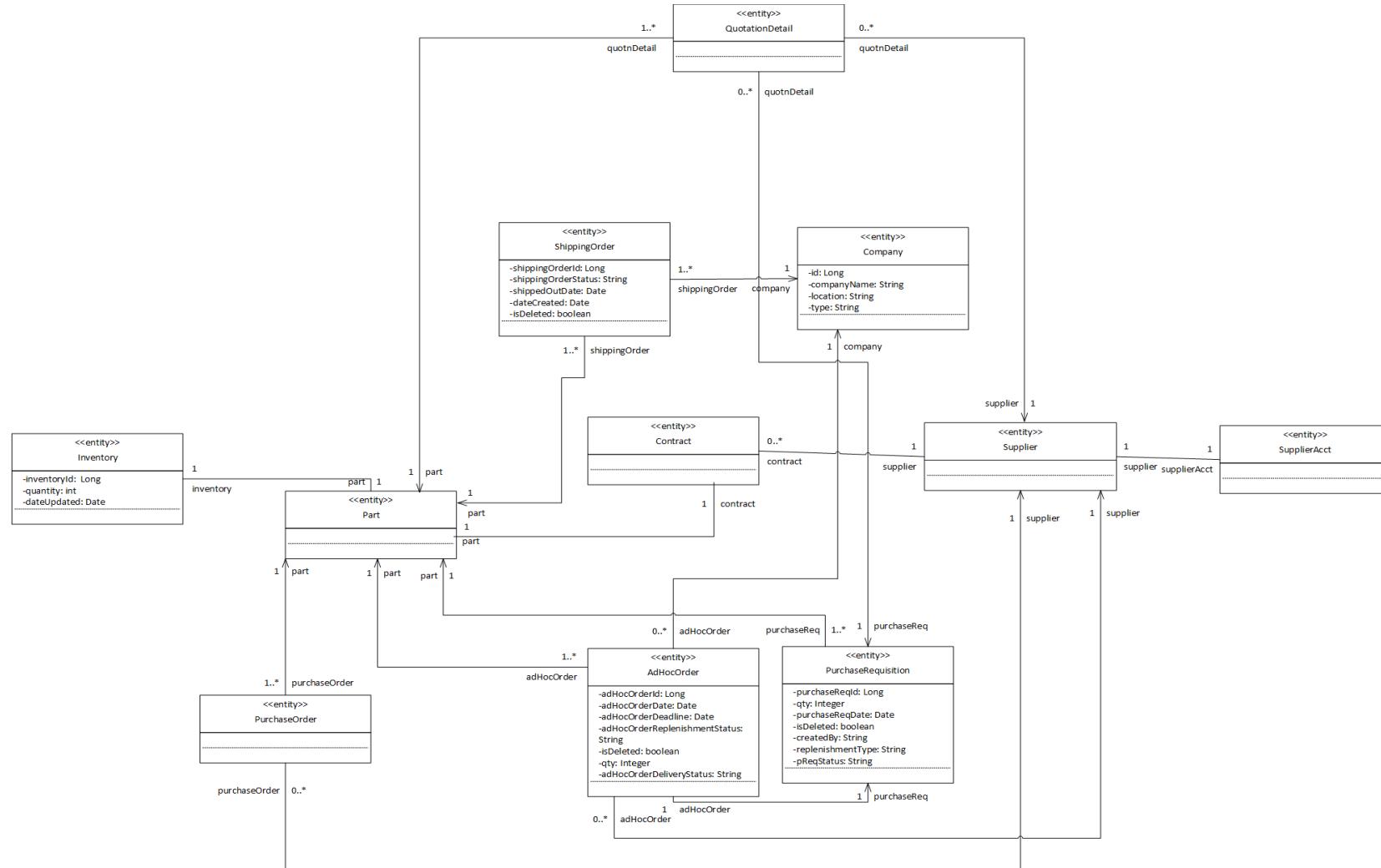
Use Case Description 3

Use case Name	Post Goods Issued
Description	After receiving parts from a supplier, the purchase order of parts is updated to “Received” status. Thereafter, factory will produce goods according to order. After production, the SCM Inventory Staff will issue the goods to their respective stores. The SCM Inventory Staff needs to update the Purchase Order status from “Received” to “Issued” with the goods issued date.
Actors	SCM Inventory Staff
Triggers	SCM Inventory Staff wants to ship goods to respective stores
Goals	To update the status of purchase order and date issued upon shipment of goods
Pre-conditions	<ol style="list-style-type: none"> 1. Purchase order must be in “Received” status to indicate that the goods has been received by user from supplier. 2. Lists of purchase order loaded to the system. 3. User login to the system. 4. Parts are received at the manufacturing site.
Post-conditions	<ol style="list-style-type: none"> 1. The purchase order status is updated to “Issued”.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User clicks “view all purchase order”. 2. System displays a list of purchase order. 3. User selects a purchase order. 4. System displays detail of the purchase order selected. 5. User change the purchase order status to “issued”. 6. User clicks “update”. 7. System updates the status of purchase order.

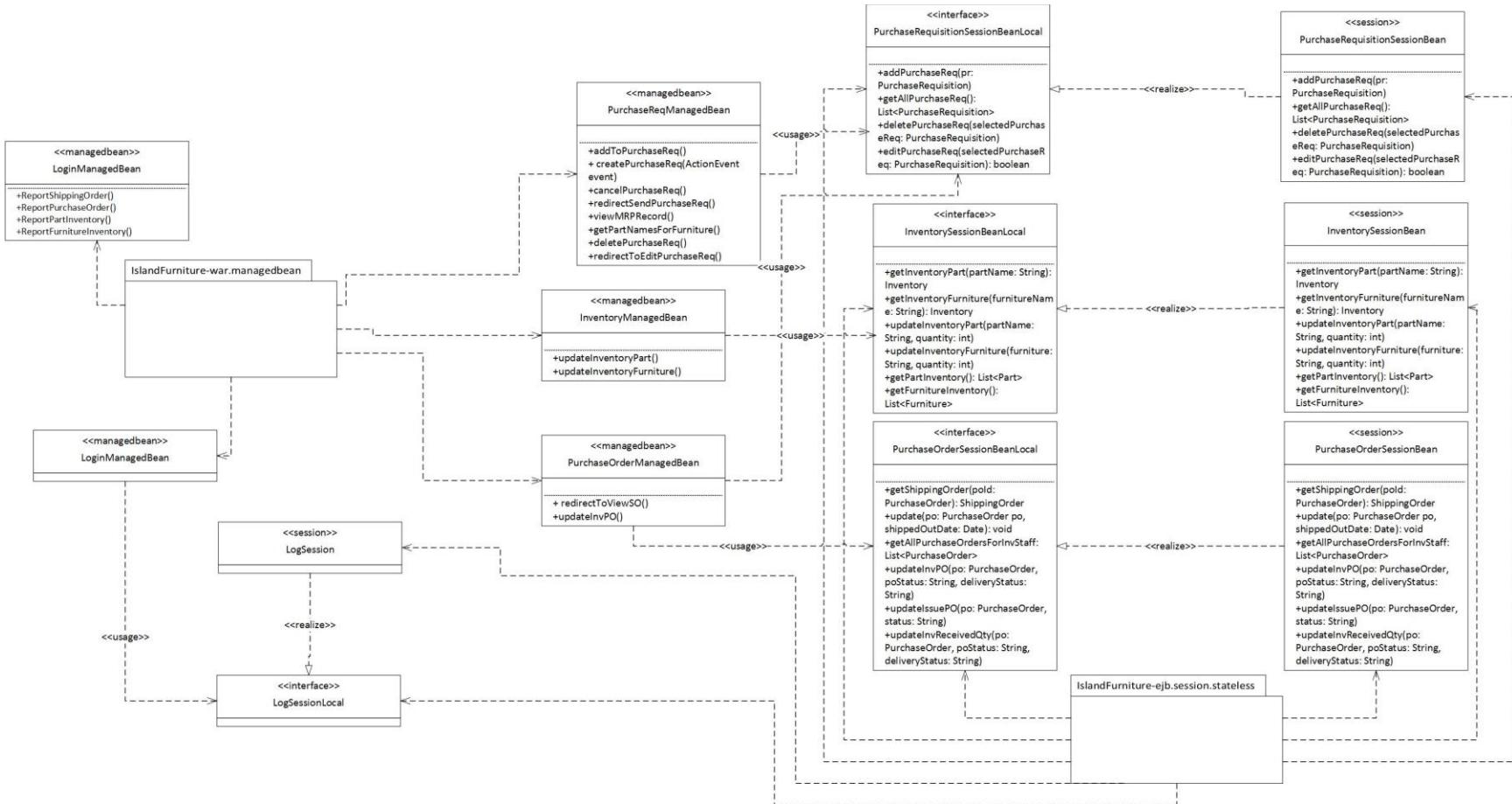
	8. System displays update success.
Alternative Courses	<p>2a. User selects a purchase order with status other than “approve” or “receive”:</p> <ol style="list-style-type: none"> 1. System displays an error message. 2. Continue at step 2. <p>3a. User selects the wrong purchase status:</p> <ol style="list-style-type: none"> 1. System displays error message to indicate wrong selection. 2. Continue at step 2.
Exceptional courses	

5.4.2.3 Class Diagram

Entity Class Diagram

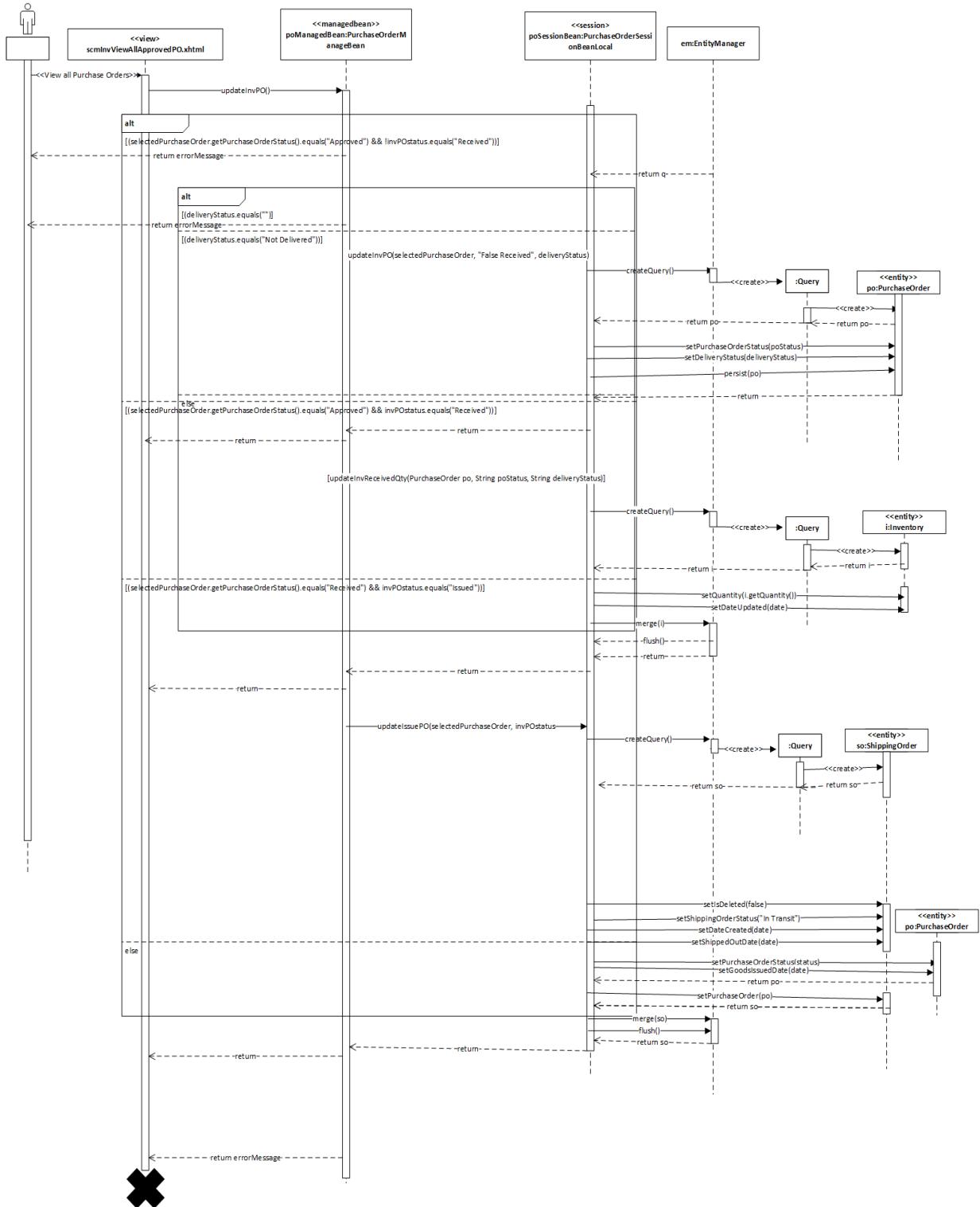


Non-Entity Class Diagram



5.4.2.4 Sequence Diagram

This diagram shows "Post Goods Receipt" use case.

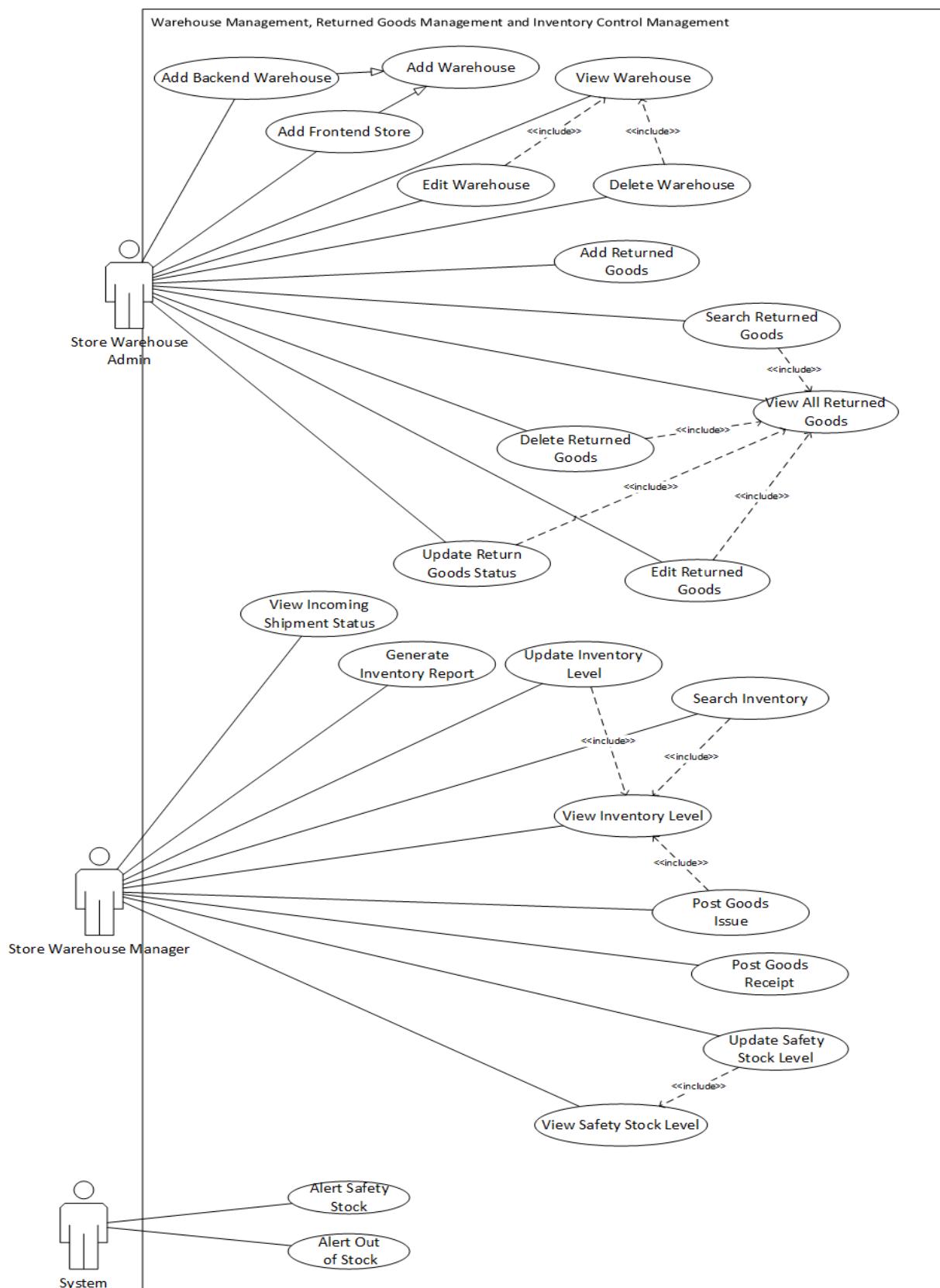


5.5 Inventory Management Sub-system

5.5.1 Warehouse Management, Inventory Control and Returned Goods Management Modules

The functional design of D.1.1Warehouse Management Module, D.1.2 Inventory Control Module and D.1.3 Returned Goods Management Module is shown below :

5.5.1.1 Use Case Diagram



5.5.1.2 Use Case Description

Use Case Description 1

Use Case Name	Add Backend Warehouse
Description	Store warehouse admin creates a backend warehouse record for a store
Actors	Store warehouse admin
Triggers	Store warehouse admin accesses system to add a new warehouse
Goals	Add a new warehouse record to keep track of the location of inventory
Preconditions	1. User has logged into the system
Postconditions	A new warehouse record has been created successfully without any duplications
Extension Points	Nil
Basic Course	<ol style="list-style-type: none"> 1. User clicks "Backend Warehouse" tab 2. User enters new warehouse details <ol style="list-style-type: none"> a. Warehouse Name b. Warehouse Location c. Warehouse capacity 3. User clicks "Add warehouse" button 4. System checks for existing warehouse record conflicts 5. System saves warehouse record and returns a success message
Alternative Courses	Nil
Exceptional Courses	4a. A warehouse record detected : <ol style="list-style-type: none"> 3. System pops up warning message 4. Use case terminates

Use Case Description 2

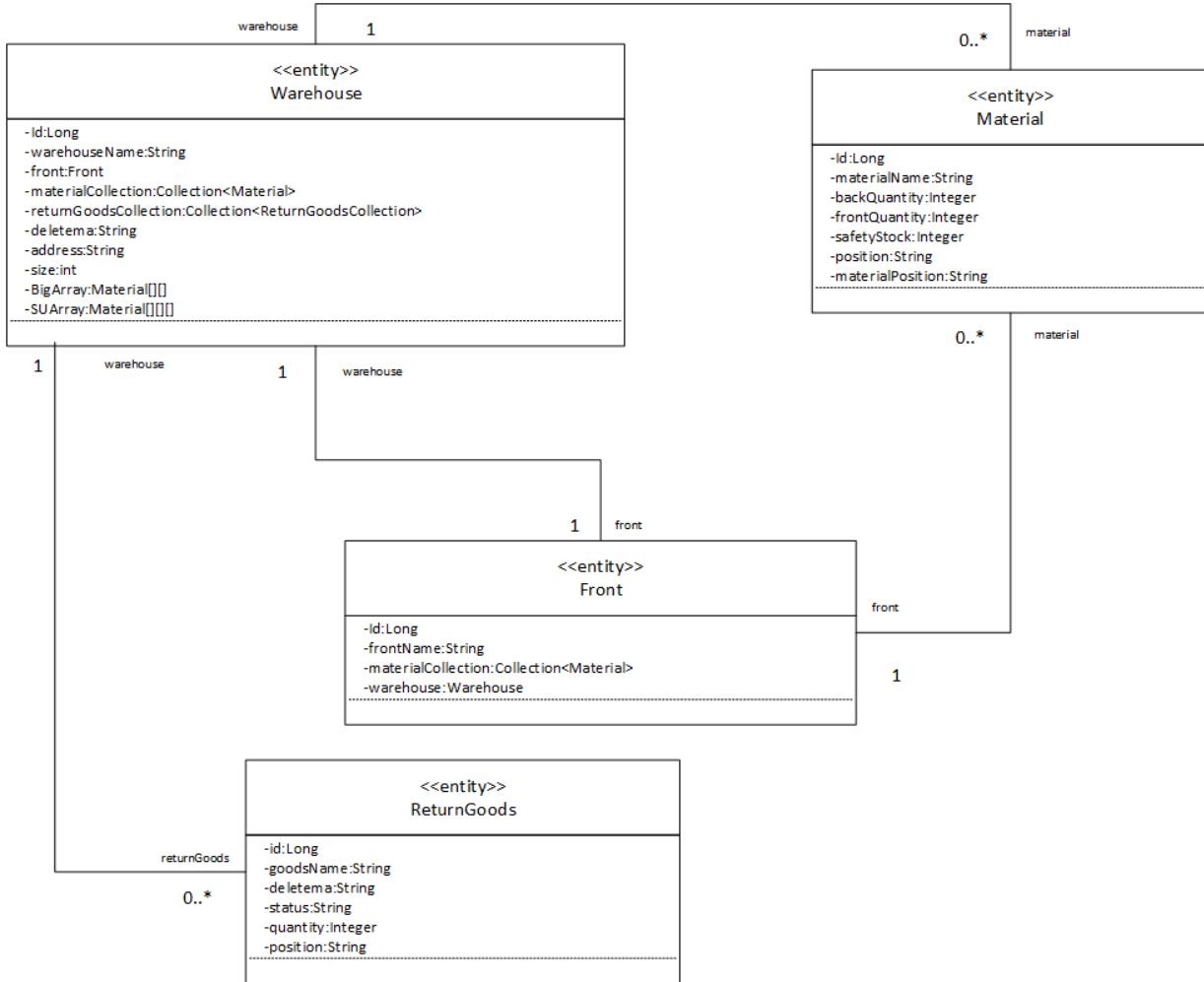
Use Case Name	View Inventory Level
Description	Store warehouse manager view inventory level of a selected furniture
Actors	Store warehouse manager
Triggers	Store warehouse manager accesses system to view inventory level of a furniture
Goals	Accurate updated inventory level can be viewed
Preconditions	1. User has logged into the system
Postconditions	Accurate updated inventory level can be displayed to user successfully
Extension Points	Nil
Basic Course	<ol style="list-style-type: none"> 1. User clicks "View Inventory Level" button 2. System retrieves a list of furniture and its respective inventory level 3. User can search a specific furniture to view its inventory level <ol style="list-style-type: none"> a. System only retrieves the entered furniture in search and displays its inventory level and location details 4. System displays correct inventory level successfully with respect to user input
Alternative Courses	Nil
Exceptional Courses	Nil

Use Case Description 3

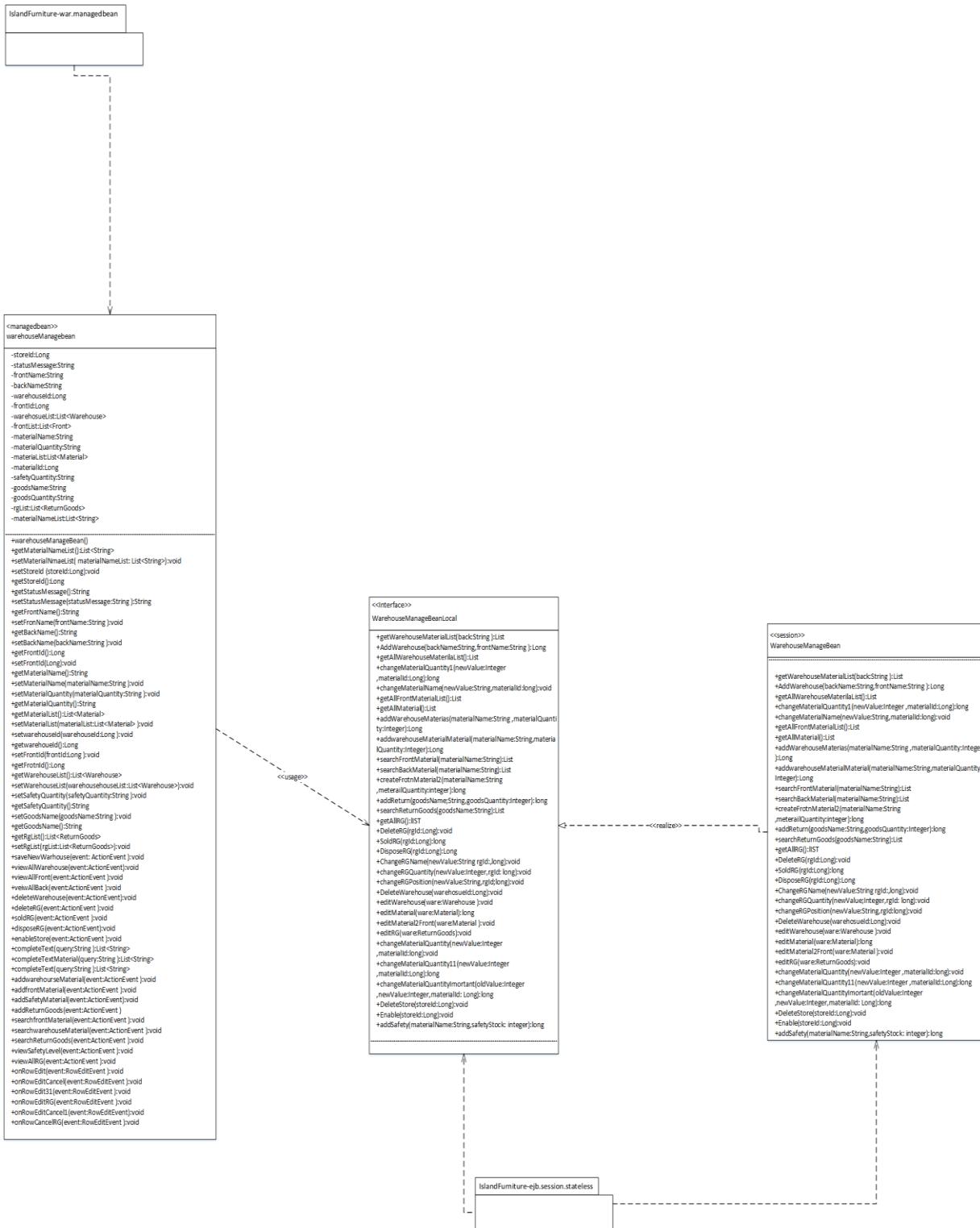
Use Case Name	Post Goods Issue
Description	Store warehouse manager post goods issue to replenish the selected product to frontend store
Actors	Store warehouse manager
Triggers	Store warehouse manager accesses system to post goods issue for a product
Goals	Transfer the desired amount of a selected product to frontend store with correct update of inventory level by posting of goods issue
Preconditions	<ul style="list-style-type: none"> 1. User has logged into the system 2. A product is selected for goods issue
Postconditions	Goods Issue is posted successfully results in correct inventory level updates
Extension Points	Nil
Basic Course	<ul style="list-style-type: none"> 1. Include (View Inventory Level) 2. User clicks "Post Goods Issue" button 3. System prompts a window for user input : <ul style="list-style-type: none"> a. Enter quantity 4. User clicks "Confirm" button 5. System updates inventory level by reducing the entered quantity amount at backend warehouse and increasing the amount at frontend store for this selected product 6. System saves post goods issue record and updates inventory level successfully
Alternative Courses	Nil
Exceptional Courses	Nil

5.5.1.3 Class Diagram

Entity Class Diagram

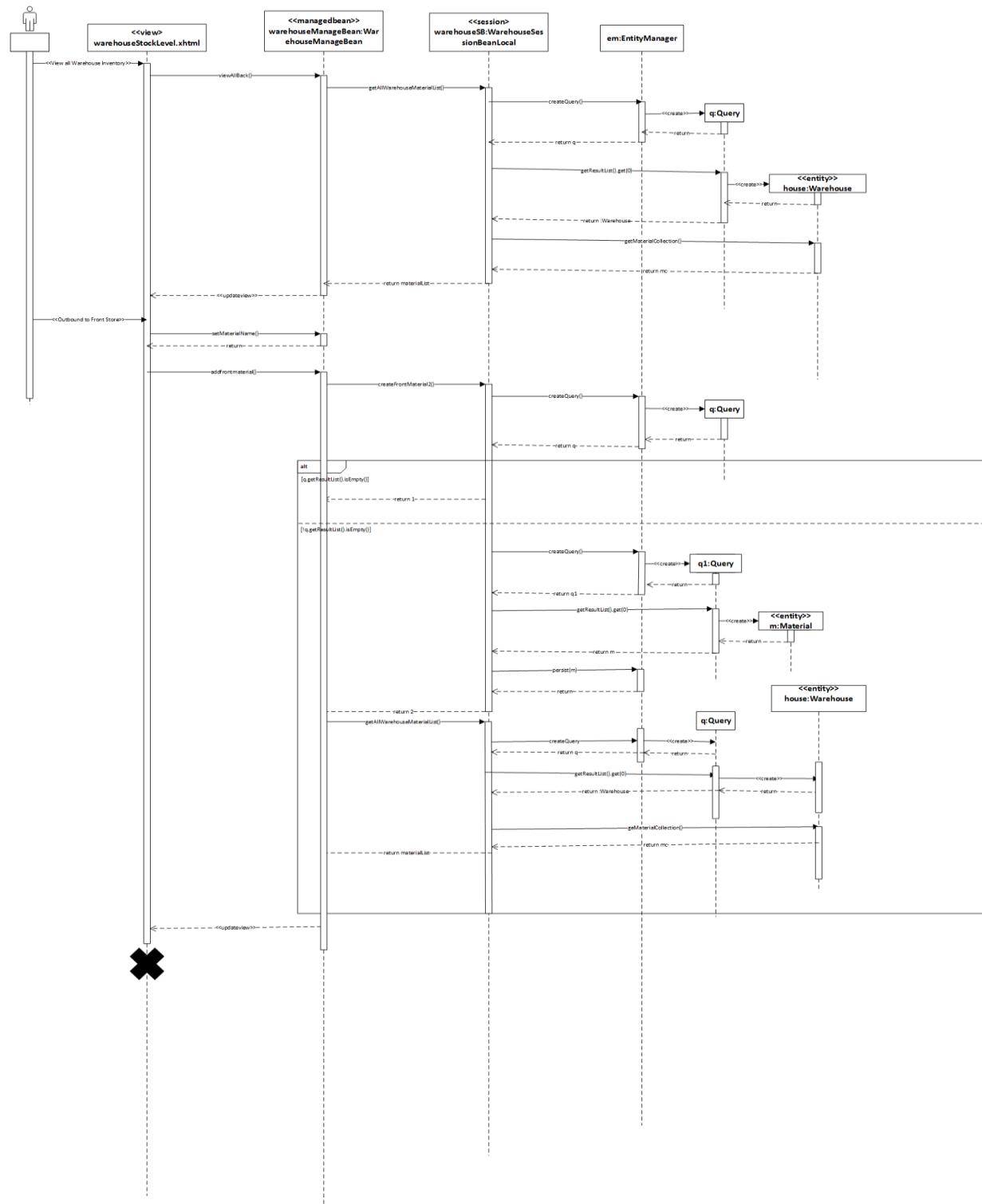


Non-Entity Class Diagram



5.5.1.4 Sequence Diagram

This diagram shows "Post Goods Issue" use case.

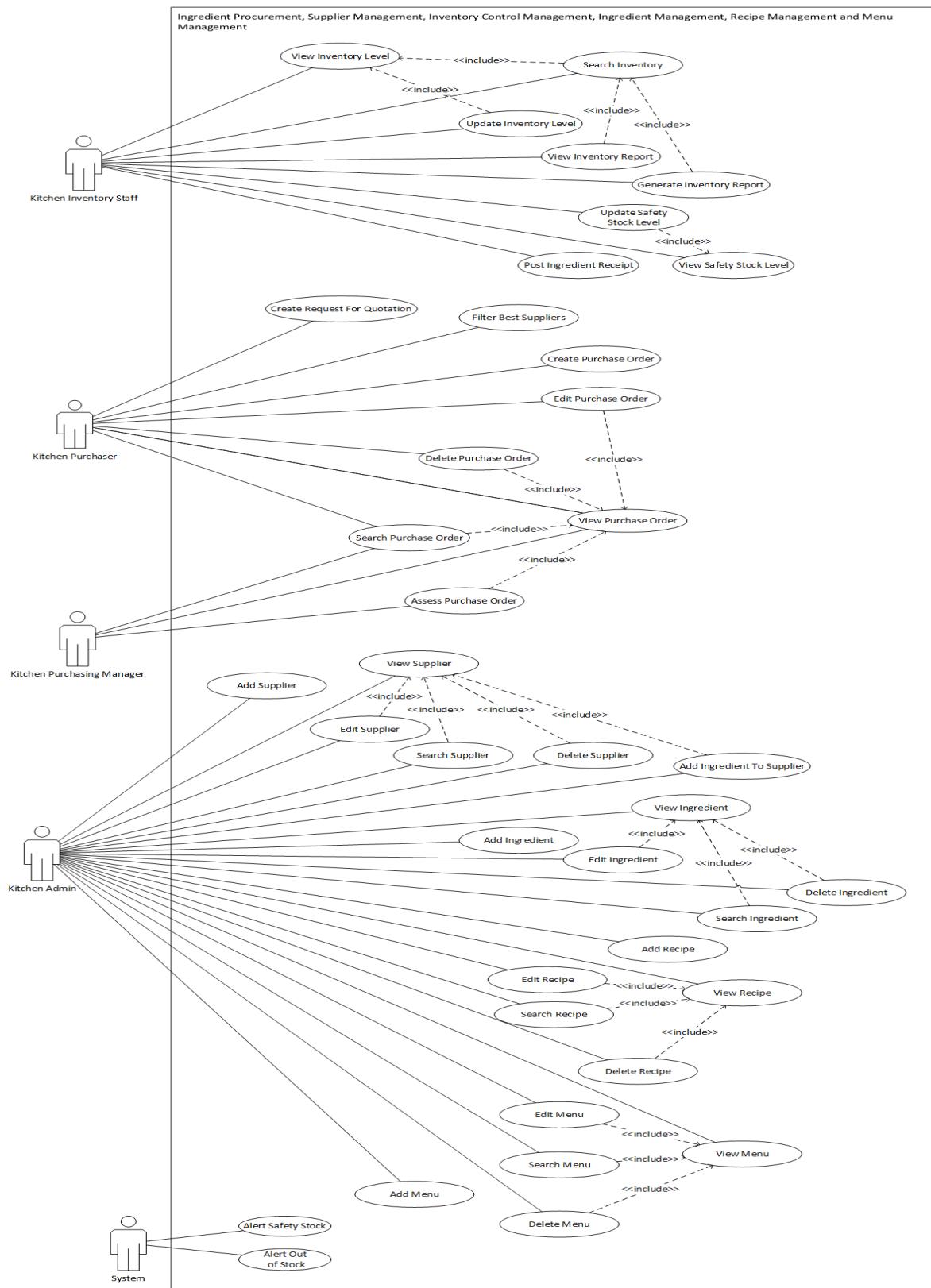


5.6 Kitchen Management Sub-system

5.6.1 Kitchen Operations Modules

The functional design of D.2.1 Ingredient Procurement Module, D.2.2 Ingredient Supplier Management Module, D.2.3 Ingredient Inventory Control Module , D.2.4 Ingredient Management Module, D.2.5 Recipe Management Module and D.2.6 Menu Management Module is shown below :

5.6.1.1 Use Case Diagram



5.6.1.2 Use Case Description

Use Case Description 1

Use case Name	Update Inventory Level
Description	Kitchen staff wants to update the ingredient stock level in accordance to the level of stock in the kitchen on a weekly basis. This is to prepare for the replenishment of ingredients.
Actors	Kitchen Inventory staff
Triggers	At the end of each week, user accesses the system to update ingredient stock level in the kitchen after accounting the stocks.
Goals	Update new ingredient stock level in the kitchen.
Pre-conditions	<ol style="list-style-type: none"> 1. Kitchen staff has already confirmed the stock level of ingredients and is ready to insert these values into the database. 2. Kitchen staff has the access right to make changes to the old stock level. 3. Kitchen staff login to the system. 4. List of ingredient loaded into the system.
Post-conditions	<ol style="list-style-type: none"> 3. New stock level for ingredient successfully updated into the system. 4. User able to view the new updated ingredient stock level.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Include (View Inventory level). 2. Staff selects the ingredient to be updated. 3. Staff clicks on the 'View Inventory' button. 4. System prompts the user to enter in the quantity amount to be updated. 5. Staff enters in the quantity. 6. Staff clicks 'update'. 7. System updates the new quantity into the database. 8. System displays the new quantity amount of the selected

	ingredient in the table.
Alternative Courses	
Exceptional courses	

Use Case Description 2

Use case Name	Search Ingredient
Description	User searches for an ingredient in the database to access its information and to manage the details of the ingredient.
Actors	Kitchen Admin
Triggers	User login to the system to search for an ingredient's information
Goals	Retrieve information of the desired ingredient according to the name entered.
Pre-conditions	<ol style="list-style-type: none"> 1. User login to the system. 2. List of ingredient loaded into system.
Post-conditions	1. Information of the requested ingredient being returned to the user.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Include (View Ingredient). 2. User enters the name of the ingredient. 3. System accesses the database. 4. System filters the database for the ingredient according to the name entered. 5. System displays the result from the filtering process. 6. User may access the result displayed.
Alternative Courses	<p>2a. If user entered a string that is a part of an ingredient's name:</p> <ol style="list-style-type: none"> 1. System accesses the database. 2. System filters the database for a list of ingredients containing the string entered. 3. Continue at step 5.

Exceptional courses	<p>5a. If no ingredients contain the specified ingredient name or the specified string entered:</p> <ol style="list-style-type: none"> 1. System displays that the database contains no such ingredient. 2. Use case terminates.
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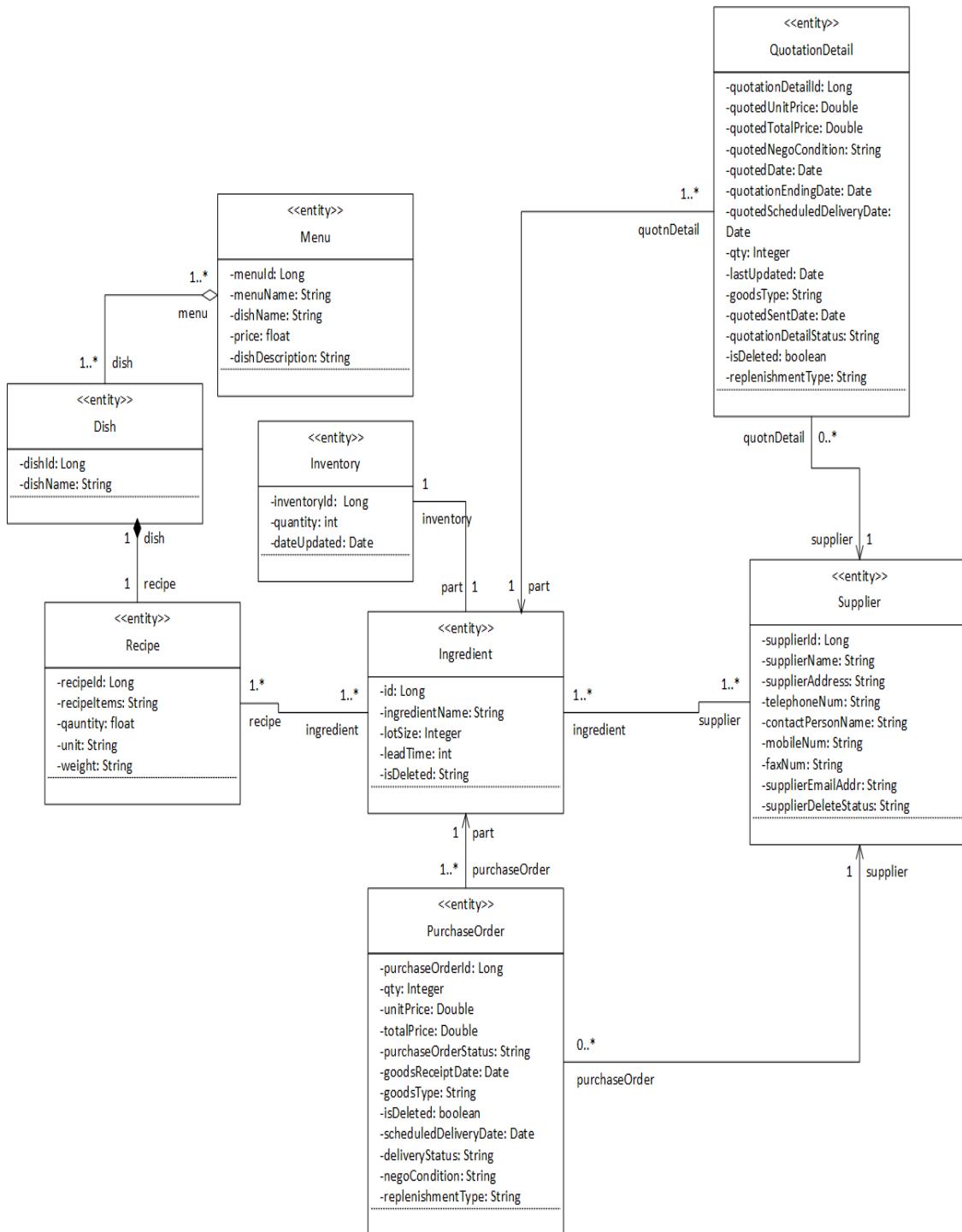
Use Case Description 3

Use case Name	Edit Supplier
Description	User wants to edit the supplier's information within the database. There are mistakes with the recorded information about the supplier or there is an update of personal details for a supplier therefore user requires to make a change to the recorded information.
Actors	Kitchen Admin
Triggers	User accesses the system to make an update to the personal details of the ingredient supplier. There is a mistake or a change to the recorded supplier's information.
Goals	Change/update a supplier's personal details successfully.
Pre-conditions	<ol style="list-style-type: none"> 1. User login to the system. 2. Suppliers' detail loaded to the database. 3. User has the access right to make changes. 4. Supplier's address, ID and Name are correct. 5. Detail to be updated has been validated to be correct.
Post-conditions	<ol style="list-style-type: none"> 1. System updates new information into the database. 2. System displays successfully updated information.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Include (View Supplier). 2. User clicks on 'Edit Supplier'. 3. System shows a drop-down list of all the suppliers. 4. User selects a supplier for editing.

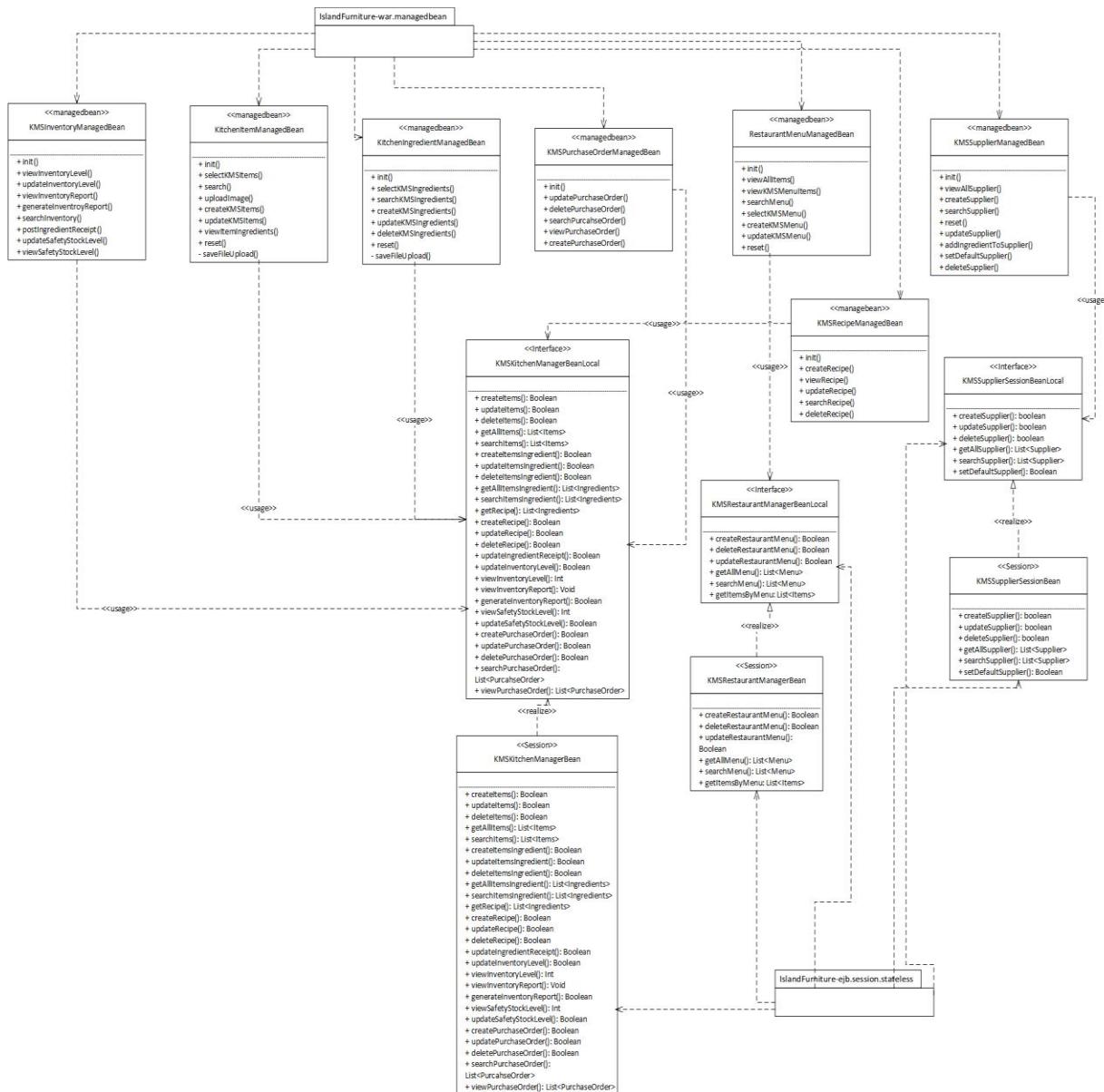
	<p>5. System displays the details of the supplier selected.</p> <p>6. User fills in the fields that are editable:</p> <ul style="list-style-type: none"> a. Telephone number b. Contact Person c. Mobile Number d. Fax Number e. Email Address <p>7. User clicks on ‘save’ button.</p> <p>8. System validates the input information.</p> <p>9. System updates the database with the new inputs.</p> <p>10. System displays update successful.</p>
Alternative Courses	<p>8a. If inputs to any of the fields are in the wrong format:</p> <ol style="list-style-type: none"> 1. System prompts user of unsuccessful update. 2. Return to step 6. 3. System highlights fields with wrong formats. 4. User re-enters information with the right format in the highlighted fields. 5. Continue at step 7.
Exceptional courses	

5.6.1.3 Class Diagram

Entity Class Diagram

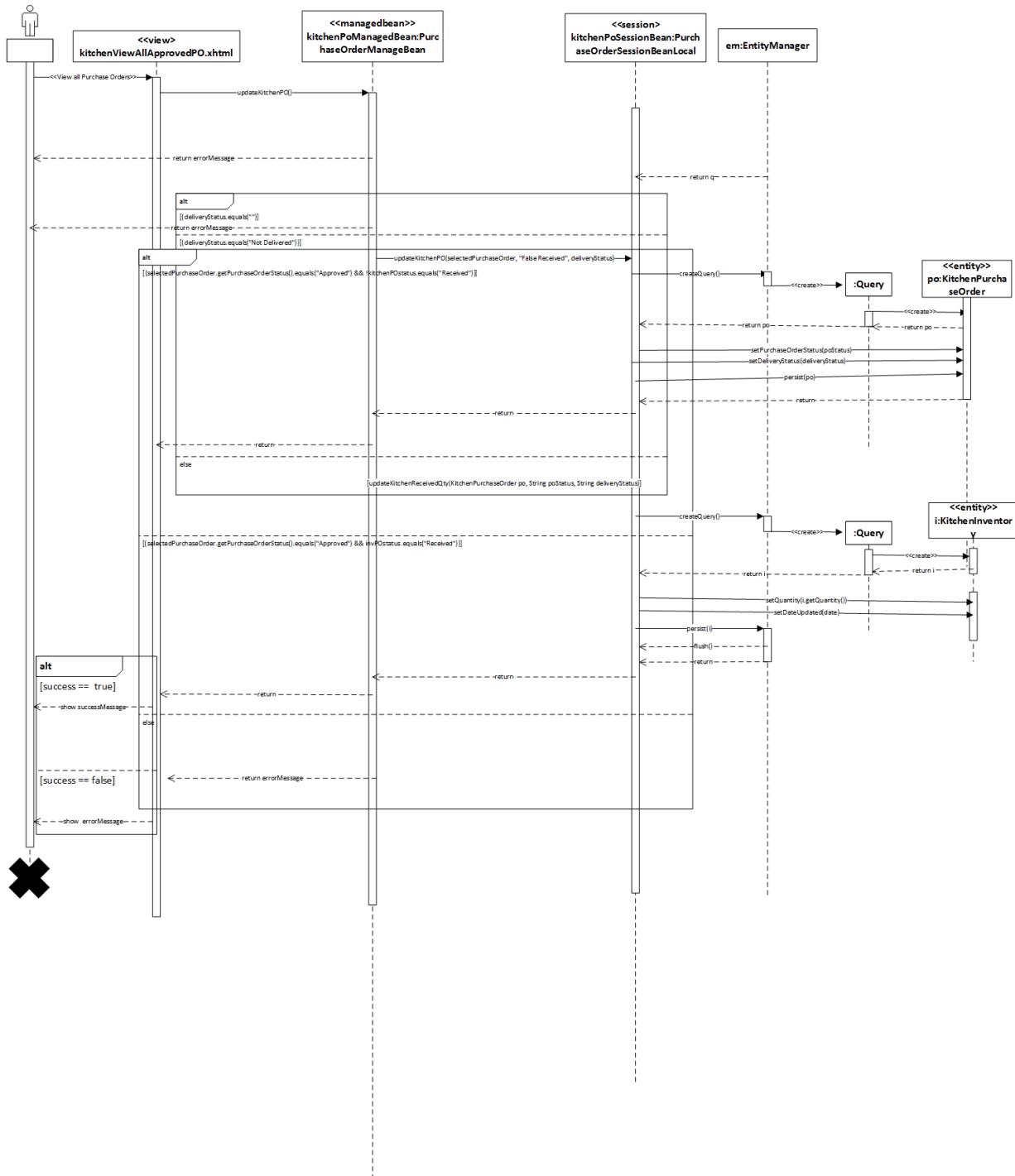


Non Entity Class Diagram



5.6.1.4 Sequence Diagram

This diagram shows "Post Ingredient Receipt" use case.

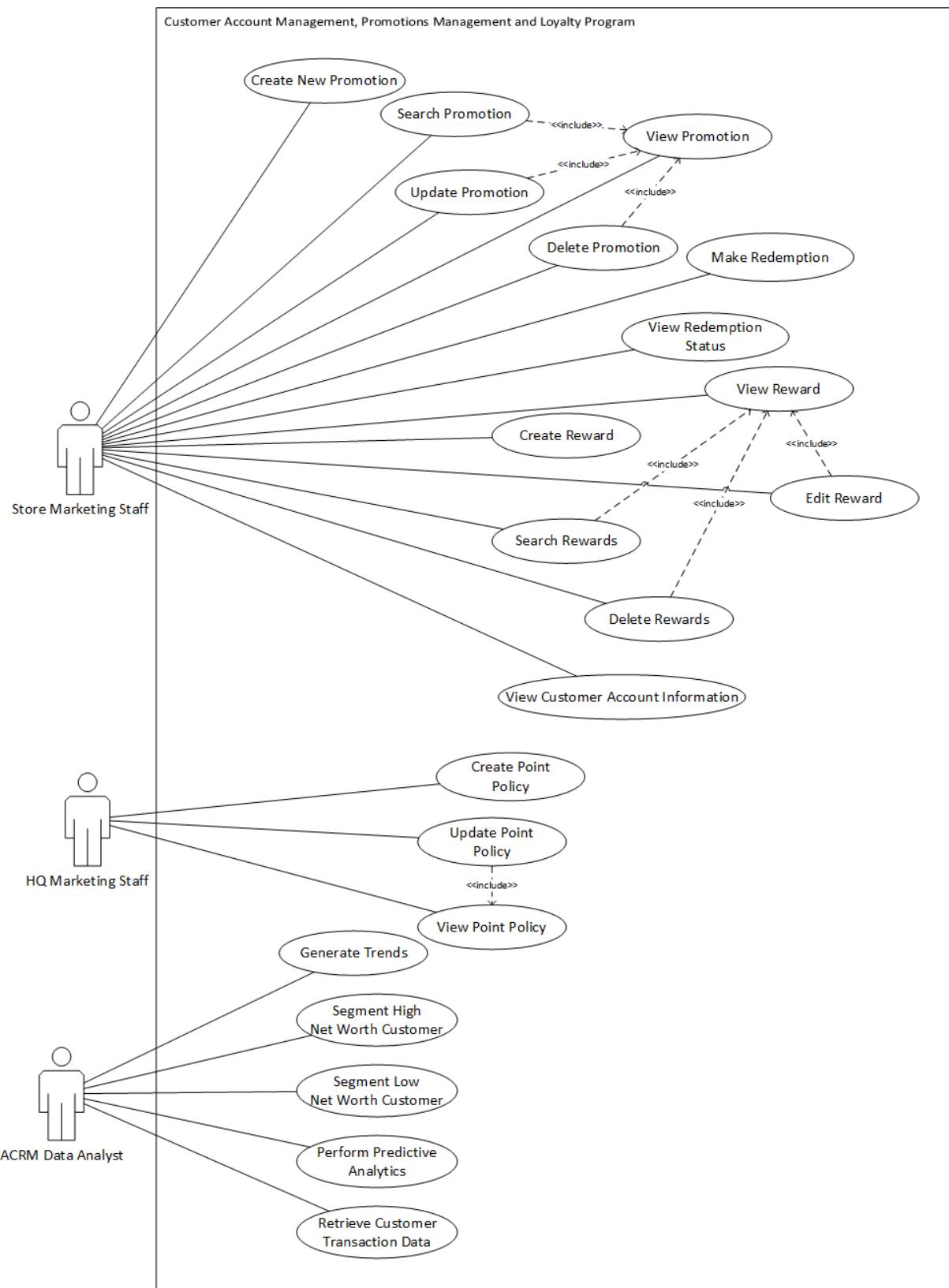


5.7 Operational CRM & Analytical CRM Sub-systems

5.7.1 Customer Account Management, Promotions, Loyalty Program Management and Customer Analytics Modules

The functional design D.3.1 Customer Account Management Module, D.3.2 Promotions Management Module, D.3.3 Loyalty Program Management Module and D.4.1 Customer Analytics Module is shown below :

5.7.1.1 Use Case Diagram



5.7.1.2 Use Case Description

Use Case Description 1

Use case Name	Create New Promotion
Description	Stores at individual/country/regional level submit their promotion information to HQ to be emailed to the customers to create awareness. HQ marketing staff will compile all the promotion information into a booklet, attach and sent it out to registered customers through email based on locations. The promotion is set to attract more customers and increase revenue for the stores.
Actors	Primary actor - Store Marketing Staff, secondary actor - customers
Triggers	User login to the system to create new promotion and to notify HQ about it.
Goals	Update new promotion details to HQ such that it can be emailed to registered customers.
Pre-conditions	<ol style="list-style-type: none"> 1. User log in to the system. 2. User has the authority to send new promotion details HQ. 3. A Store may choose to create a promotion at store, country or regional level. 4. For country or regional level, the stores had met up and finalized the promotional details before sending it to HQ. 5. All the stores, which participated in finalizing the promotion details, had reached a common consensus to carry out the promotion at their stores. 6. Each region/country may choose a representative store to submit a standardized promotion to HQ. 7. System does not allow user to choose branches or furniture type if the percentage of discount is not specified first.
Post-conditions	<ol style="list-style-type: none"> 1. New promotion updated to HQ.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User clicks on “Manage Promotion” tab.

	<p>2. System requires User to fill in the following fields:</p> <ul style="list-style-type: none"> a. Promotion Name b. Project Manager c. Promotion level (store/country/regional) d. Quantity e. Date Start f. Date End g. Whether customers can redeem it. h. Whether customers can purchase it. i. Description j. Channels for any further updates/enquiries. k. Areas that this promotion will cover: <ul style="list-style-type: none"> 1. Restaurant <ul style="list-style-type: none"> a. Restaurant discount (%) b. Restaurant branches where the discount will take place 2. Retail Outlet <ul style="list-style-type: none"> a. Retail discount b. Retail outlet branches where the discount will take place 3. Furniture Marketplace <ul style="list-style-type: none"> a. Furniture discount b. Furniture type 3. User clicks “Update”. 4. System sends the information to HQ.
Alternative Courses	<p>3a. If discount rate is not declared first under the restaurant, retail outlet and furniture marketplace component:</p> <ul style="list-style-type: none"> 1. System does not allow user to choose branches or furniture type. 2. Continue at step 3.
Exceptional courses	

Use Case Description 2

Use case Name	Make Redemption
Description	Customer wants to redeem rewards at the store using his/her accumulated loyalty points. Customer will be updated with the latest rewards information at various stores through email sent out by HQ. Store marketing staff will access the system to make the necessary deduction of loyalty points according to the rewards claimed. Thereafter, system will compute the new loyalty points of that customer and update it to HQ.
Actors	Primary – Store Marketing Staff (SMS), Secondary - customer
Triggers	SMS login and accesses the system to deduct loyalty points according to the reward claimed.
Goals	Redeem a reward and deduct the corresponding loyalty points.
Pre-conditions	<ol style="list-style-type: none"> 1. Information for rewards at all the stores was distributed through email to registered customer. 2. SMS has the access right to make necessary deduction to the loyalty point of the customer. 3. SMS login to the system. 4. Customer has accumulated sufficient loyalty points to redeem reward.
Post-conditions	<ol style="list-style-type: none"> 1. Loyalty Points deducted according to the rewards redeemed from the customer's account. 2. System computes new loyalty points for the customer after deduction.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. SMS keys in the membership ID of the customer. 2. SMS selects the reward package to redeem. 3. System returns the information of the reward package. 4. SMS selects the quantity to redeem. 5. SMS clicks on 'Submit' button.

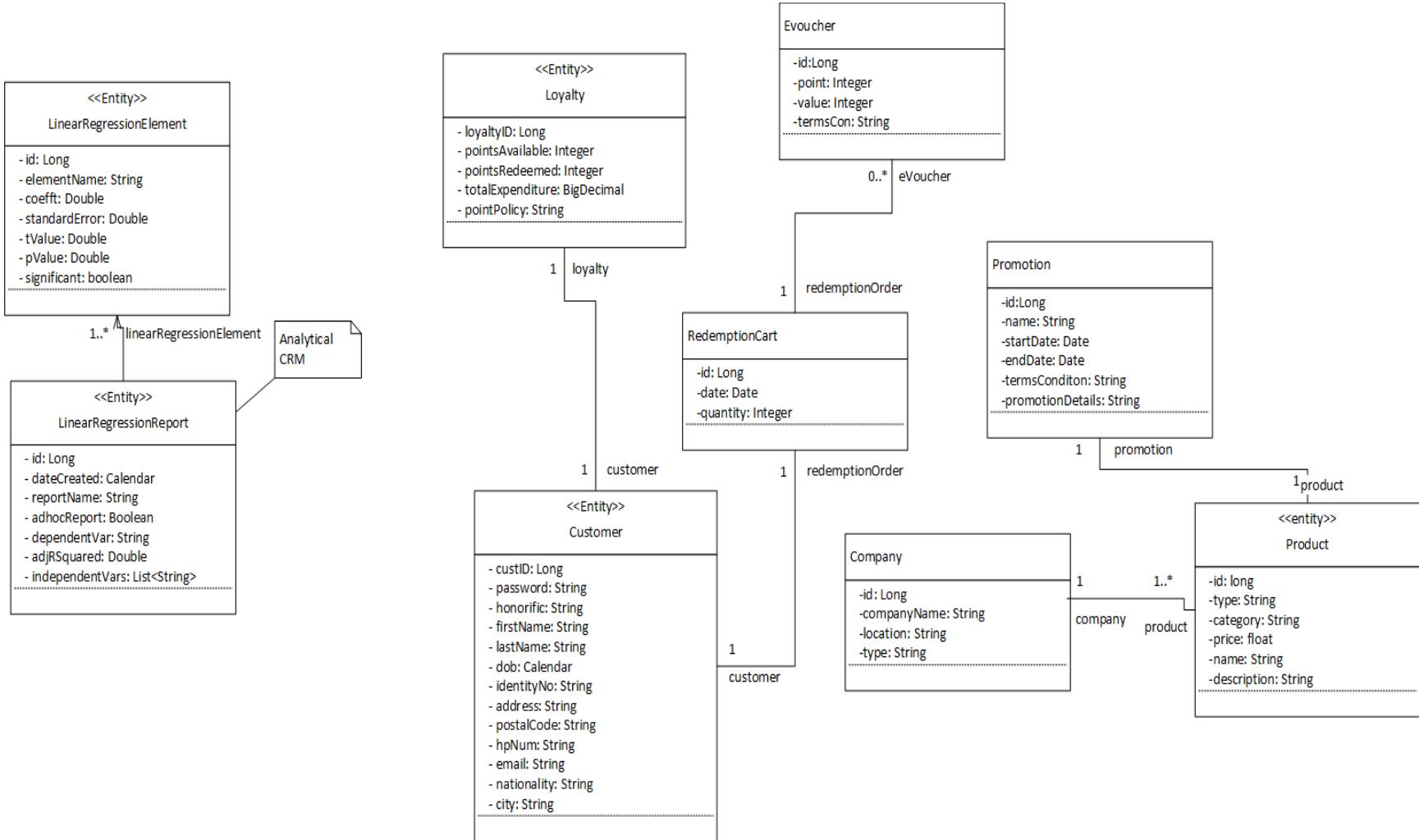
	<p>6. System returns a summary page of what the user has selected as a confirmation.</p> <p>7. SMS clicks ‘Redeem’.</p> <p>8. System deducts and computes the new total loyalty points left in the customer’s account after redemption.</p> <p>9. System updates HQ on the new loyalty points to be updated onto the e commerce website.</p>
Alternative Courses	
Exceptional courses	

Use Case Description 3

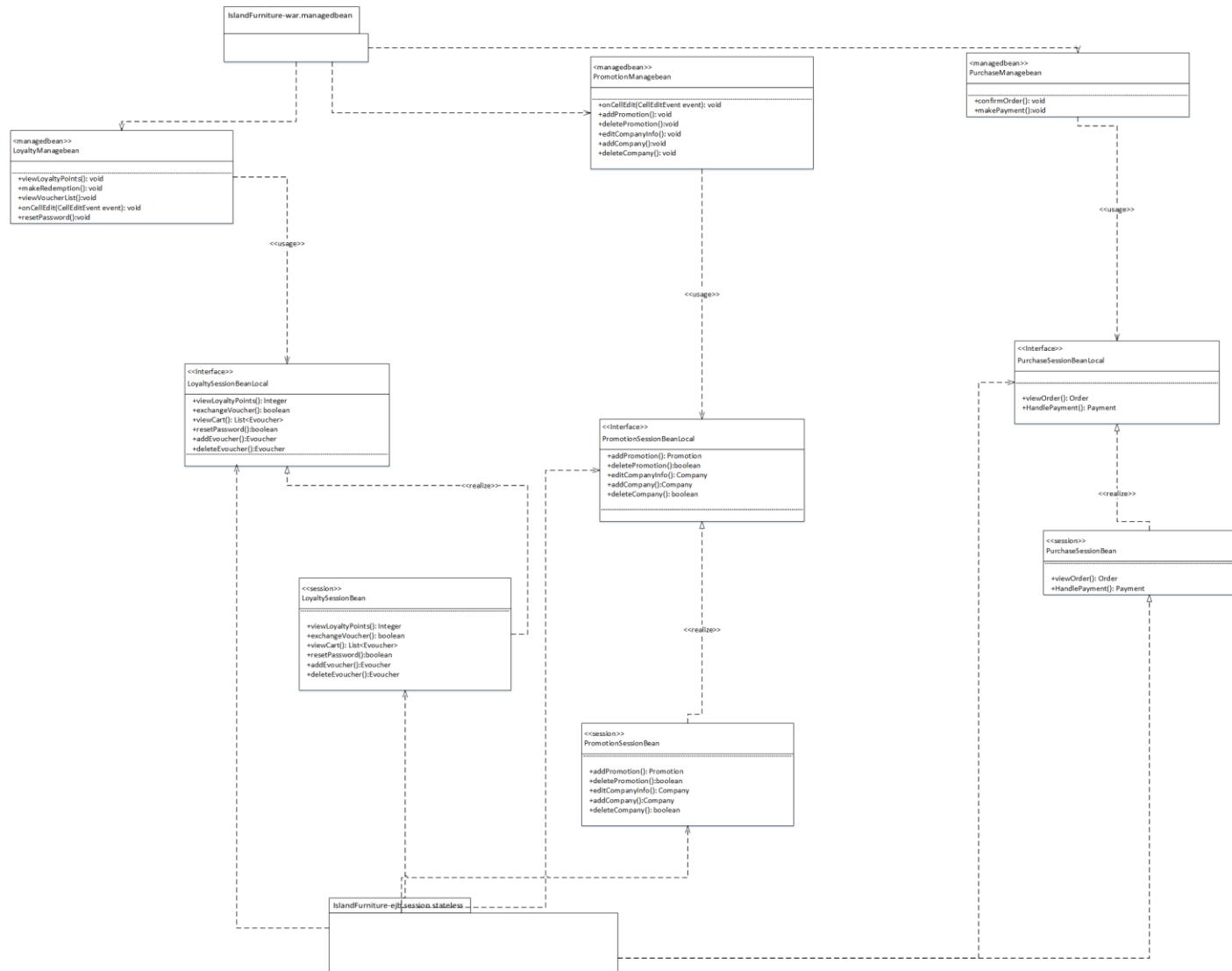
Use case Name	Delete Rewards
Description	Store Marketing Staff (SMS) wants to remove rewards from the system due to expired reward program.
Actors	Store Marketing Staff (SMS)
Triggers	SMS login to system to delete away rewards saved in the database.
Goals	Remove rewards from the system
Pre-conditions	<ol style="list-style-type: none"> 1. SMS is authorized to make amendments to the rewards. 2. SMS login to the system. 3. Only staffs at each individual stores can access the system and make changes to rewards offered at the store. 4. Rewards loaded into the system. 5. SMS can remove one or more rewards from the system at a time.
Post-conditions	1. Rewards successfully removed from the system.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Include (View Reward). 2. SMS clicks on “Delete Rewards”. 3. System retrieves a list of rewards in the current loyalty program. 4. SMS selects the rewards that are going to be removed. 5. SMS clicks “Submit”. 6. System displays a summary on the rewards to be removed. 7. SMS clicks ‘Remove’. 8. System removes selected rewards from the database. 9. System displays that rewards are successfully removed.
Alternative Courses	
Exceptional courses	

5.7.1.3 Class Diagram

Entity Class Diagram

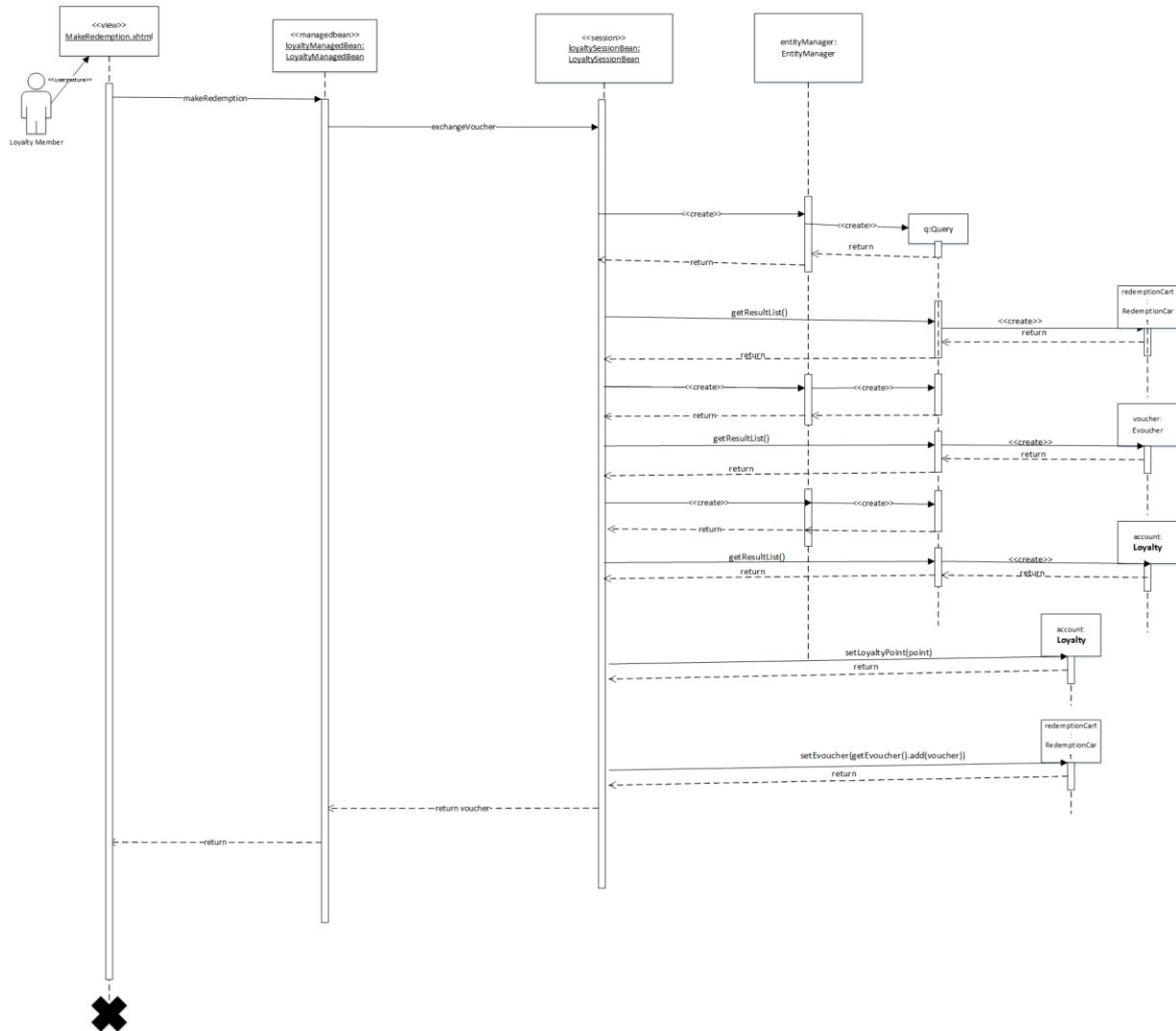


Non-Entity Class Diagram



5.7.1.4 Sequence Diagram

This diagram shows the "Make Redemption" use case.

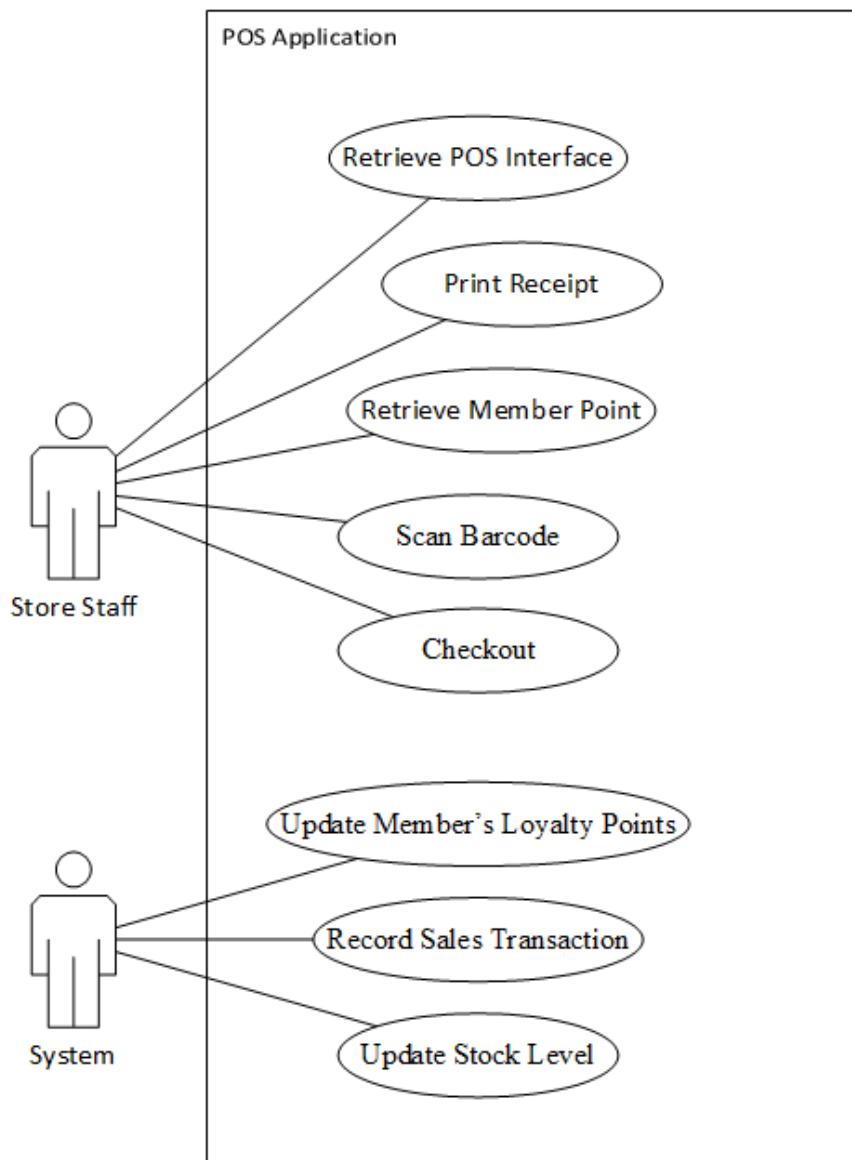


5.8 POS Application

5.8.1 POS

The functional design of POS application is shown below :

5.8.1.1 Use Case Diagram



5.8.1.2 Use Case Description

Use Case Description 1

Use case Name	Checkout
Description	Items selected at the store are scanned and updated into the system. The store staff makes use of the system to calculate the total cost of the scanned items and change involved.
Actors	Store staff (cashier)
Triggers	User wants to check
Goals	To calculate the total amount of bills payable and changes involved in a transaction at the store.
Pre-conditions	<ol style="list-style-type: none"> 1. The customer had presented to the staff the necessary document to acquire the discount. 2. Store staff has been assigned the duty of cashier, so he/she has the right to access the transaction. 3. System loads with the details of the items to selling at the store. 4. (If the customer is paying through cash, system requires user to enter in the cash amount to facilitate calculation of change.) 5. All items on discount are updated with the latest price in the system.
Post-conditions	1. Total amount of bills payable and change to return are calculated and displayed.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User clicks on 'check out'. 2. System retrieves the prices of all the products scanned into the system. 3. System computes the overall bill. 4. System displays the overall bill. 5. Customer pays for the items:

	<p>a. Cash or</p> <p>b. Nets</p>
Alternative Courses	<p>5a. If the customer does not pay the exact amount of bill:</p> <ol style="list-style-type: none"> 1. User keys in the amount paid into the system. 2. System computes the change to return. 3. User returns the change.
Exceptional courses	

Use Case Description 2

Use case Name	Retrieve member point
Description	Store staff wants to retrieve customer's member points to answer customer's enquiry on their loyalty points status.
Actors	Primary – store staff, secondary – customer
Triggers	Store staff accesses the system to view a customer's accumulated loyalty points.
Goals	To retrieve a customer's loyalty point
Pre-conditions	<ol style="list-style-type: none"> 1. User log in to the system. 2. Customer enquires the store staff of his/her accumulated loyalty points. 3. Customer has a registered account with Island Furniture.
Post-conditions	<ol style="list-style-type: none"> 1. System displays the loyalty points currently accumulated in the customer's account.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User clicks on "Retrieve Loyalty Point". 2. User enters the username of customer. 3. System filters through the database and retrieve the customer's loyalty points record. 4. System displays the loyalty point of the customer.
Alternative Courses	

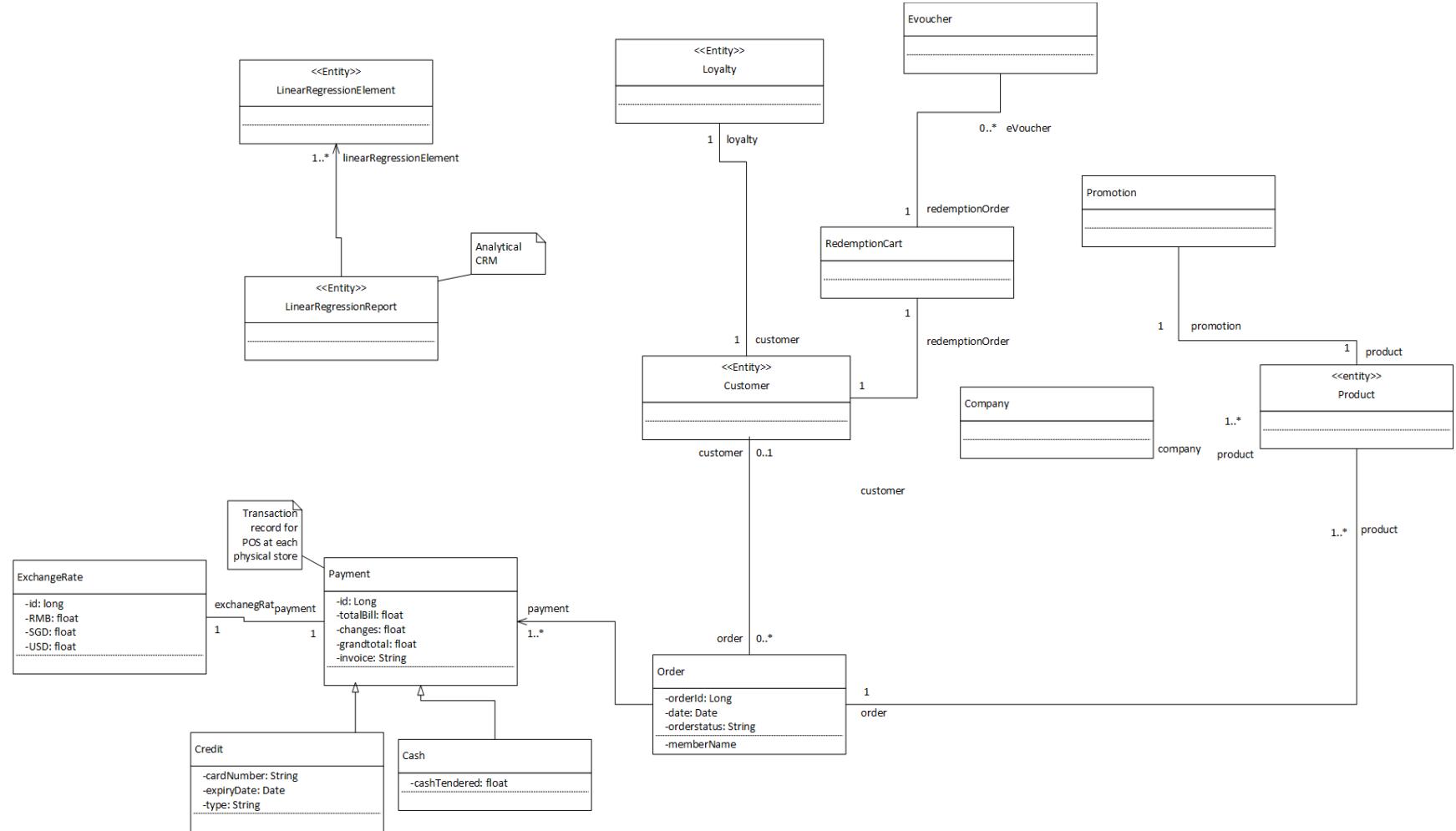
Exceptional courses	
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Use Case Description 3

Use case Name	Record Sales Transaction
Description	After a customer checked out all the items to be purchased at the counter, store staff (cashier) commits the transaction through POS. The system will then record down essential details regarding the transaction. These details are crucial for the store to analyze customers' spending behavior, which would be helpful in generating more revenue.
Actors	Store Staff
Triggers	Store staff wants to record down the details of a customer's sales transaction after payment has been made at the counter.
Goals	To update a sales transaction detail
Pre-conditions	<ol style="list-style-type: none"> 1. Store Staff login to the system. 2. Customer had made the necessary payment and change was returned as well. 3. Store Staff kept the payment to the POS machine. 4. Store Staff has the access right to the POS system.
Post-conditions	1. POS updated the necessary details from a transaction to the system.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User locks up the POS machine and clicks on "finish transaction". 2. System updates all the necessary information related to the transaction session to the database: <ol style="list-style-type: none"> a. Amount Paid b. Time c. Date d. Items involved e. Item types f. Counter that handle the transaction 3. System displays transaction successful.
Alternative Courses	
Exceptional courses	

5.8.1.3 Class Diagram

Entity Class Diagram



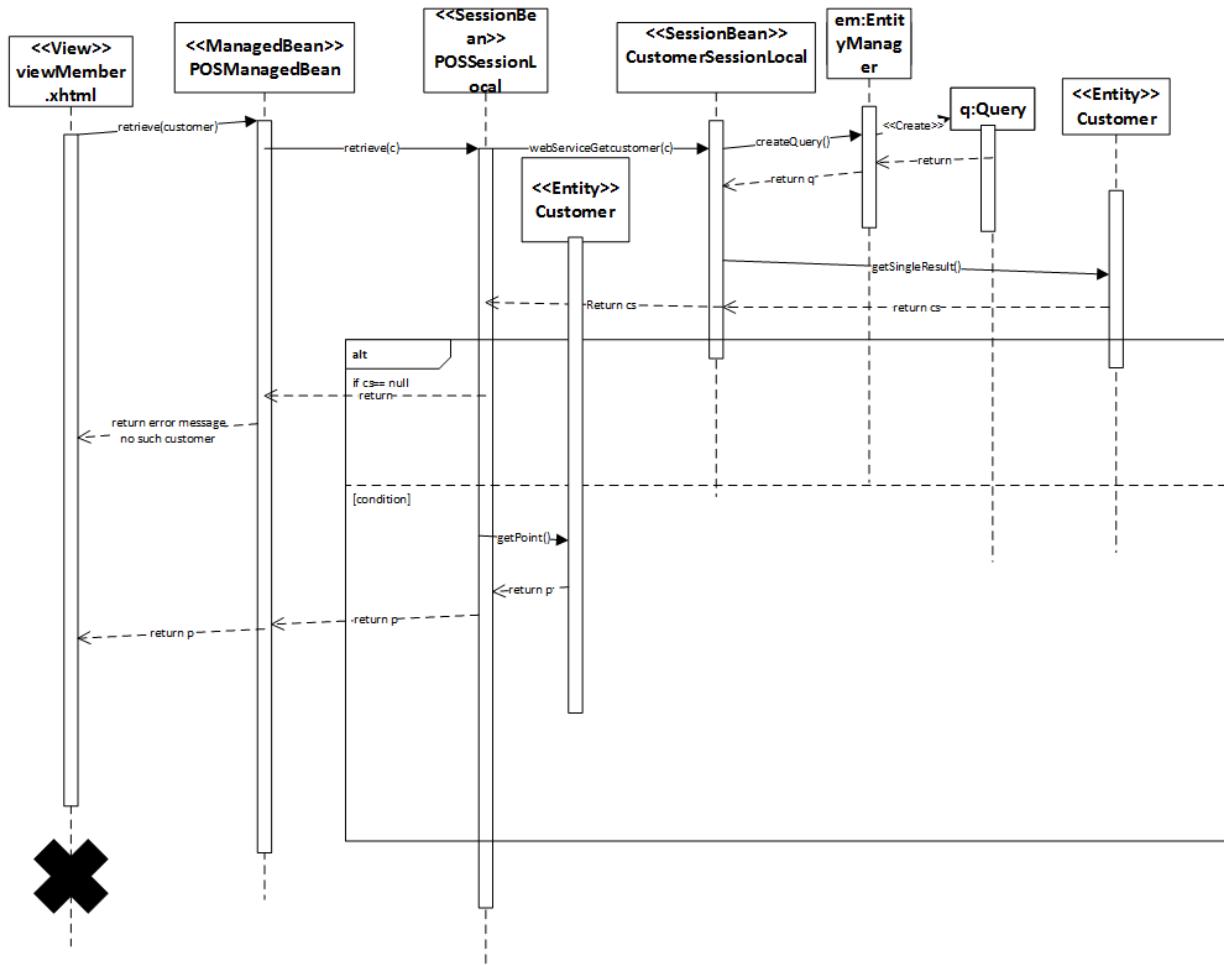
Non-Entity Class Diagram

POS is using methods in operational CRM and sends data to global HQ.

There is no non-entity class diagram can be shown.

5.8.1.4 Sequence Diagram

This diagram shows "Retrieve Member Points" use case

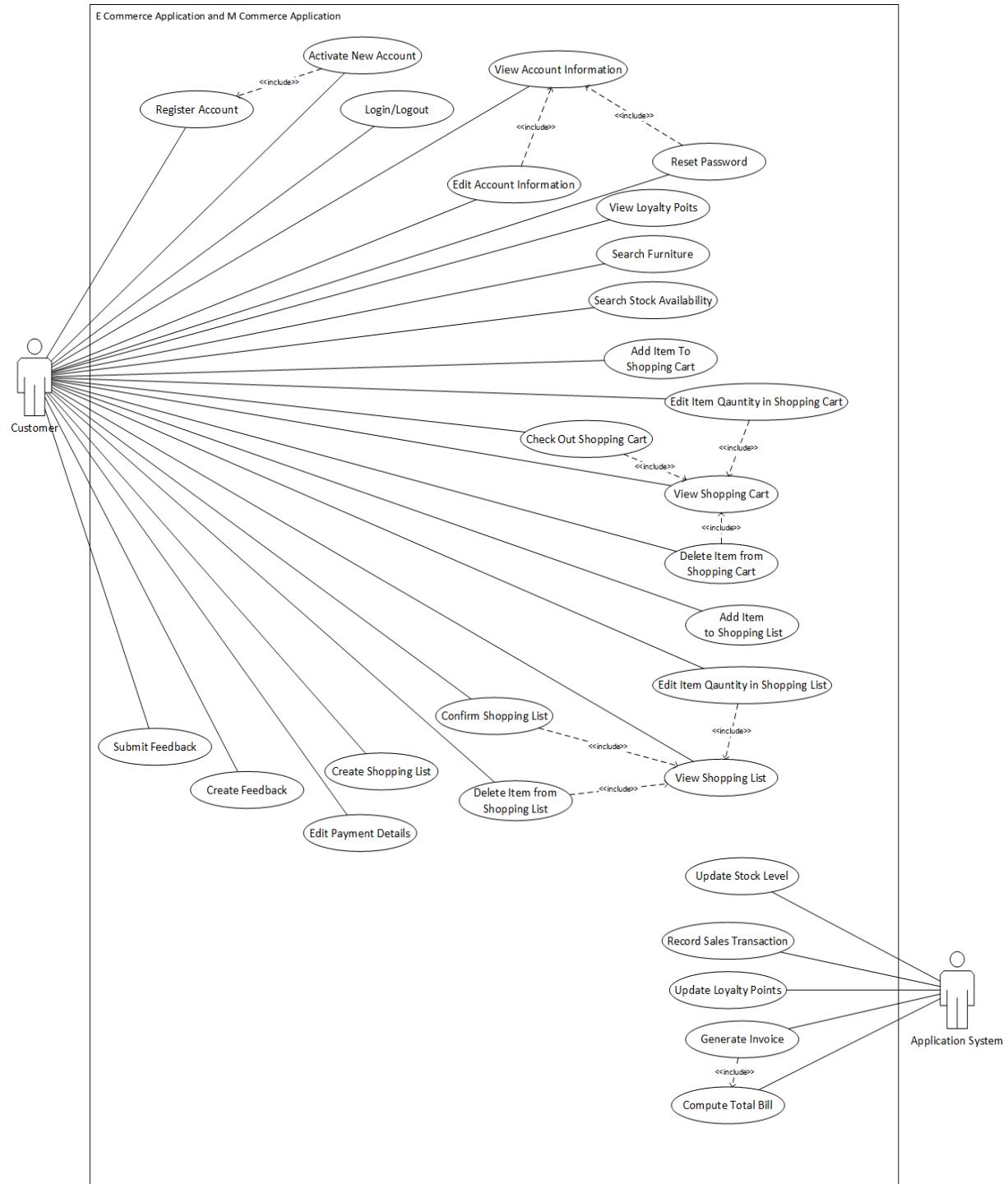


5.9 E & M Commerce Applications

5.9.1 E&M Commerce Customer Account Management and Sales Modules

The functional design of F.1 E-commerce Customer Account Management Module, F.2 E-commerce Sales Module, M commerce G.1 M-commerce Customer Account Management Module and G.2 M-commerce Sales Module is shown below :

5.9.1.1 Use Case Diagram



5.9.1.2 Use Case Description

Use Case Description 1

Use case Name	Register Account
Description	Customer wants to register an account on the Island Furniture web portal to become a member. Thereafter, he/she may do online shopping with Island Furniture and qualify for the loyalty point program.
Actors	Customer
Triggers	User login to create new account with Island Furniture
Goals	<ol style="list-style-type: none"> 1. Create new account and save it to the system. 2. Username does not conflict with existing registered usernames.
Pre-conditions	<ol style="list-style-type: none"> 1. User is registering for an account with Island Furniture the first time. 2. User is either using Island Furniture's E-commerce website or M-commerce app to register for an account.
Post-conditions	<ol style="list-style-type: none"> 1. New account successfully activated through activation email.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. Customer clicks on 'Create new account' on the home page of the website or app. 2. Customer fills in his/her personal particulars: <ol style="list-style-type: none"> a. First Name b. Last Name c. Identity Number d. DOB e. Gender f. Marital Status g. Preferred language h. Address

	<ul style="list-style-type: none"> i. Income level j. Mobile number k. Telephone number l. Country of residence m. City n. Email o. Nationality p. Username q. Payment details <ul style="list-style-type: none"> i. Credit Card Number ii. Payment Type iii. Expiration Date iv. CSC v. Billing Address <ol style="list-style-type: none"> 3. Customer clicks ‘Register’. 4. System validates the input information. 5. System saves the information into the database. 6. System displays registration successful and send an activation email to the user’s email. 7. User uses the password attached to the activation email to login to the new created account.
Alternative Courses	<p>2a. If username already exist in the database:</p> <ol style="list-style-type: none"> 1. System prompts customer to re-enter a new username. 2. User enters a new user name. 3. Continue with uncompleted fields in part 2. <p>4a. If any of the fields (DOB, Address, Mobile number, telephone number, email) failed the validation:</p> <ol style="list-style-type: none"> 1. Go back to step 2. 2. System highlights the fields with mistake in red. 3. User re-enters the information in the right format.

	4. Continue at step 3.
Exceptional courses	

Use Case Description 2

Use case Name	Compute total bill
Description	Customer had completed adding items to the online shopping cart and he/she is ready to check out the shopping cart. He/she submits the list of items to be purchased; system will compute the total bill payable by customer according to the items he/she had submitted.
Actors	Customer
Triggers	Customer wants to check the bill of all the items currently inside his/her online shopping cart.
Goals	To compute the total bill according to the items in the shopping cart.
Pre-conditions	<ol style="list-style-type: none"> 1. User has a registered account with Island Furniture. 2. User had chosen all the items that he/she wants to purchase. 3. User login to the system. 4. User is either using the E commerce application or M commerce application to do the online purchase. 5. Products listed online are all updated with the latest price including any discounts if the product is undergoing any form of discount.
Post-conditions	System computes and displays the total bill.
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User clicks the ‘view shopping cart’ button on the shopping cart page. 2. System retrieves products’ price information from the database.

	<ol style="list-style-type: none"> 3. System computes the overall bill of items in the shopping cart. 4. System displays the total bill together with other product details of the items in the cart. 5. User may then proceed to payment or continue to add more items to cart.
Alternative Courses	
Exceptional courses	

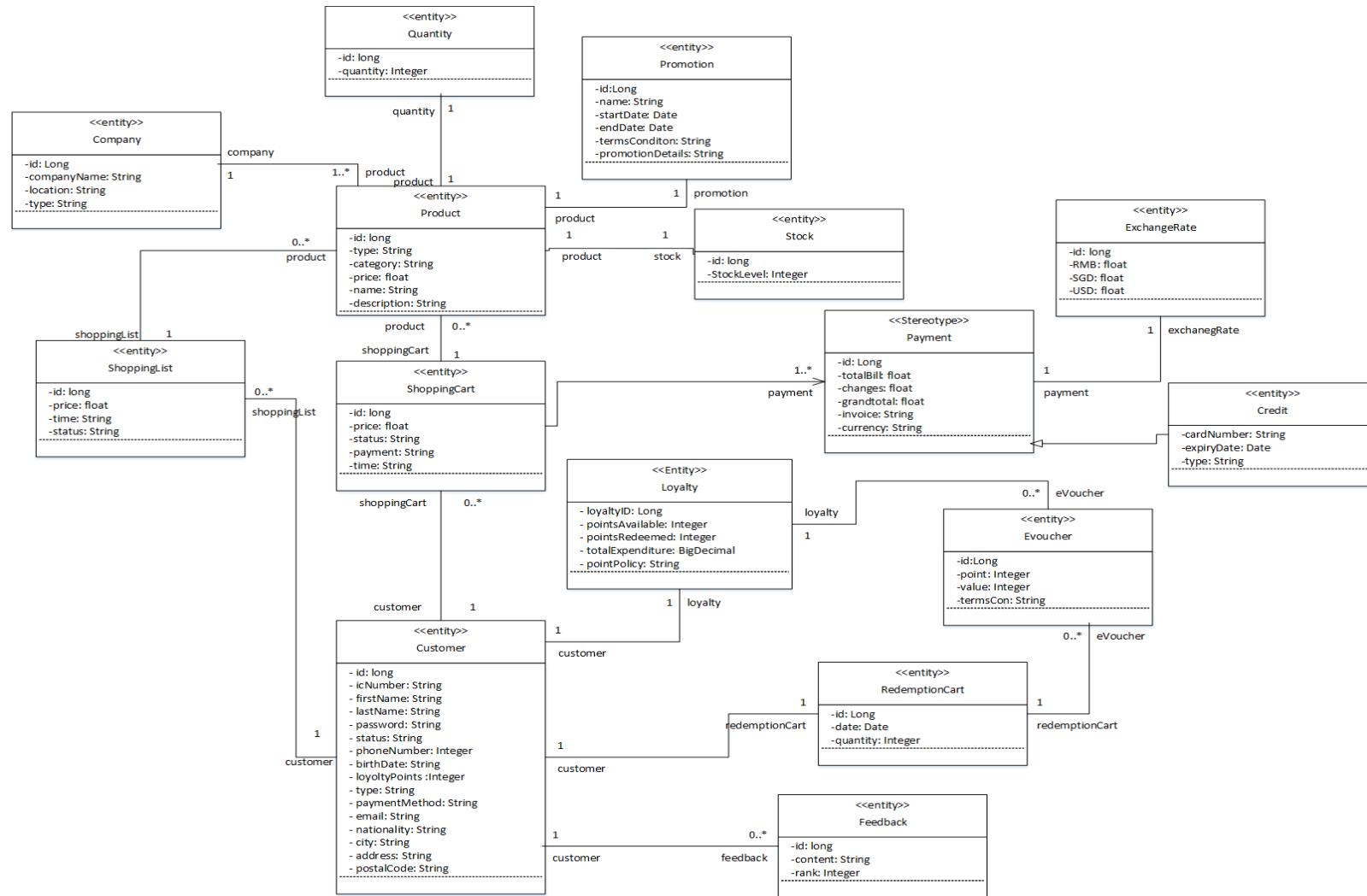
Use Case Description 3

Use case Name	Edit Item Quantity in Shopping Cart
Description	Customer wants to update the quantity of an item in the shopping cart; he/she is still in the online shopping process and hasn't checked out the shopping cart from online store yet.
Actors	Customer (online)
Triggers	Customer wants to change the quantity of an item to be purchased in the shopping cart.
Goals	To change the quantity of an item in the online shopping cart.
Pre-conditions	<ol style="list-style-type: none"> 1. List of items load to online store. 2. There is at least one item placed in the shopping cart. 3. Customer may change the quantity of any item in the shopping cart anytime as long as he/she hasn't check out the cart. 4. Customer selects an item from a list of items in the cart.
Post-conditions	1. Quantity of an item successfully changed in the shopping cart
Extension points	
Basic Course	<ol style="list-style-type: none"> 1. User clicks ‘View Cart Item’. 2. User selects an item to update the quantity. 3. User clicks “Update Change”. 4. System retrieves the item from the cart.

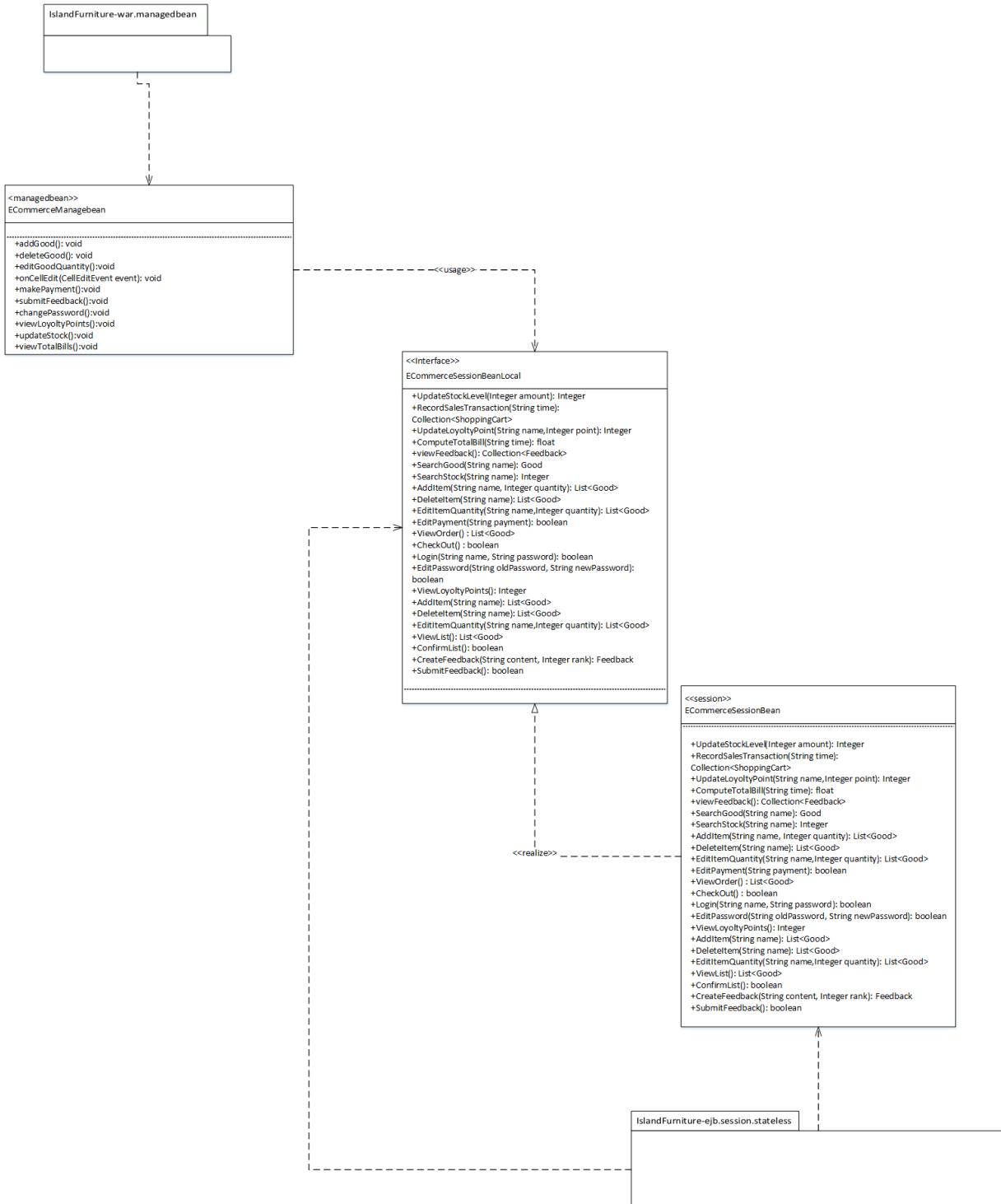
	5. System updates new quantity to the selected item. 6. System displays update successful.
Alternative Courses	
Exceptional courses	

5.9.1.3 Class Diagram

Entity Class Diagram

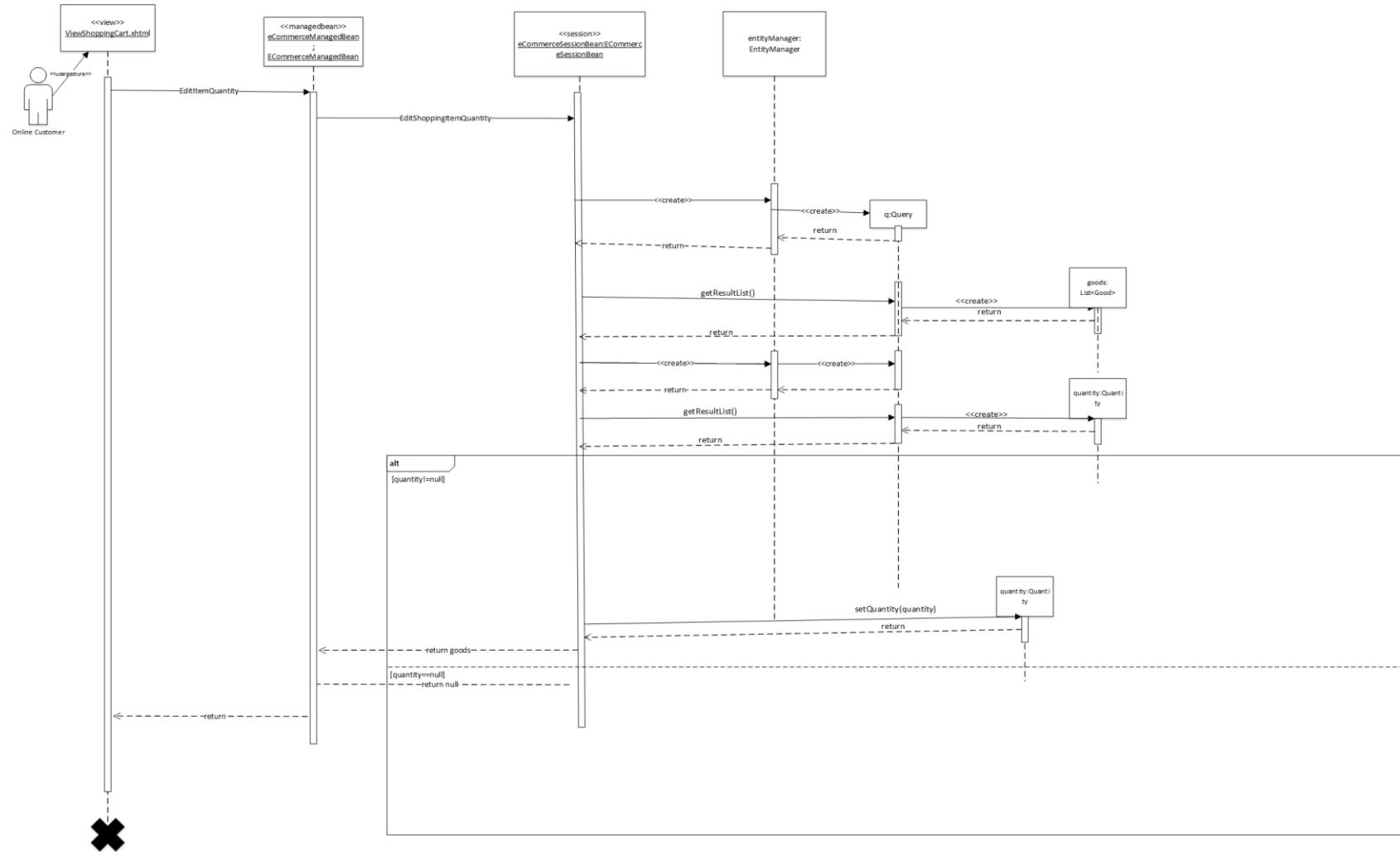


Non-Entity Class Diagram



5.9.1.4 Sequence Diagram

This diagram shows "Edit Item Quantity in Shopping Cart" use case.



6. User Interface Design

6.1 Guided principles for user Interface designs

In the development of user interface (UI) for our Island Furniture System, we have taken our objective a step further than simply creating a user-centered design. Our team aims to create a usage-centered environment through our system interface. We hope to improve work efficiency and promote system's user friendliness concurrently as user interacts with our system. A well-designed interface will provide Island Furniture's customer and staff a delightful and satisfied experience as they utilize the functions of the system to complete various business processes.

6.1.1 Being usage-centered

There are a number of principles to abide with in order to produce a quality usage-centered design. And these include:

The structured principle (See Fig.1):

A purposefully organized user interface finds it's basis upon clear and consistent models that are distinctly recognizable to users, it categorizes related things together and segregates unrelated things to differentiate dissimilar things from things of similar nature. This principle is concerned with the overall user interface architecture (Larry Constantine and Lucy Lockwood in *Investment Banking Application* by Corporation Essvale, 2011).

Our subsystems are constructed upon a standardize set of formatting to ensure a complete, consistent and inclusive layout for all the webpages. We group together similar functions that are dependent on each other for task performance based on the formatting plan. For example, main menu bar for every subsystem is placed distinctly on top of the webpage.

The simplicity principle (See Fig.2x):

The design is able to communicate directly and even provide good shortcuts to user in a way that makes common tasks straightforward (Larry Constantine and Lucy Lockwood in *Investment Banking Application* by Corporation Essvale, 2011).

Our system uses simple, elegant and swift methods to manage and handle processes. It provides step-by-step guidance, which enables user to accomplish tasks efficiently and effortlessly.

The visibility principle (See Fig.3x):

The design should make all useful options and materials for a given task visible to the user, while taking away unnecessary information that will divert the user's attention. Avoid providing too many alternatives that will often confuse users (Larry Constantine and Lucy Lockwood in *Investment Banking Application* by Corporation Essvale, 2011).

Our System utilizes a unified menu bar to enhance the navigation within all subsystems. Only the most essential links are made available to users. Users can see all the functionalities within a subsystem in a single view and they are prominently display in the menu bar for selection. With a simplified but well organized interface, our system prevents users from being exposed to too many choices at a single point in time, which would greatly reduce confusion. Hence, new users to our system can get the hand of operating it readily.

The feedback principle (See Fig.4x):

The design keeps user informed of actions taken, update user on any change of state/condition, and prompt of any errors that are related to the task the user is handling in simple and clear terms understandable to users (Larry Constantine and Lucy Lockwood in *Investment Banking Application* by Corporation Essvale, 2011).

We ensure that our system provides timely feedbacks to update users for all types of system changes. These feedbacks are put forth in comprehensive terms to ensure that they

would not result in any misunderstanding. Adding to that, they help to notify and rectify problems instantly, if there's any.

The tolerance principle (See Fig.5x):

The design enables flexible and permissible undoing and redoing to reduce the cost of mistakes and misuse. The design is also capable of interpreting reasonable actions and is more tolerant towards uncertain inputs, which helps to minimize errors (Larry Constantine and Lucy Lockwood in *Investment Banking Application* by Corporation Essvale, 2011).

Our system's UI design is integrated with precise and crucial business checks on users' input to promptly identify mistakes. All the validation functions allow the system to be more tolerant towards errors. Our system also enables user to edit a record whenever there is a mistake.

The reuse principle (See Fig.6x):

The design should aim to reduce the need for users to recall and remember. This can be achieved through reusing external and internal components and behaviors, maintaining a purposeful consistency rather than an arbitrary one (Larry Constantine and Lucy Lockwood in *Investment Banking Application* by Corporation Essvale, 2011).

Our Island Furniture UI is consistent in its view layer designs. The standard formatting and layout enhances system usability and reduce the need to constantly recall on its operation methodology.

6.2 Screenshots for Illustration of Principles

6.2.1 The Structured Principle

The screenshot shows a web-based application interface. At the top, there is a blue header bar with the text "ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM". Below it is a yellow navigation bar containing links: "Welcome", "Create Account", "Manage Account", "Reset Password", "View Log", "Manage Profile", and "Logout". A red arrow points from the "Logout" link down to the main content area. The main content area has a white background. It features a search bar with the placeholder "Enter User Name: admin" and two buttons: "Search User" and "View All User". A red box highlights the search bar and its buttons. Another red arrow points from this box down to a table below. The table has a light gray header row with columns for "User Name", "Account Type", "Account Status", "Employee Name", "Email", "Date of Birth", "Reset Password", and "Delete". Below the header, there are seven rows of data, each representing a user account. Each row contains a "Change" button next to the account type and status, and another "Change" button next to the email address. The "Delete" button is located in the bottom right corner of each row. A red box highlights the entire table.

Fig 1. A grid structure format with the menu bar distinctly placed on top of the page.

6.2.2 The Simplicity Principle

Following illustrates a step by step guided process to accomplish an add purchase requisition task:

The screenshot shows a web-based application interface. At the top, there is a blue header bar with the text "ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM". Below it is a yellow navigation bar containing links: "Welcome", "Manage Inventory", "Manage Purchase Requisitions", "Manage Purchase Orders", "Manage Profile", and "Logout". A large red number "1" is overlaid on the "Manage Purchase Requisitions" link. A red box highlights this link. Below the navigation bar, the page title "SUPPLY CHAIN MANAGEMENT" is displayed above a yellow header bar with the text "Welcome invinv. You are logged in as SCM Inventory Staff at Plant 1 in Singapore". The main content area has a white background. It features a navigation bar with links: "View Purchase Requisitions" and "+Add Purchase Requisition". A large red number "2" is overlaid on the "+Add Purchase Requisition" link. A red box highlights this link. Below the navigation bar is a table with a light gray header row and several data rows. The table has columns for "Purchase Requisition ID", "Purchase Requisition Date", "Part Name", and "Quantity". The data rows show various purchase requisitions with their respective dates, part names, and quantities. A red box highlights the entire table.

Fig. 2a User selects “Manage Purchase Requisition”, then clicks “Add Purchase Requisition”.

The screenshot shows a software application window with a yellow header bar containing links: Welcome, Manage Inventory, Manage Purchase Requisitions, Manage Purchase Orders, Manage Profile, and Logout.

The main content area has a yellow header "Manage Purchase Requisitions" with a sub-link "+ Add Purchase Requisition". Below it is a section titled "View Resource Planning".

A table lists parts with columns: Part ID, Part Name, Lot Size, and a "Add to Purchase Requisition" sidebar. A red number "3" is placed above the sidebar. The sidebar contains seven buttons labeled "+ Add Quantity".

Part ID	Part Name	Lot Size	Add to Purchase Requisition
5	Wood	10	
1	Screw	100	
2	Nail	200	
4	Wire	400	
6	Leather	20	
3	Hinge	300	

At the bottom are "Continue" and "Cancel" buttons.

Fig. 2b User chooses any part and click on “Add Quality”.

This screenshot shows the same software interface as Fig. 2b, but with a modal dialog box overlaid. A red number "4" is placed over the dialog.

The dialog is titled "Add Quantity" and contains fields for Part Id (5), Part Name (Wood), Lot Size (10), and Quantity (50). It also includes a "Replenishment Type" section with "Scheduled" and "Ad Hoc" options, and a "Add to Purchase Requisition" sidebar with seven "+ Add Quantity" buttons.

The background table remains the same as in Fig. 2b.

Fig. 2c System displays a pop-up to request for quantity.

The screenshot shows a web-based supply chain management system. At the top, there's a logo of two chairs and a table, followed by the title "SUPPLY CHAIN MANAGEMENT" and the subtitle "ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM". Below this is a welcome message: "Welcome invinv. You are logged in as SCM Inventory Staff at Plant 1 in Singapore". A navigation bar contains links for "Welcome", "Manage Inventory", "Manage Purchase Requisitions", "Manage Purchase Orders", "Manage Profile", and "Logout". The main content area is titled "Add Purchase Requisition - Confirmation". It displays a table with two rows of parts: "Wood" and "Screw". For "Wood", the quantity is set to 50. For "Screw", the quantity is set to 300. There are dropdown menus for "Lot Size" and "Replenishment Type" (both set to "Scheduled"). At the bottom of the form are buttons for "Back", "Cancel", and "Add to Purchase Requisition", with the latter being highlighted with a red border.

Fig. 2d After user entered the quantity, user may end the process by adding all the chosen parts to purchase requisition.

6.2.3 The Visibility Principle

This screenshot shows the "COMMON INFRASTRUCTURE" section of the system. It features a logo of two chairs and a table, the title "COMMON INFRASTRUCTURE", and the subtitle "ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM". A welcome message says "Welcome admin. You are logged in as Admin at Plant 1 in SG". A prominent horizontal menu bar at the top includes links for "Welcome", "Create Account", "Manage Account", "Reset Password", "View Log", "Manage Profile", and "Logout". A red arrow points from the "Logout" link down to a secondary message: "Welcome admin. You are logged in as Admin at Plant 1 in SG".

This screenshot shows the "SUPPLY CHAIN MANAGEMENT" section. It has a logo of two chairs and a table, the title "SUPPLY CHAIN MANAGEMENT", and the subtitle "ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM". A welcome message says "Welcome scm2. You are logged in as SCM Procurement Manager at Plant 1 in SG". A horizontal menu bar at the top includes links for "Welcome", "Manage Purchase Order", "Manage Profile", and "Logout". A red arrow points from the "Logout" link down to a confirmation message: "Hey scm2! Are you sure you want to log out?". A "Logout" button is visible at the bottom of this message area.

Fig. 3a & 3b All functionalities are display prominently in a single view in the menu bar.

6.2.4 The Feedback Principle

The screenshot shows a web-based application for Supply Chain Management. At the top, there is a decorative header with two lamps and the text "SUPPLY CHAIN MANAGEMENT". Below it, a blue bar reads "ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM". A yellow notification box in the top right corner says "You have successfully reset email". The main content area has a yellow header "Welcome scm2. You are logged in as SCM Procurement Manager at Plant 1 in SG". Below this is a navigation bar with links: "Welcome", "Manage Purchase Order", "Manage Profile", and "Logout". The main content area is titled "Manage Profile" and displays a table with user information:

User Name	Account Type	Employee Name	Email	Date of Birth	
scm2	SCM Procurement Manager	Shuwei	shuwei@islandfurniture.com	06/10/1992	

Fig.4a Our system provides timely feedback to notify user of system changes.

The screenshot shows a form for adding a supplier. The header says "Welcome shuwei. You are logged in as SCM Manager at Plant 1 in Singapore". The navigation bar includes links for managing suppliers, contracts, purchase requisitions, inventory, MRP records, and purchase requisitions. The main form is titled "Add Supplier" and has a section for "Supplier Particulars" with fields for Supplier Name, Supplier Address, Telephone No, Contact Person, Mobile No, Fax No, and Email Address. A red box highlights the "Supplier Name" field, which has an error message: "Supplier Name is required." A red arrow points from this field to a vertical list of errors on the right side of the screen. This list contains six items, each with a red checkmark and a message: "Supplier Name is required.", "Supplier Address is required.", "Telephone No is required.", "Contact Person is required.", "Mobile No is required.", and "Email Address is required.".

Fig.4b Our system provides timely feedbacks to alert user of errors.

6.2.5 The Tolerance Principle

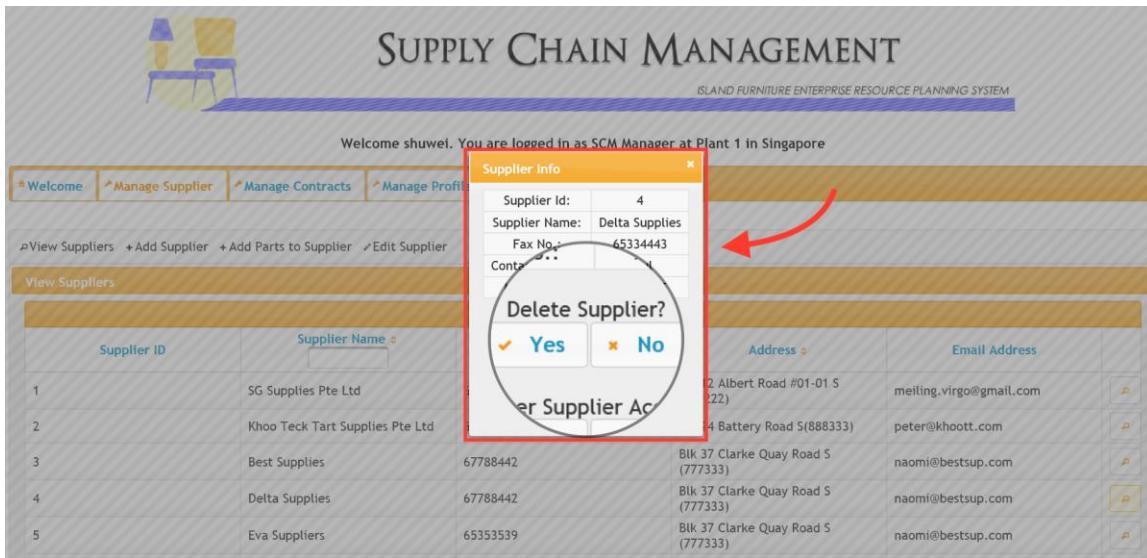


Fig. 5a Our system allows user to delete away wrong record.

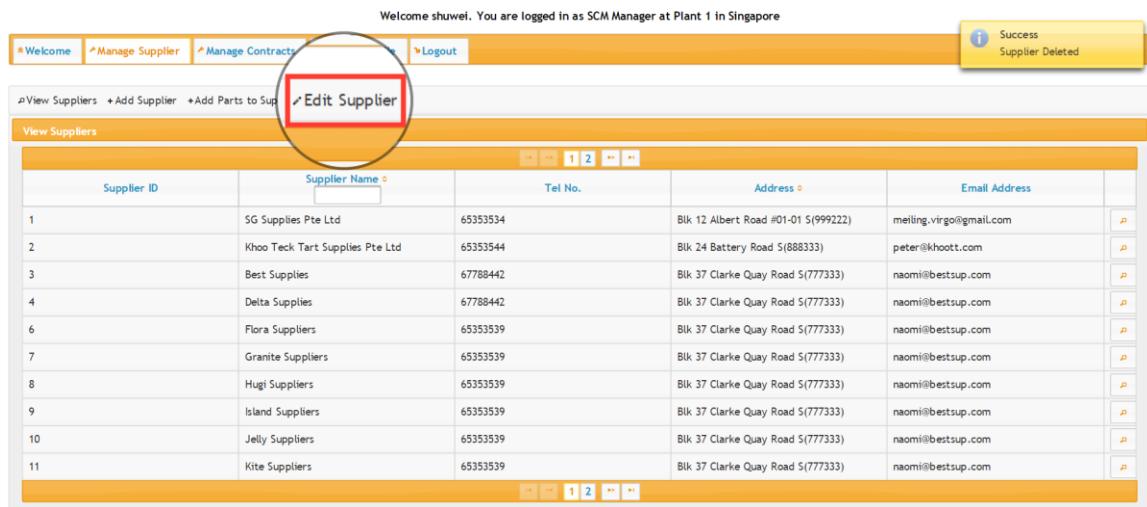


Fig. 5b Our system provides edit function to allow users to manage database information.

6.2.6 The Reuse Principle

Welcome shuwei. You are logged in as SCM Manager at Plant 1 in Singapore

[Welcome](#) [Manage Supplier](#) [Manage Contracts](#) [Manage Profile](#) [Logout](#)

[View Suppliers](#) [Add Supplier](#) [Add Parts to Supply](#) [Edit Supplier](#)

Success
Supplier Deleted

View Suppliers

Supplier ID	Supplier Name	Tel No.	Address	Email Address
1	SG Supplies Pte Ltd	65353534	Blk 12 Albert Road #01-01 S(999222)	meiling.virgo@gmail.com
2	Khoo Teck Tart Supplies Pte Ltd	65353544	Blk 24 Battery Road S(888333)	peter@khoott.com
3	Best Supplies	67788442	Blk 37 Clarke Quay Road S(777333)	naomi@bestsup.com
4	Delta Supplies	67788442	Blk 37 Clarke Quay Road S(777333)	naomi@bestsup.com
6	Flora Suppliers	65353539	Blk 37 Clarke Quay Road S(777333)	naomi@bestsup.com
7	Granite Suppliers	65353539	Blk 37 Clarke Quay Road S(777333)	naomi@bestsup.com
8	Hugi Suppliers	65353539	Blk 37 Clarke Quay Road S(777333)	naomi@bestsup.com
9	Island Suppliers	65353539	Blk 37 Clarke Quay Road S(777333)	naomi@bestsup.com
10	Jelly Suppliers	65353539	Blk 37 Clarke Quay Road S(777333)	naomi@bestsup.com
11	Kite Suppliers	65353539	Blk 37 Clarke Quay Road S(777333)	naomi@bestsup.com

[View Purchase Orders](#)

SUPPLY CHAIN MANAGEMENT
ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM

Welcome scm2. You are logged in as SCM Procurement Manager at Plant 1 in Singapore

[Welcome](#) [Manage Purchase Order](#) [Manage Profile](#) [Logout](#)

[View Purchase Orders](#)

Purchase Order ID	Purchase Order Date	Scheduled Delivery Date	Part Name	Supplier Name	Total Price	Order Status
1	30/08/2014	30/10/2014	Screw	SG Supplies Pte Ltd	\$40.00	Rejected
5	01/10/2014	21/05/2014	Hinge	Best Supplies	\$120.00	Rejected
7	21/09/2014	02/11/2014	Leather	SG Supplies Pte Ltd	\$250.00	Approved
37	26/09/2014	09/10/2014	Nail	Delta Supplies	\$616.00	Approved
41	04/10/2014	12/10/2014	Leather	Flora Suppliers	\$55.00	Approved
25952	14/10/2014	09/09/2014	Wire	Best Supplies	\$880.00	Rejected
26002	14/10/2014	11/10/2014	Wire	Best Supplies	\$880.00	Approved
29456	21/10/2014	04/11/2014	Hinge	Khoo Teck Tart Supplies Pte Ltd	\$600.00	Pending Approval
29706	21/10/2014	07/11/2014	Leather	Flora Suppliers	\$13.20	Approved

Fig. 6a & 6b Using the reuse principle to ensure internal consistency with user interface.

6.3 UI Aesthetics

6.3.1 ERP Webpage

Login page



ISLAND FURNITURE ERP

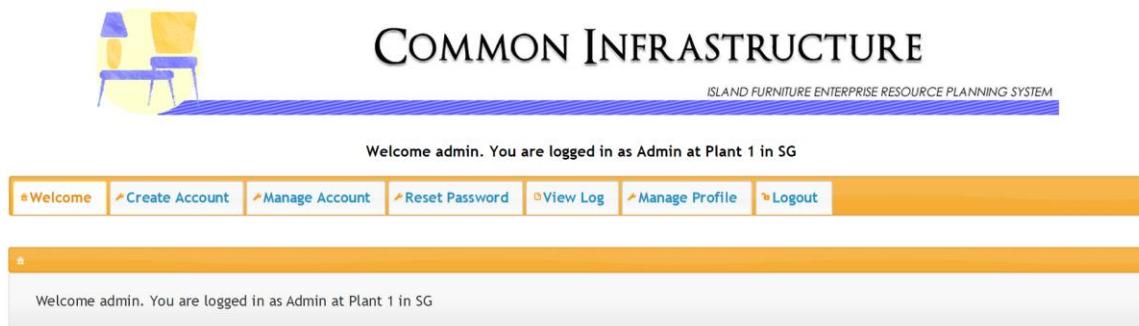
ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM

Login

User Name: *

Password: *

Welcome page



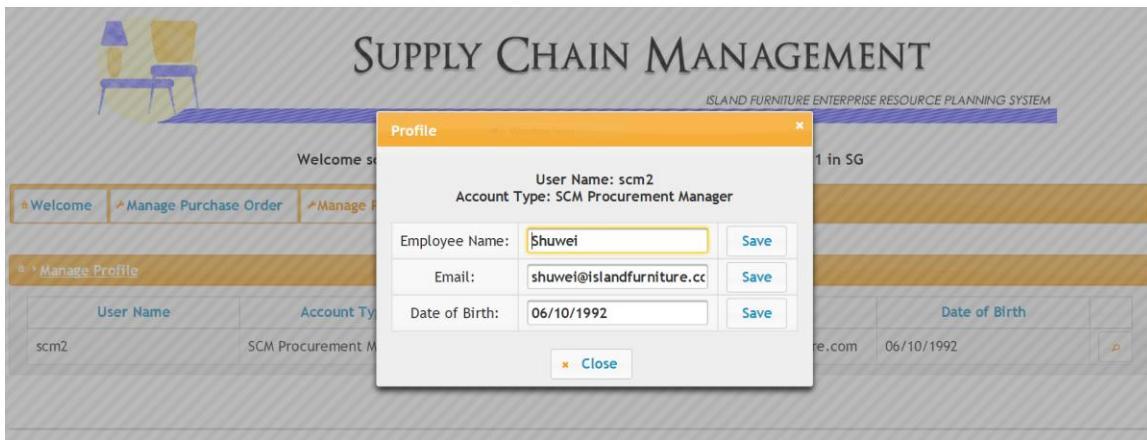
COMMON INFRASTRUCTURE

ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM

Welcome admin. You are logged in as Admin at Plant 1 in SG

#Welcome ↗ Create Account ↗ Manage Account ↗ Reset Password ↗ View Log ↗ Manage Profile ↗ Logout

Profile Management Page



Filter And Search Purchase Order: Tabular Form

The screenshot shows a web-based application titled "SUPPLY CHAIN MANAGEMENT" under the sub-section "ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM". A central table displays a list of purchase orders. The table has columns: Purchase Order ID, Purchase Order Date, Scheduled Delivery Date, Part Name, Supplier Name, Total Price, and Order Status. The table contains 10 rows of data. The "Order Status" column includes a dropdown menu with options like "Select One", "Approved", "Rejected", and "Pending Approval". The "Supplier Name" column lists various suppliers such as SG Supplies Pte Ltd, Best Supplies, Delta Supplies, Flora Suppliers, and Khoo Teck Tart Supplies Pte Ltd. The "Total Price" column shows values ranging from \$40.00 to \$680.00. The "Purchase Order Date" and "Scheduled Delivery Date" columns show dates from October 2014 to November 2014. The "Part Name" column lists items like Screw, Hinge, Leather, Nail, and Wire.

Purchase Order ID	Purchase Order Date	Scheduled Delivery Date	Part Name	Supplier Name	Total Price	Order Status
1	30/08/2014	30/10/2014	Screw	SG Supplies Pte Ltd	\$40.00	Rejected
5	01/10/2014	21/05/2014	Hinge	Best Supplies	\$120.00	Rejected
7	21/09/2014	02/11/2014	Leather	SG Supplies Pte Ltd	\$250.00	Approved
37	26/09/2014	09/10/2014	Nail	Delta Supplies	\$616.00	Approved
41	04/10/2014	12/10/2014	Leather	Flora Suppliers	\$55.00	Approved
25952	14/10/2014	09/09/2014	Wire	Best Supplies	\$880.00	Rejected
26002	14/10/2014	11/10/2014	Wire	Best Supplies	\$880.00	Approved
29456	21/10/2014	04/11/2014	Hinge	Khoo Teck Tart Supplies Pte Ltd	\$600.00	Pending Approval
29706	21/10/2014	07/11/2014	Leather	Flora Suppliers	\$13.20	Approved

Search Account Through Username

Welcome admin. You are logged in as Admin at Plant 1 in Singapore

* Welcome * Create Account * Manage Account * Reset Password * View Log * Manage Profile * Logout

* Manage Account
+ Search Account

Enter User Name: admin
Search User View All User

User Name	Account Type	Account Status	Employee Name	Email	Date of Birth	Reset Password	Delete
admin	Admin Change	active Reset	Shuwei Change	ziguistall@hotmail.com Change	06/10/1992 Change	Change	Delete
scminv	SCM Inventory Management Staff Change	active Reset	Change	Change	Change	Change	Delete
invinv	SCM Inventory Staff Change	active Reset	Change	Change	Change	Change	Delete
shuwei	SCM Manager Change	active Reset	Change	Change	Change	Change	Delete
scm2	SCM Procurement Manager Change	active Reset	Change	Change	Change	Change	Delete
mrp1	MRP Staff Change	active Reset	Change	Change	Change	Change	Delete
scm1	SCM Procurement Staff Change	active Reset	Change	Change	Change	Change	Delete

Error Messages With Fields That Are Wrong Highlighted In Red

Welcome shuwei. You are logged in as SCM Manager at Plant 1 in Singapore

* Welcome * Manage Supplier * Manage Contracts * Manage Purchase Requisitions * Manage Inventory * View MRP Records * Manage Purchase Requisitions * Manage Purchase Requisitions

* View Suppliers + Add Supplier + Add Parts to Supplier ✓ Edit Supplier

Add Supplier

Supplier Particulars

Supplier Name: * Supplier Name is required.

Supplier Address: *

Telephone No: *

Contact Person: *

Mobile No: *

Fax No: *

Email Address: *

Save

- Supplier Name is required.
Supplier Name is required.
- Supplier Address is required.
Supplier Address is required.
- Telephone No is required.
Telephone No is required.
- Contact Person is required.
Contact Person is required.
- Mobile No is required.
Mobile No is required.
- Fax No is required.
Fax No is required.
- Email Address is required.
Email Address is required.

Password Reset with email confirmation

User Name	Account Type	Account Status	Reset Password	Email	Date of Birth	Reset Password	Delete
admin	Admin	active	Reset	meiling.virgo@gmail.com	06/10/1992	Change	Delete
scminv	SCM Inventory Staff	active	Reset	Change	Change	Change	Delete
invinv	SCM Inventory Staff	active	Reset	Change	Change	Change	Delete
shuwei	SCM Admin	active	Reset	Change	Change	Change	Delete
scm2	SCM Purchasing Manager	active	Reset	Change	Change	Change	Delete
mrp1	MRP Staff	active	Reset	Change	Change	Change	Delete
scm1	SCM Purchaser	active	Reset	Change	Change	Change	Delete

Information on Approved Purchased Order

SUPPLIER PORTAL
ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM

Welcome SG Supplies Pte Ltd. You are logged in as meiling.virgo@gmail.com

Shipping Order ID:	32365
Scheduled Delivery Date:	Fri Oct 24 00:00:00 SGT 2014
Shipping Status:	Shipped
Shipped Out Date:	Wed Oct 22 00:00:00 SGT

Additional Details
 Purchase Order ID: 32361
 Purchase Order Created on: Tue Oct 21 00:00:00 SGT 2014

Part Name: Hinge
 Unit Price: 1.0
 Quantity: 300
 Total Price: \$ 300.0

Negotiation Condition: Term(s) from Quotation: nowaw

Shipping Detail with Proper Navigation Headings

Welcome SG Supplies Pte Ltd. You are logged in as meiling.virgo@gmail.com

[Welcome](#) [View Request for Quotation](#) [View Approved Purchase Order](#) [Logout](#)

[View Approved Purchase Order](#) > [Shipping Details](#)

Shipping Order Details

Shipping Order ID:	32365
Scheduled Delivery Date:	Fri Oct 24 00:00:00 SGT 2014
Shipping Status:	Shipped
Shipped Out Date:	Wed Oct 22 00:00:00 SGT

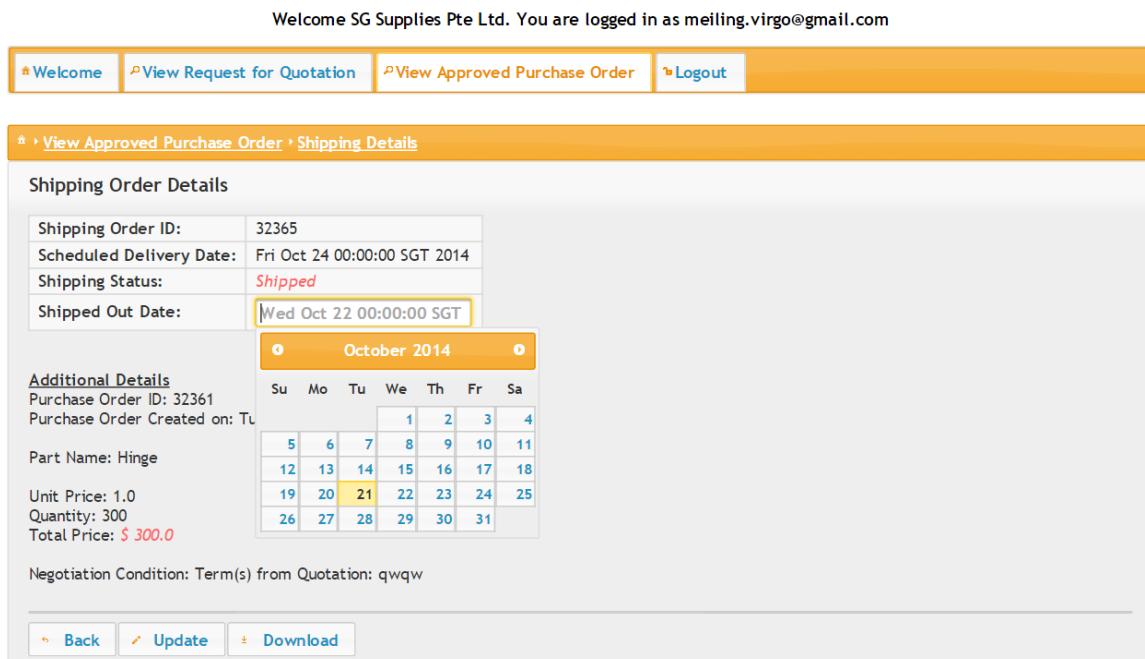
Additional Details

Purchase Order ID: 32361
Purchase Order Created on: Tu

Part Name: Hinge
Unit Price: 1.0
Quantity: 300
Total Price: \$ 300.0

Negotiation Condition: Term(s) from Quotation: qwqw

[Back](#) [Update](#) [Download](#)



Dropdown List with AutoFill Function for Blanks

Supplier Portal Workspace | MD5 Online | MD5 Decryp | Y.E.S. 93.3FM | SCM Workspace

localhost:8080/IslandFurniture-war/scmAdminAddContract.xhtml?i=2

ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM

Welcome shuwei. You are logged in as SCM Admin at Plant 1 in Singapore

[Welcome](#) [Manage Supplier](#) [Manage Contracts](#) [Manage Profile](#) [Logout](#)

[View Contracts](#) [+ Add Contract](#) [+ Edit Contract](#)

Create Contract

Start Date: *

End Date: *

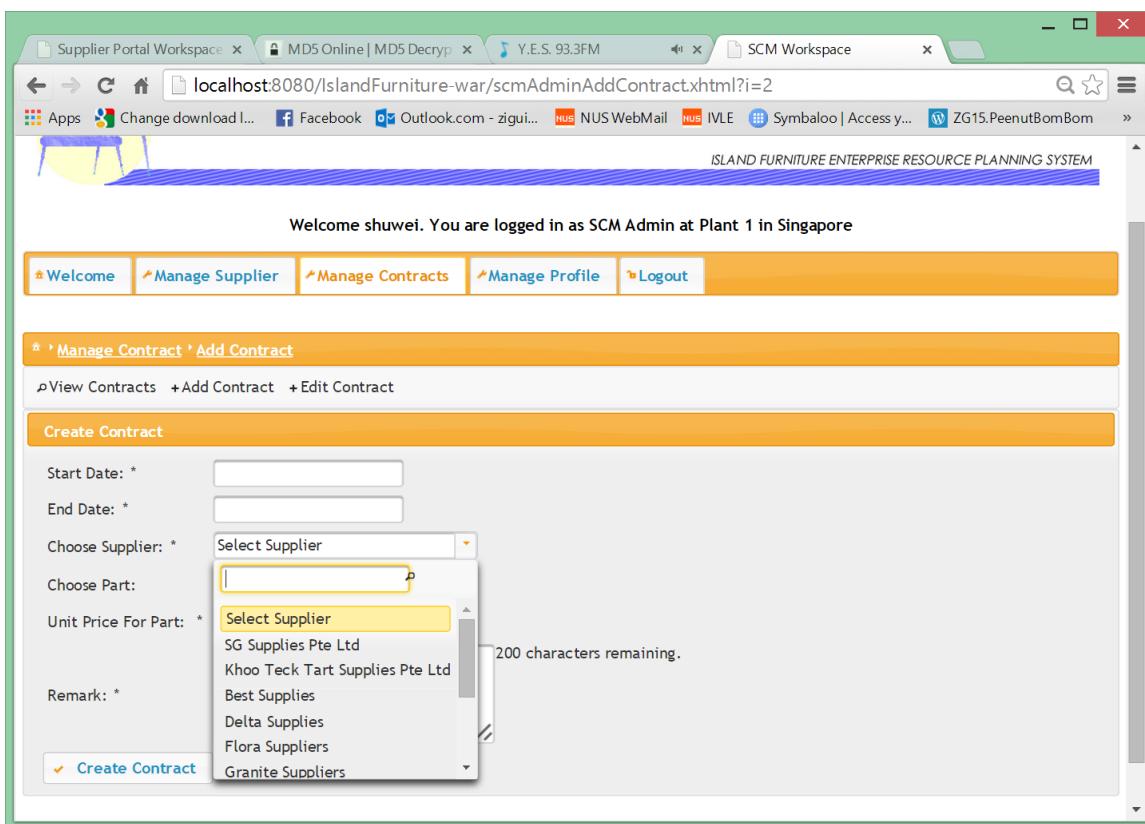
Choose Supplier: * Select Supplier

Choose Part:

Unit Price For Part: *

Remark: * 200 characters remaining.

[Create Contract](#)



Dropdown list for selection

A screenshot of a web-based application interface. At the top, there is a navigation bar with icons for back, forward, and search. Below it is a toolbar with buttons for sorting and filtering. The main area contains a table with columns: Order ID, Scheduled Delivery Date, Part Name, Supplier Name, Total Price, and Order Status. The Order Status column includes a dropdown menu with options: Select One, Pending Approval, Approved, Rejected, and Pending. The table data is as follows:

Order ID	Scheduled Delivery Date	Part Name	Supplier Name	Total Price	Order Status
I14	30/10/2014	Screw	SG Supplies Pte Ltd	\$40.00	Select One
I14	21/05/2014	Hinge	Best Supplies	\$120.00	Pending Approval
I14	02/11/2014	Leather	SG Supplies Pte Ltd	\$250.00	Approved
I14	09/10/2014	Nail	Delta Supplies	\$616.00	Rejected
I14	12/10/2014	Leather	Flora Suppliers	\$55.00	Approved
I14	09/09/2014	Wire	Best Supplies	\$880.00	Rejected

Multiple Selection Function

A screenshot of a web-based application titled "SUPPLY CHAIN MANAGEMENT". The page header includes the URL "localhost:8080/IslandFurniture-war/scmAdminAddPartToSupplier.xhtml?i=1" and the title "ISLAND FURNITURE ENTERPRISE RESOURCE PLANNING SYSTEM". The main content area displays a welcome message: "Welcome shuwei. You are logged in as SCM Admin at Plant 1 in Singapore". Below this is a navigation bar with links: Welcome, Manage Supplier, Manage Contracts, Manage Profile, and Logout. A sidebar on the left shows a tree view of parts: Screw, Nail, Hinge, Wire, Wood, and Leather. The "Hinge" node is expanded, showing it is selected (indicated by a checked checkbox). The main panel contains a form with a "Supplier" input field, a "Parts to Supplier" section with a "Add Part to Supplier" button, and a "Edit Supplier" link.

6.3.2 M-Commerce Application Login Page



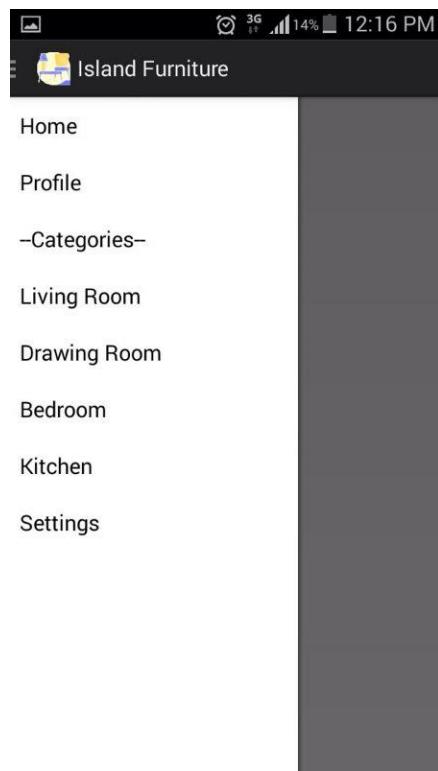
Username

Password

[Login](#)

[Login as Guest](#)

M-Commerce Application Home Page



6.3.3 E-commerce Website Landing Page

The screenshot shows the homepage of Island Furniture. At the top, there is a navigation bar with the logo 'ISLAND FURNITURE' featuring a stylized chair icon. To the right of the logo are fields for 'Select Country' (set to Singapore) and 'Select Language' (set to English), along with links for 'Login/Register' and 'My shopping list'. Below the navigation bar is a search bar with the placeholder 'Search...'. A main banner titled 'All Products' features a photograph of a living room with a bright orange sofa, a striped rug, and various decorative items. The sofa has price tags: '\$149' on the left and '\$779' on the right. A small badge on the sofa says '10% Off Selected Items'. Below the banner, there are category links: 'Limited Time Deals', 'Bedroom', 'Bathroom', 'Living room', 'Kitchen', 'Storage', and 'All departments'. The overall layout is clean and modern, typical of a furniture e-commerce site.

7. Naming and Package Conventions

S/N	Convention Type	Description	Example
1	EJB Module Source Package Naming	<p>Top level source packages in the EJB module are named and divided based on the file type, i.e. entity classes, session beans and data model POJO classes.</p>	entity session.stateless datamodel
2	Web Module Source Package Naming	<p>Top level source packages in the Web Module are named and divided based on the file type.</p> <p>The package managedbeans contains all the various managed beans.</p> <p>The package manager contains all functional wrapper JavaBean classes.</p> <p>The package util contains all helper JavaBeans.</p> <p>The package Report contains all files used for generating JasperReport</p>	managedbean manager util report
3	Web Folder Naming	<p>Top level folder begins with web. The folders are then named according to their file type, or the type of resources such as images and CSS style sheets.</p> <p>The web folder contains various web pages required for the system.</p> <p>The resources folder contains a css sub folder for all style sheets used in</p>	web web/resources/css web/img

		<p>the system.</p> <p>The img folder contains all images, such as company logo and banners.</p>	
4	JSF File Naming	<p>All filenames for JSP pages are prefixed with the main module name, followed by the actual page name.</p> <p>For JSF pages in Common Infrastructure main module, they are prefixed with the word ‘admin’ to indicate that only administrators will have access to these functionalities.</p> <p>JSP pages for index page, initial deployment and redirected login are named based on the functionality of the JSF page.</p>	mrpManagePart.xhtml adminCreateAccount.xhtml index.xhtml initialDeployment.xhtml redirectLogin.xhtml
5	Entity Class Naming	<p>All entity classes are named based on the business objects represented in the real world context, and are words consisting of nouns.</p> <p>For ease of use, certain entity classes have been named according to their short forms. For example, “SupplierAccount” is named as “SupplierAcct”.</p>	Company BOM MPS MRP SupplierAcct

6	Session EJB Naming	<p>All Session EJB begins with their name, and ends with SessionBean. Their corresponding local interface ends with SessionBeanLocal.</p> <p>For Session EJB using web services, the naming convention begins with their name, and ends with WebSession. Their corresponding local interface ends with WebSessionLocal.</p> <p>For ease of use, certain Session EJB has been named according to their short forms. For example, “PurchaseRequisition” is named as “PurchaseReq”.</p>	MPSSessionBean MPSSessionBeanLocal PartWebSession PartWebSessionLocal PurchaseReqSessionBean PurchaseReqSessionBeanLocal
7	Manager (Functional Wrapper JavaBean) Naming	All functional wrapper JavaBeans begins with their functionality and ends with Manager .	EmailManager
8	JSF Managed Bean Naming	<p>All JSF managed beans begins with their functionality and ends with ManagedBean.</p> <p>Managed beans used for displaying messages consisting of information such as role type and username ends with WelcomeMessage.</p>	LoginManagedBean WelcomeMessage SupplierWelcomeMessage

8. Declaration of Open-source Codes

S/N	Type	Complete Name with Version (Filename)	Source	Usage Location
1	FR	PrimeFaces-5.0.jar	http://www.primefaes.org/	All web pages
2	LI	JasperReport v5.6.0	http://jasperforger.org/	All generated PDF Reports
3	LI	Primefaces Community Theme, ui-lightness.jar	http://repository.primefaces.org/org/primefaces/themes/ui-lightness/1.0.10/	All ERP web pages

9. Project Management Plan

9.1 Gantt Chart

Kent Ridge Technology makes use of Gantt Chart in the Microsoft Project to ensure schedule and milestones are met. This is done by identifying and monitoring the critical path of the ERP development after listing all project schedule details according to their corresponding start date and end date.