Integration of Automatic Identification and Data Capture devices with SAP R/3

by

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Supervised by

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Dissertation report submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Business Information System)

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CERTIFICATE OF APPROVAL

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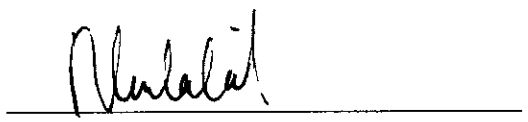

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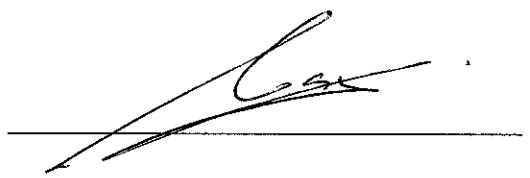
CERTIFICATE OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work in my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



NAZRUL AMINUR HAFIZ ABD RAHMAN

ABSTRACT

Although SAP R/3 has become widely utilized as a means to change IT systems and business processes, not all organizations embarking on its implementation have achieved their intended results particularly in inventory management. Automatic identification and data capture are distinguished as an important emergent area of enterprise resource planning (ERP) implementation. Due to optimization and globalization of business operation, efficient supply chain management becomes more crucial. The objective of this project is to present the accessibility of barcode technology in providing automated data handling. A number of products are available for implementation, but this project focuses on SAP R/3 from SAP AG. Business scenario from media industries are been utilized to stimulate the real environment of barcode implementation within SAP system. Configuration of the SAP system is implemented to obtain the optimal solutions based on requirement gathered from the first phase of the project. Replication of the case study illustrates the applicability of the approach to overcome the issues and the advantages of the solution. Simulation of the result is expected to be a key answer for reducing the human errors occurs in business process transaction and increase the employee's productivity.

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CHAPTER 1: INTRODUCTION

1.1 Background of Study

The idea for the barcode was developed by Norman Joseph Woodland and Bernard Silver. In 1948 while graduate students at Drexel University, they developed the idea after hearing the president of a food sales company wishing to be able to automate the checkout process. According to wikipedia.com(2005) the first barcode reader was built by Woodland (who was an IBM employee at the time) and Silver in 1952 and included a 500 watt light bulb and a photomultiplier vacuum tube made by RCA for movie sound tracks (which were printed optically on film). The barcode enable organization to work in timeliness and effectively.

SAP, originally developed and marketed in Germany, is an integrated software package providing core business applications. In the 1990s SAP software became better known outside Germany and captured a large share of the integrated package market in medium and large companies throughout the world. With extensive functionality and a high level of integration the software covers the full range of business requirements, including financial accounting and control, sales and distribution, materials management, production planning and human resources management.

Barcode widely implemented to increase the level of warehouse management efficiency. Barcode varies in various aspects such as barcode types, scanning technology and applications. These different type of barcode types are differentiated by their character sets (numeric only versus alphanumeric), by their print density (how many characters they can encode per lineal inch), by how easy they are to print using low resolution printers and by several other attributes. Modern bar code scanner/decoders can read all of these types automatically and most bar code printing packages can print all of these types and many more. Integration of barcode within SAP system facilitates companies with competitive advantages against their

competitor in the business world. By having most efficient ERP system, business operation become more efficient and organizes.

1.2 SAP R/3 and Components

The SAP R/3 system is structured in a three-tier client /server architecture from a software perspective, with each tier having a distinct function (see Figure 1-1). In this architecture, the presentation tier provides the interface to the user; the application tier processes the business logic, and the database tier stores the business data. The SAP system architecture supports heterogeneous environments and provides a high degree of system scalability and flexibility. With the introduction of the Internet middleware, SAP systems are now considered to be structured in a multi-tier architecture.

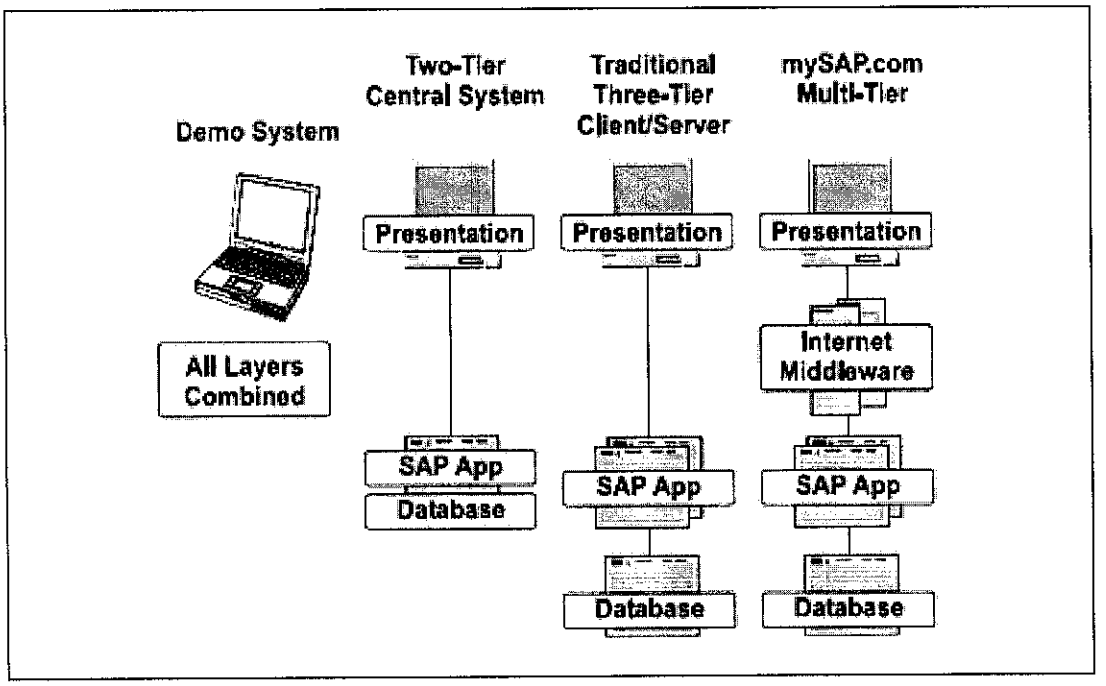

Figure 1.1 SAP R/3 clients/ server architecture

From SAP's point of view, the three software tiers of database, application, and presentation as shown in Figure 1.1 are parts of one unit. In practice, only the application and database servers typically located in the data center are considered the SAP system. The presentation server, typically an SAPGUI application running on the user's workstation or PC, is often mislabeled as "client" or assumed equivalent to a "user."

The initial intention of most enterprises is to deploy one single central SAP system for the entire organization. However, as time goes by, a multitude of independent SAP systems sprouts because different business units deploy different business processes and have different maintenance, geographical, and legal considerations, for example.

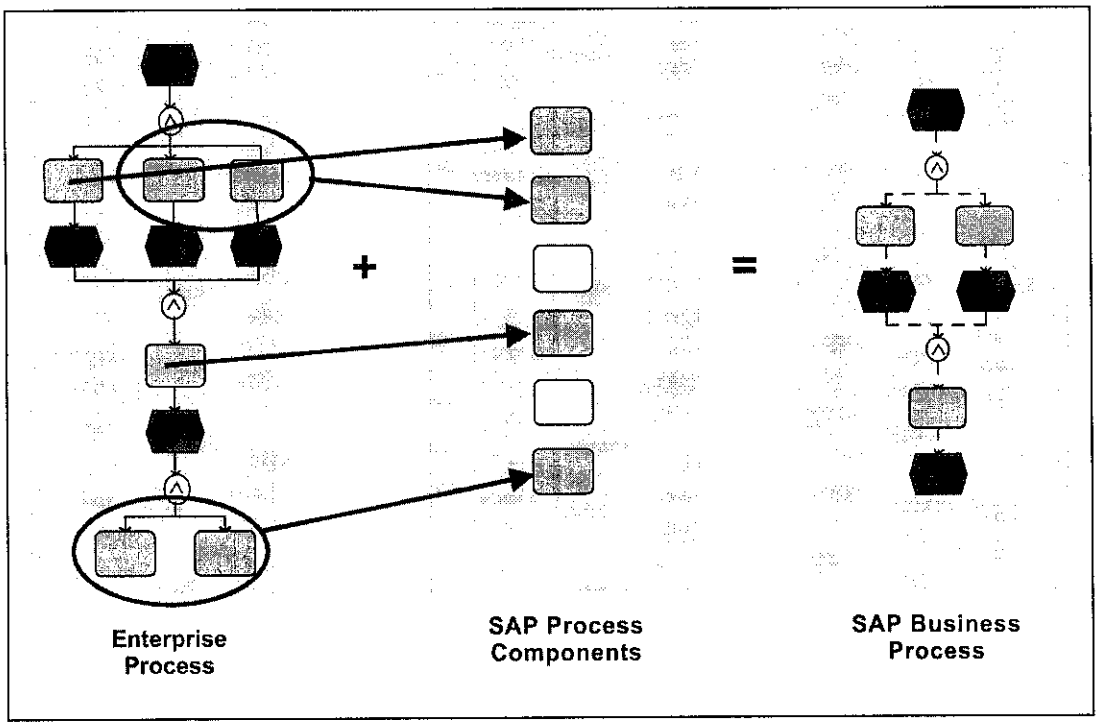

Figure 1.2 SAP business process

A business process is a sequence of functions that are executed by organizational units, according to appropriate business process logic, using the necessary data. Figure 1.2 demonstrates the sequences of SAP business process execution. Within SAP, business processes are defined according to levels, with each level providing more details. As in the solutions maps, as one navigates to lower levels, information that is more detailed is revealed to support analyses. (Gulledge, Sommer and Simon, 2004). Typically, by examining the AS-IS business process from existing system, functional consultant will match it with SAP process components to produce SAP business process (see Figure 1.2).The SAP R/3 system consists of a number of components that are completely integrated with one another. This high level of integration of the individual components guarantees consistency of data throughout the system and the company itself. Materials management (MM) module is a component within the SAP R/3 system.

Materials Management (MM) enables the sharing of the accurate inventory and purchasing process information across the supply chain network. Within an organization, information is accessible online for all departments. It facilitates plan-driven procurement, inventory management and invoicing. (help.sap.com, 2005)

In brief, materials are planned based on the consumption history of a material, where procurement proposal is made either to produce internally or buy externally. All stock movement relates to these operations (production or procurement) will be updated to the Inventory Management sub-modules in additions to any transfers made. The movement includes the delivery of goods to customer that has been withdrawn from the stock (processed with the Sales & Distribution module).

This project will cover the sub-modules for Materials Management (MM) which includes:

Procurement

Purchasing is a component of Materials Management (MM). it supports external procurement of materials and services.

Inventory Management

Under Materials Management (MM) module, inventory management handled the management of material stock on a quantity and value basis. All transactions that bring about a change in stock are entered in real time, as are the stock updates resulting from these changes. User can obtain an overview of the current stock situation of any given material at any time. The stocks are managed not only on a quantity basis but also by value. The system automatically updates the following data each time there is a goods movement:

1. Quantity and value for Inventory Management
2. Account assignment for cost accounting
3. G/L accounts for financial accounting via automatic account assignment

The subcomponents been used for this project will been described in further details under **Chapter 4: Result and Discussion**.

1.3 Problem Statement

1.3.1 Problem identification

One of the SAP system components is Materials Management. SAP Material Management (MM) comprises all activities related with material acquisitions (purchasing) and control (inventory, warehousing). The warehouse management module manages complex warehouse structures, storage areas, and transportation routes. Stock is always controlled because every material movement is immediately recorded.

Any company that produces and sells a product, whether the product is consumer or manufacturer oriented, will need warehouse management to monitor their inventory. Good administration of the inventory could positively affect the asset utilization, liquidity ratios and other financial ratios which could provide a meaningful comparison of a company to its industry. Inventory management help organization to monitor and record all the procurements processes and inventory flows throughout organization.

Typically, data entries are done by key entering data with a keyboard. Keyboard data entry creates a lot of problems. Inaccuracies and delays in updating the computer contribute to lower inventory turns, missed delivery dates, lower sales, lower productivity and a host of other important problems. In addition, keyboard data slower down the organization operation and productivity because of time consuming when employees need to manually entering each data into the system.

As an example of the book publication and distributor's company, mainly the International Standard Book Number (ISBN) has been used as material number in SAP system which consists of 13 digit numbers. Therefore it required employees to exploit their short-term memory ability to memorize these 13 digits which in some way could possibly cause human errors. This is because in dealing with customers, employees sometimes need to speed up their work pace because to meet the customer needs and requirements. Besides, different people will have different level of memorizing ability.

As a result, even SAP has providing good inventory management to monitor the materials life-cycle but within certain circumstances such as human errors or lack of technological benefits, it causes some disparity values to the system.

1.3.2 Significant of the project

The significant of this project is experimenting the barcode with SAP system to reduce the human errors occurs during data handling by implementing automatic identification and data capture (AIDC). In the end of this project, automated data handling system will be a possible solution to help reducing inaccurate data entry from keyboard. The study also includes understanding the business scenario and process for industry chosen and analyzes the flexibility of SAP system in configuring the system to meet the business needs and operations.

1.4 Objective and Scope of the Project

Implementation of this project supported by several objectives which are:

1. Identify and analyze AS-IS business process in Materials Management module for a typical Book Publisher & Distributor Company that affected with problem statement which are business process for purchasing, goods receipt, material master creation and stock transfer.
2. Design and analyze TO-BE business process for each selected AS-IS business process.
3. Design and develop the framework or platform for automation data collection (AIDC) using SAPConsole. SAPConsole translates GUI (Graphical User Interface) screens to character based screens used on a wide variety of data-collection devices.
4. Configure the SAP system using Implementation Guidelines (IMG) screen in SAP system based on requirement from TO-BE business process to stimulate the real environment.
5. Integrate barcode reader with SAP system by analyzing the architectures and flexibility of SAP system.

This project is focusing more on SAP R/3 system component, Materials Management. The scope for this project will be on the subcomponent for Materials Management such as purchasing (Purchase order creation), inventory management (Goods Receipt, Transfer Posting) and materials master. This is because Materials Management is dealing with stocks or inventory which applicable for barcode integration.

1.4.1 The Relevancy of the Project

This project is one of possible way to enable an effective and organized inventory management system without any interference from human errors. Automated data handling eliminates the amount of human errors by automatically captures the data from barcode and transfers it into the system. Therefore, it helps employees to perform their tasks faster and effective. In other words, it increases the level of productivity among employees. Barcode also tag on some beneficial values to SAP system in managing inventory and business transactions.

1.4.2 Feasibility of the Project within the scope and Time Frame.

As two semester project, this project has been grouped into two phases. Within FYP Part A, the tasks will be on gathering the requirement to setup the business environment that replicate the book publisher and distributor organization. The information gathering includes information about the SAP system customization, business process identification, requirements for system customization, hardware allocation and research on barcode and ISBN. During FYP Part A, it is also requires to identify and analyze the AS-IS business process and then to produce TO-BE designs for business scenario which will be used for implementation for the second phase.

Within 14 weeks of FYP Part B, implementation will taken place. All the configuration from the first phase will be utilize and testing. Barcode reader also will be tested during this semester to check its comparability with SAP system. It can be conclude that the crucial part of this project will be in second phase where it will focus on the issues of system configuration.

CHAPTER 2: LITERATURE REVIEW AND THEORY

2.1 Introduction

SAP has been recognized as one of the top five ERP vendors which providing customer with enterprise-wide resource planning (ERP) system software packages that are highly integrated, complex systems for businesses and thousands of businesses are running them successfully worldwide (Vidyaranya and Brady, 2005). One of SAP's major strengths includes the extensive capability of the software's functionality.

The study would be focusing on SAP system environment and implementation of barcode. Barcodes is in wide-spread used – world wide and also work well in fully automated environment, such as baggage routing at airports. The recognition a line of barcode from wherever physical objects represented the information that is to be processed by computers. The study itself is aim to analyze the ability of SAP to deliver customer-centric, open, personalized and collaborative inter-enterprise solutions on demand to clients. The flexibility of SAP system in offering services can be implemented to fully integrate an organization's operational business processes from finance, human resources and manufacturing to sales and distribution, while enabling the company to reach out to its customers and business partners along the supply and value chain (Majed Al-Mashari and Mohamed Zairi, 2000)

2.2 Automatic Identification and Data Capture (AIDC)

With information technology (IT) and communications exercising ever-increasing impact on business and industrial processes, any developments supporting better handling of information demand attention and prospective exploitation for competitive advantage. The technologies are collectively known as automatic identification and data capture (AIDC) and barcode identification is one of the AIDC (Furness, 2000). More logically they may be referred to as automatic data capture

and identification to better represent the sequence of data capture prior to identification.

The significance of automatic identification and data capture, barcode to factory automation and assembly resides in the capability they provided for identification of items, location, people and data and the facility (Furness, 2000) for enhancing the speed, timeliness, accuracy and integrity of data handling processes. Implementation of barcode into SAP system requires system customization to help the organization utilize the functionality of barcode. Within SAP itself, barcode could be an automatic data entry using barcode scanner and printing barcode from SAP by modifying an existing output form. Generally, barcode solution consists of a barcode printer, barcode reader and mobile data collection application or program (Ravikumar, 2005).

2.3 Barcode

Barcodes has been group into different types such as linear barcode, stacked barcode and 2-D barcode. Different types will represent different functionality which has particular relevance to manufacture and assembly because different symbologies for different applications and different industries. In general, organizations implement linear barcode and logistics supply chain has adopted code 93 and 128 (Ravikumar, 2005) for automated data handling. On the other hand, book publisher and distributor have other unique barcode symbologies to represent their materials which International Standard Book Number (ISBN). Even though ISBN grouped under linear barcode same as code 93 and 128 but ISBN been coded using EAN according to The International Standard Book Number System: ISBN User's Manual (2001). Starting from 1 January 2007, new ISBN structure will be fully used to replace the 10 digits number. This new ISBN will consists of 13 digits: the 3-digit prefix that identifies the book industry (currently 987), followed by the core 9-digit number and the recalculated check digit that validates the internal integrity of the whole number, referring to Guidelines for the Implementation of 13-Digit ISBNs (2004).

Implementation of barcode into SAP system always seems to be an additional requirement from client in order to have automated data handling. This is because companies prefer to implement SAP with minimal customization (Vidyaranya and

Brady, 2005) by running the business process re-engineering to fit with SAP standard solutions. Besides, the installation of an integrated SAP system is a strategic decision with substantial cost and disruption to the business implications (Martin and Cheung, 2000). Without any good strategic decision, success of SAP implementation within organization is questionable.

Currently, there are bunch of barcode solution for SAP available in the market. On-shelf product will be very costly and also need comprehensive analysis in determining which solution will fit into organization environment which could differ in term of the types of barcode reader that been used. Therefore, a few options available for organization to choose either acquire on-shelf barcode solution, add-on new requirement during business blueprint preparation or configure barcode solution without any assistance from external consultant.

2.4 SAP R/3

The SAP Enterprise Resource Planning (ERP) system, SAP R/3, is built as an integrated system where all functionality necessary to run an enterprise is provided by one system. The main benefits of this approach are the workflow and seamless integration of the different business processes within an enterprise. The integration is what ensures the consistency of the business information. The functionality within SAP R/3 is split into modules dedicated to the business functions in an enterprise. The core modules include hundreds of business processes to address the needs of an enterprise. They can be categorized under financials, logistics, and human resources management. Each of these, in turn, consists of multiple sub-modules. For instance, logistics includes general logistics, material management, plant maintenance, and production planning, among others. All modules are available on the installation media; customers are free to decide what modules should be implemented. The following section includes brief descriptions of the main modules.

The R/3 System consists of a number of components that are completely integrated with one another. This integration allows the various departments and units of an enterprise to share and maintain the same information. Purchasing is a component of Materials Management (MM). The Materials Management (MM) module is fully integrated with the other modules of the SAP System. It supports all the phases of

materials management: materials planning and control, purchasing, goods receiving, inventory management, and invoice verification. (help.sap.com, 2005)

2.4.1 Procurement cycle

One of the Materials Management function is procurement process. According to help.sap.com (2205), the typical procurement cycle for a service or material consists of the following phases:

1. Determination of Requirements. Materials requirements are identified either in the user departments or via materials planning and control. (This can cover both Materials Resources Planning (MRP) proper and the demand-based approach to inventory control. The regular checking of stock levels of materials defined by master records, use of the order-point method, and forecasting on the basis of past usage are important aspects of the latter.)

2. Source Determination. The Purchasing component helps to identify potential sources of supply based on past orders and existing longer-term purchase agreements. This speeds the process of creating requests for quotation (RFQs), which can be sent to vendors electronically via SAP EDI, if desired.

3. Vendor Selection and Comparison of Quotations. The system is capable of simulating pricing scenarios, allows comparing a number of different quotations. Rejection letters can be sent automatically.

4. Purchase Order Processing. The purchasing system adopts information from the requisition and the quotation to help in creating a purchase order. As with purchase requisitions, it could be manually generated the post or have the system generate them automatically. Vendor scheduling agreements and contracts (in the SAP System, types of longer-term purchase agreement) are also supported.

5. Purchase Order Follow-Up. The system checks the reminder periods you have specified and - if necessary - automatically prints reminders or expediters at the predefined intervals. It also provides with an up-to-date status of all purchase requisitions, quotations, and purchase orders.

6. Goods Receiving and Inventory Management. Goods receiving personnel can confirm the receipt of goods simply by entering the purchase order number. By specifying permissible tolerances, buyers can limit over- and under deliveries of ordered goods.

7. Invoice Verification. The system supports the checking and matching of invoices. The accounts payable clerk is notified of quantity and price variances because the system has access to purchase order and goods receipt data. This speeds the process of auditing and clearing invoices for payment.

2.5 Materials Master

As described above, procurement cycle includes few processes. Materials master are needed in order to process the transactions. Duplication or errors in materials master could able to delay the business transactions. This is because in business environment, all transaction is recorded and even a single mistake able to give a huge impact to the company. This is why automated data handling is required because to reduce the level of data inaccuracy because of human errors.

Materials master could be assigned using external number assignment where number been created by entering the character string directly from keyboard or internal number assignment where the system assigns a consecutive number. (help.sap.com, 2005) The external number assignment will be applied for this project by using barcode reader to capture 13 digit of ISBN number.

The people element must be handles on two levels. At one level, employees must be trained on the new system in order to use it to continue day-today operations. The second level is educational exposure. (Davenport, 2000) Therefore after barcode integration it is important for managers to know and understand the implications of the system and must come to a consensus about the changes that will take place. The managers could be able to motivate his/ her staffs to adopt new processes in performing their tasks. This is because sometimes, employees not ready to face the transition of the processes.

CHAPTER 3: METHODOLOGY / PROJECT WORK

3.1 Procedure Overview

This project is divided into two different areas: SAP system customization and barcode implementation. For this project, in implementing barcode into the system, business environment is required to verify the barcode capability in providing solution to organization. Therefore case study is needed to stimulate the real case environment in facing troubles for managing inventory.

Book publisher and distributor environment has been decided as a case study to represent the business environment that deal with barcode as ISBN has been primarily used to characterize their products. Under SAP and ABAP development, the scope will be on analyzing the AS-IS and TO-BE business process and environment, development of interfaces program (if required), understanding the SAP architectures, identifying solutions to meet business processes and executing the SAP project. Within barcode area, it is necessary to understand the foundation concept of barcode technology which covers types of barcode, scanning technology, symbol and reviewing the barcode execution from previous project implementation which may vary in term of database, technology and system.

Implementation of this project based on component-based software engineering (CBSE) as shown in Figure 3.1. Component-based software engineering (CSBE) emerged in the late 1990s as a reuse-based approach to software systems development (Sommerville, 2004). This approach has been used because this project involved customization on existing SAP R/3 system in order to improve the system efficiency. The stages are:

1. Requirement specification
2. Component analysis
3. Requirement modification
4. System design with reuse
5. Development and integration
6. System validation

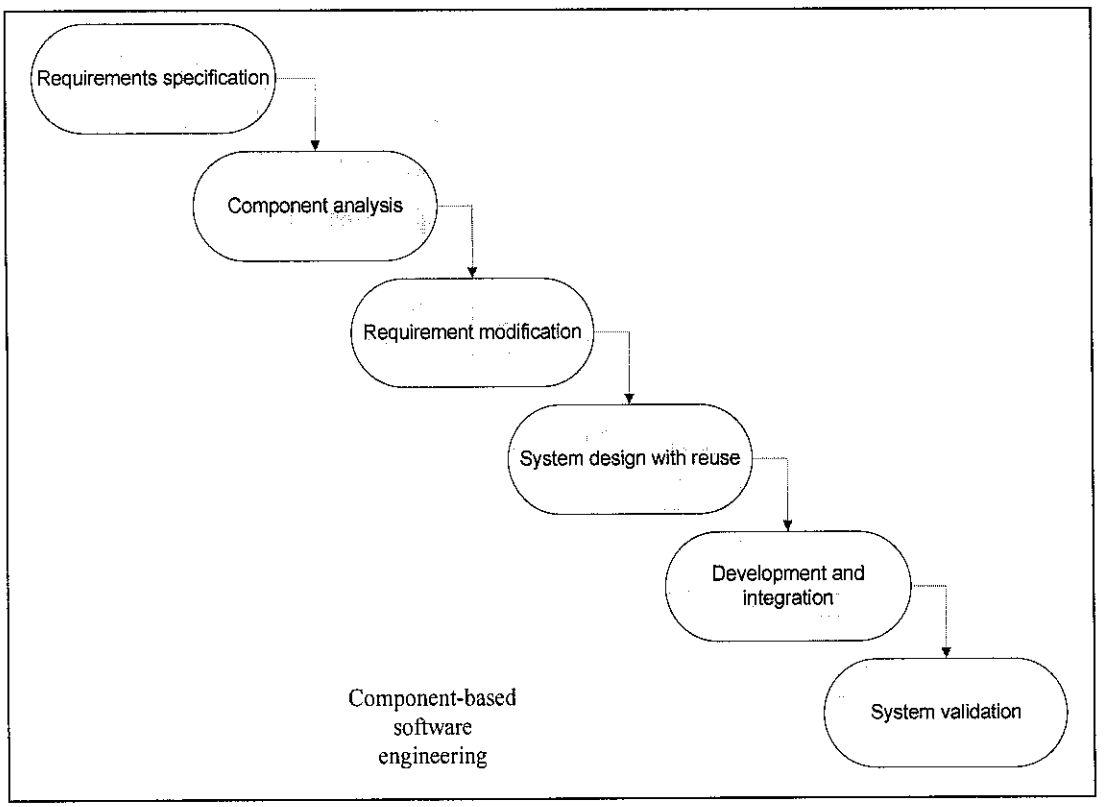

Figure 3.1 Component-based software engineering

3.2 Procedure identification

3.2.1 FYP Part A

1. Identify the fundamental requirement for system implementation

As basic requirements to execute this study, it is essential to understand the foundation of barcode technology, SAP system architectures and warehouse management main characteristics. This will be done by doing literature reviews in order to get the information needed and sample of previous system implementation.

2. ***Data gathering on identifying the requirement for set up business environment***

Requirement for replicating the business environment consists of information on organization structure, accounting, supply chain management and other information that required. It is also essential to identify the case study to stimulate the business environment.

3. ***Identifying and understanding the AS-IS business process***

In most cases, the system under development will replace an existing an existing system. Thus, the first step is to study this system and understand its strengths and weaknesses. The AS-IS system for this project is a SAP R/3 which the computerized system, then revision on analysis and design documents from previous implementation is require to be reviewed. One of the objectives of reviewing the previous documentations is to identify and analyze the existing projects that have integrated the automatic identification and data capture (AIDC) devices in their system. This process is essential in analyzing the possible problem from existing projects. Without an understanding of the AS-IS business process, it is hard to understand the user requirement.

This project involved business process improvement. Business process improvement devotes considerable time and effort in understanding the AS-IS business process (whether it is manual or automated) because the TO-BE business process will continue to support most of the AS-IS business process.

4. ***Identifying improvement opportunities***

Once AS-IS business process been understand, it then identifies ways to improve business process. Again, various information-gathering techniques are used to understand what improvement should be made. For this project, inaccuracies and delays in updating and delays in updating the computer using keyboard contribute too many problems. Automated data handling has been selected as a solution to eliminate the problems.

5. ***Design the TO-BE business process from AS-IS business process.***

TO-BE business processes been designed after the information about the system has been gathered and improvements are identified. The TO-BE business process for this project is similar with AS-IS business process in general structure, with some business processes being altered. The behavioral and structural models of TO-BE business processes are usually very close to the AS-IS business processes in many area, with exceptions of the (often few) processes that have been changed. The TO-BE business processes is derived from AS-IS models by performing or adding some other elements to meets the requirements.

3.2.2 FYP Part B

1. ***Configure the SAP system based on TO-BE business process.***

System configuration will be executed by using TO-BE business processes as guidelines. The Implementation Guide (IMG) screen will be the medium for configuring the system and it will affect the overall SAP R/3 system. This project is not only requires requirements for configure the barcode integration but also requirements for configuring the business scenario mainly for Materials Management. Business environment for Materials Management is needed because to test the relevancy of barcode integration in handling data transactions.

2. ***Integrate barcode reader with SAP system.***

The barcode integration will take place after SAP R/3 has been configured. This is because barcode only can be tested after all the SAP R/3 configuration has been finalize and completed.

3. ***Perform system testing to check system reliability.***

In order to check the system reliability and barcode integration, testing will be performed. Business process will be tested and each element must work together without errors. The testing includes verifying the system compatibility and effectiveness of barcode reader integration. The analysis been performed is discussed under **Chapter 4: Result and Discussion** under subtopic 4.3 Analysis and

Discussion where a study been conducted to examine the effect of barcode reader integration on time processing and duplication of data.

3.3 Tools

During the development of this particular system, it will be needed and requiring a number of software and tools as what would be described as follows;

3.2.1 Software requirement

- SAP R/3 system
- Microsoft Office for documentation purposes

3.2.2 SAP Transaction Codes

Table 3.1 SAP Transaction Codes

Transaction Code	Descriptions
SPRO	Implementation Guides – lists all actions required for implementing the SAP system and helps you to control and document the implementation. User can configure system based on system requirements in this screen.
MM01	Create Material Master – This screen enable user to create new material master. Material number could be internally generated or external numbering. The basic requirements for creating new material master are *industry sector*, *material type*, *material description*, *base unit of measure* and *material group*.
MM02	Change Material Master – MM02 transaction code enable user to change the material master for specific material number. User only able to change the attributes or information about the material master but not the material numbering.
MM03	Display Material Master – Display material master created by entering the material number.

ME21N	Create Purchase Order – Transaction code ME21N enable user to create purchase order document. One purchase order document can have many item ordered. After document been posted, PO number generated automatically.
ME22N	Change Purchase Order – User use this screen to change or update the purchase order document.
ME23N	Display Purchase Order – To display purchase order document, use transaction code ME23N.
MIGO	Goods Movement – Transaction code MIGO enable user to perform many material movements posting such as goods receipt, goods issue, return delivery and others. Each material movement transaction is differentiated by movement type.
MIGO-GR	Goods Receipt – After products arrived, next user need to issue goods receipt to update the product's quantities inside the system. Movement type 101 is for goods receipt with reference to purchase order document.
MIGO-GI	Goods Issue – MIGO-GI is one of the available transaction codes to perform goods issue. User also able to perform goods issue using transaction code MIGO.
MB1B	Transfer Posting – For transferring stock between plants or storage locations, use transaction code MBIB
SE80	ABAP Navigator

3.2.2 Hardware requirement

- Barcode scanner and ISBN

CHAPTER 4: RESULT AND DISCUSSION

4.1 Overview

Logistics is one of the most extensive areas of SAP R/3 and contains the largest number of modules. The logistic modules manage all processes involved in the internal supply chain, from raw material procurement to final customer delivery and billing. These functions interact with virtually every SAP R/3 module, from financial to human resources (considered workflow). The main logistic-related modules are Sales Distribution (SD), Production Planning (PP), and Materials Management (MM). This project will be focusing on Materials Management (MM) for automatic identification and data capture device integration. The functions identified to be implemented for this project from Materials Management module in SAP R/3 system are as follows:

Table 4.1: Subcomponent available in Materials Management

Area	To Be Process	Related R/3 Functions
Procurement	Purchase Order	Purchase Order for Goods (ME21N) (for Back-to-back order processing)
Inventory Management	Goods Receipts	Goods Receipts (MIGO)
	Stock Transfer	Stock transfer between storage locations (MIGO)
Materials Master	Materials Creation	Materials creation (MM01)

This function as illustrated in Table 4.1 has been identified based on its relevancy to the project integration with automatic identification and data capture (AIDC) devices. The simulation of this function is required in analyzing the functionality of the barcode integration. The AS-IS and TO-BE business process will be the guidelines in configuring the SAP R/3.

4.2 Analysis: Business Process

4.2.1 System Architecture

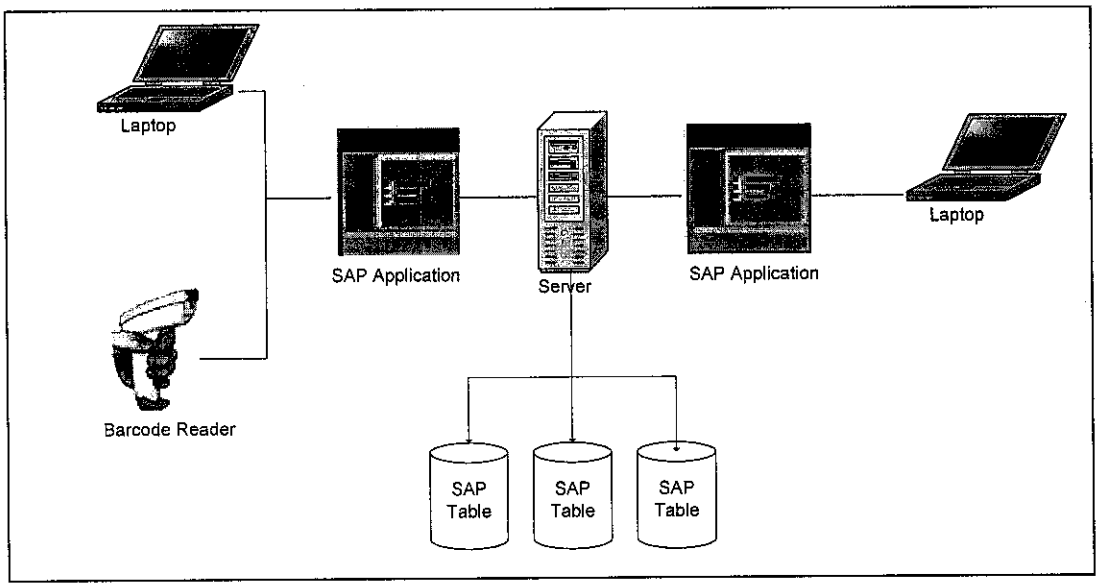

Figure 4.1: System architecture for project

As shown in Figure 4.1, the system consists of three main components which are computers and barcode reader for data entry, SAP applications to process the data entry and third component is data storage.

1. End user scans ISBN from books and enters data to process the transaction through computers or laptop.
2. Next, system retrieve, change and update the data relevant with transaction inside the database to continue execute the business transaction.
3. Then, system show a message as a confirmation to the user about the transaction been executed has been succeeded processed.

4.2.2 Material Master

Process Overview (AS-IS)

An employee manually creates new materials master based on list of ISBN givens. It might possibly create duplicates or errors of data without user consciousness. This is because user might insert 9814040171 or other user insert 981-4040-17-7 because there is no automated data handling been implement to avoid this kind of scenario. Therefore automated data handling is one of the solutions to decrease data duplication and errors especially when there are employees replacement occurs.

Process Overview (TO-BE)

As shown in Figure 4.2, the process for creating the material master still follow the standard SAP process. The manual system for entering the ISBN will be replaced with automated data handling using barcode reader. The steps for creating are listed below:

1. Specify the materiel type which will indicate the characteristic of materials.
2. Specify the material or industry sector. The industry sector is a branch of industry which groups companies according to their activities.
3. Enter the ISBN as material number.
4. Maintain material master views such as accounting, purchasing, sales, storage and others.
5. Post the material master.

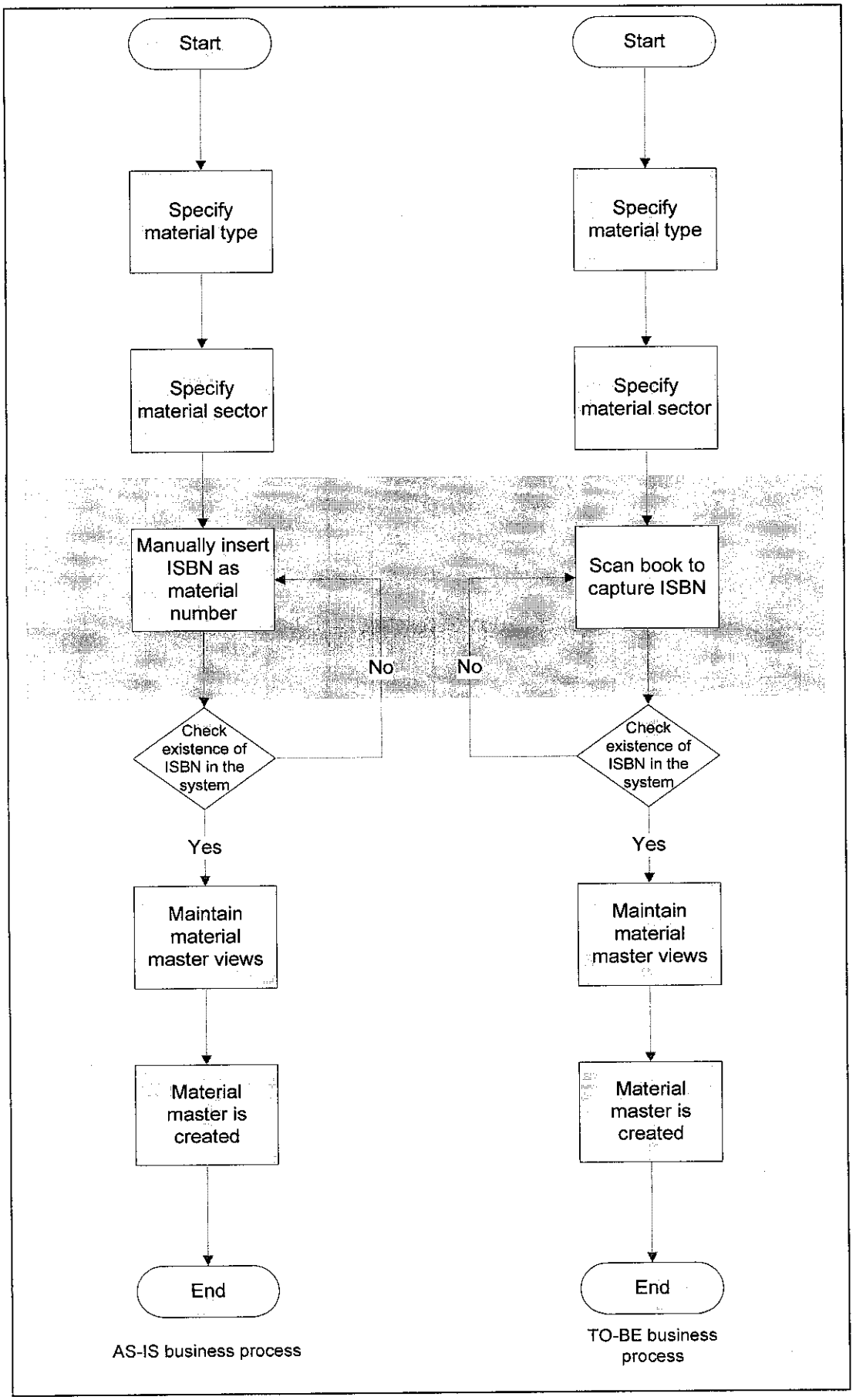

Figure 4.2: Flow diagram for material master creation (AS-IS vs. TO-BE)

4.2.3 Purchase Order

A purchase order (PO) is a formal request or instruction from a purchasing organization to a vendor or a plant to supply or provide a certain quantity of goods or services at or by a certain point in time. The Purchase Order for this project is required if there is back-to-back order processing or third-party-order processing. Standard purchase orders required when the customer orders goods that are not stock in the warehouse and must be ordered from one or more external vendors. Therefore, the company act as a middle man between other publishers with the customer where NZ Publication and Distribution (NZPD) procure books and then deliver it to customers The same thing also happens for third-party-order processing when the company does not deliver the items requested by a customer.

Process Overview (AS-IS)

Process Flow:

In standard business scenario operation, all purchase order is raised by Purchasing Department. Purchase order undergoes different approval process upon different item of purchase. There a few cases when the users need to perform reordering process for requested items.

For ISBN number, even though procurement process for back-to-back order processing only required the dummy material number but it becomes a problem when user need to create new material number for new ISBN number that they have. The duplication of data might occur as a result of human errors. The reason dummy material number been used because there are cases where the company only received the title of the books from the customers without ISBN. Therefore, dummy material number been used to represent the books inside the system and change the Purchase Order document when the book arrived.

Process Overview (TO-BE)

Figure 4.3 illustrated the change that will take place for purchasing process. The process flows are:

1. Authorized user creates purchase order using the dummy material number. For existing materials, SAP provides source of supply such as Contract, Purchasing Info Record to help user performs the task.
2. After books arrived, user creates the material master using new ISBN number that they have.
3. Book been scanned to read the barcode lines. Instead of manually entering the ISBN to create material master, automated data handling improve data accuracy and efficiency.
4. System automatically performs system check to verify the ISBN to avoid data duplication.
5. User changes the purchase order using the new material master.
6. Goods receipt posted.

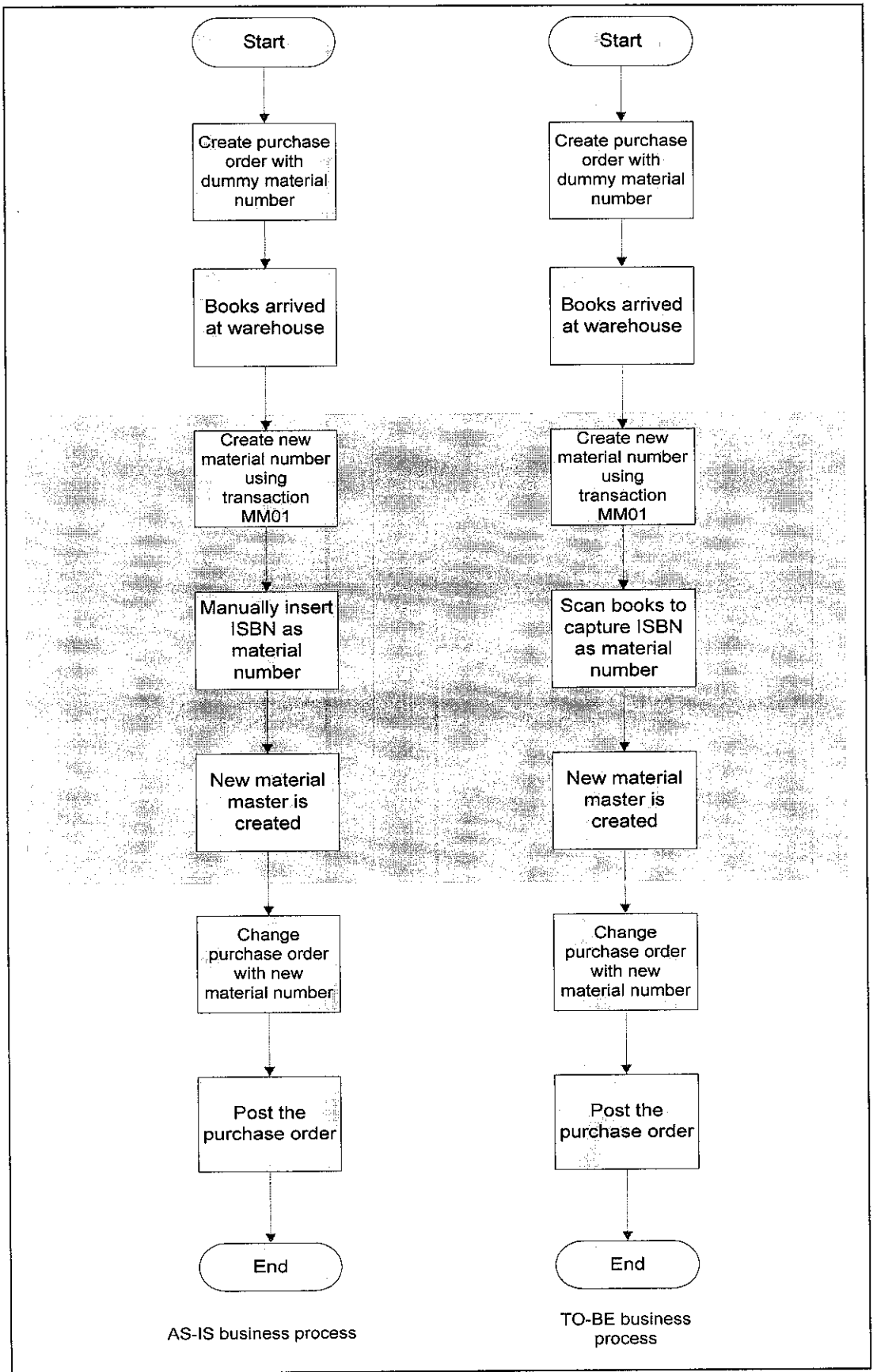

Figure 4.3: Flow diagram for purchase order business process (back-to-back order processing) (AS-IS vs. TO-BE)

4.2.4 Goods Receipt

In SAP, this is a function to record receiving activities carried out in the company for stock material, consumable or assets. In the case of stock material receiving, both quantity as well as value will be updated immediately in the material master. For each goods receipt processing, it be differentiate by using movement type as described in Table 4.2. Simultaneously, the inventory record and financial postings are updated accordingly.

Table 4.2: Goods receipt business process

Scenario	Remarks
Procurement of stock items	Goods receipt is posted with or without reference to Purchase Order number. Transaction code MIGO is used and movement code 101 and 501 will be applicable.

In most common cases, if the goods receipt entry is reference to purchase order it is important for all of the departments to get involved because of the following reasons:

- Goods receiving can check whether the delivery actually corresponds to the order.
- The system can propose data from the purchase order during entry of the goods receipt (for example, the material ordered, its quantity, and so on). This simplifies both data entry and checking (over-deliveries and under-deliveries).
- The delivery is marked in the purchase order history. This allows the Purchasing department to monitor the purchase order history and initiate reminder procedures in the event of a late delivery.
- The vendor invoice is checked against the ordered quantity and the delivered quantity.
- The goods receipt is valuated on the basis of the purchase order price or the invoice price.

Process Overview

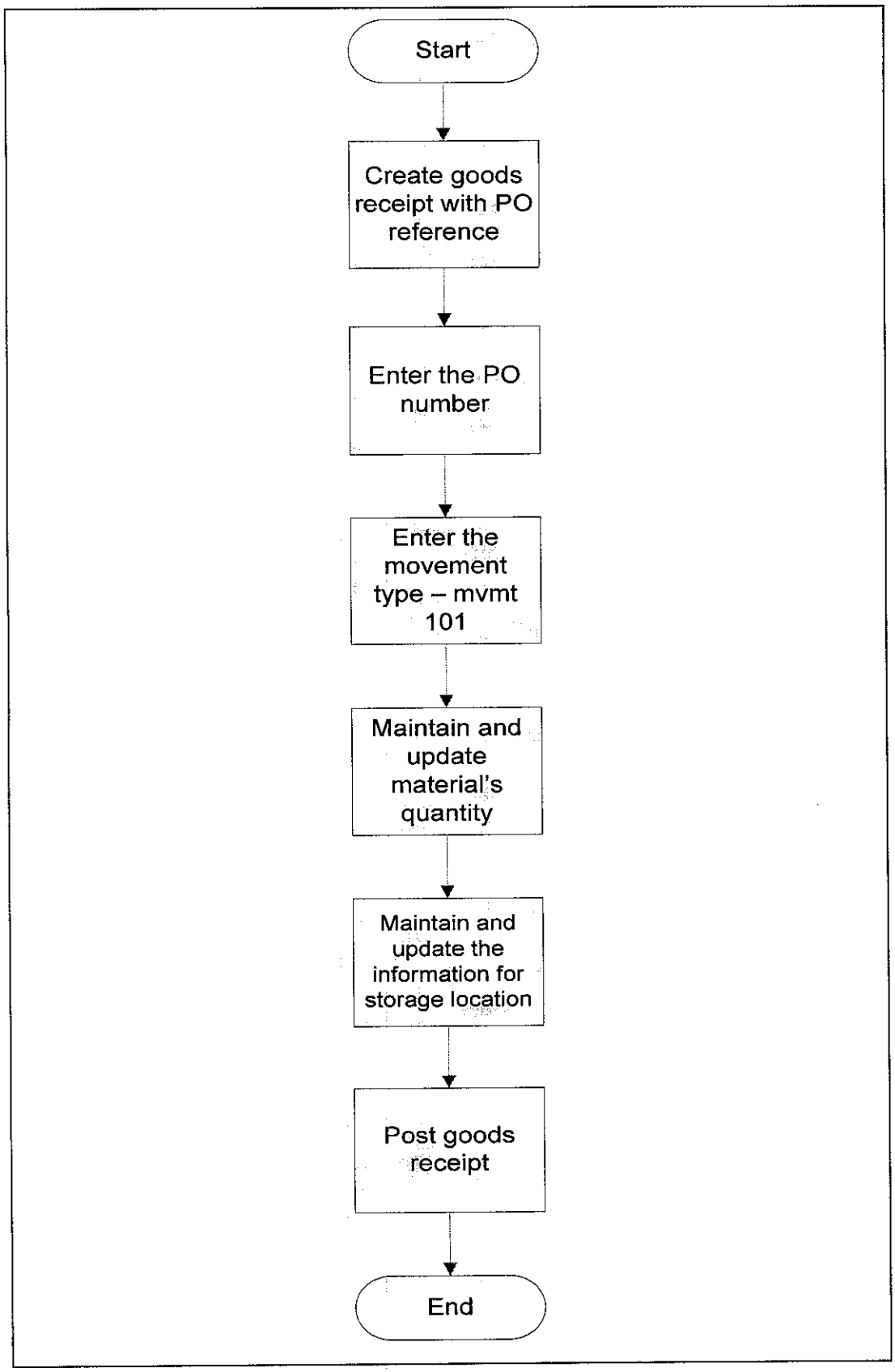

Figure 4.4: Flow diagram for goods receipt process.

Process flow:

1. Authorized warehouse user enters the goods receipt in SAP by referring to purchase order number. SAP displays the information taken from purchase order.
2. User performed the checking based on information displayed on his/ her screen, data written on delivery notes received from vendor and actual data in physical level.
3. Check will be done visually to verify the book or material quality.
4. SAP enables user to change the quantity of material delivered if materials has been delivered by partial.
5. User prints the goods receipt note for vendor as confirmation that company has received the product ordered.

4.2.5 Stock Transfer

Generally, goods movement within a company involves more than just receipt and issue of goods. Stock transfer is also necessary. In SAP, the stock transfer can take place on two different levels which also include stock transfer company-to-company (not cover for this project):

1. Storage location to Storage Location
2. Plant to Plant

In a stock transfer, the material can remain in its original storage bin or be transferred. Stock transfers and transfer postings are used to represent organizational-relevant transfers within the company (for example, decentralized storage). In the system, the transfer can be posted in one or two steps for both storage location and plant transfer. A two-step procedure means that the stock once issued out of the issuing location (plant or storage location), it will be reflected as the in-transit stock in the receiving location. This stock is not available until it is confirmed received in the receiving location. A one-step procedure is the immediate update of the available stock in the receiving location upon transfer out from the issuing location.

Stock transfer between storage locations

Process flow

1. Authorized user enters the information for material, sending storage location, destination storage location.
2. User prints out the material document.

The above process flow described is a to-be process flow for stock transfer between storage locations. Based on the transfer requirement, the requester will identify the type of transfer needed. The stock transfer required when there is short of stock in one of warehouses which delay the business operation. The decision on whether the 1-step or 2-steps transfer is to be performed in the system therefore depends on the distance between locations. As every stock movement in the system will be recorded with a material document, this can be printed as the transfer document.

When transaction has been posted, system automatically creates a material document, which serves as proof of the goods movement. Besides, it also automatically updates the stock inside the system based on goods movement activities. During stock transfer process, barcode device are used to enter the data into the system automatically as shown in Figure 4.5. This is because in normal environment, user needs to manually insert the data. There are a few ways to capture the ISBN number from books. First, by scanning one of the books need to be transferred and then calculate the quantity been requested or personnel from warehouses provide the user with the list of books with its ISBN number requested to users. The list could contain printed barcode lines and then user just need to scan the barcode lines and perform the transaction.

Process Overview

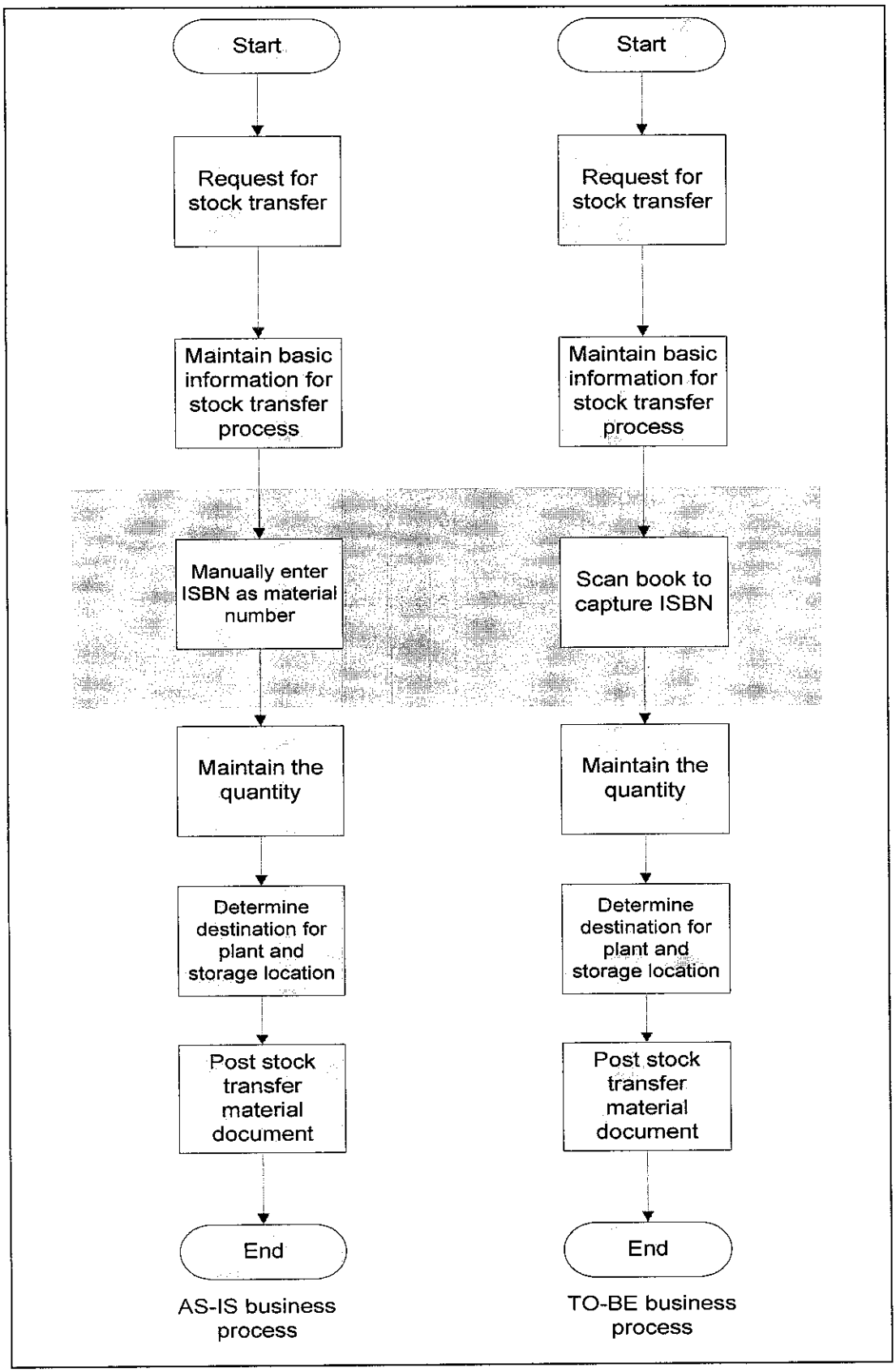

Figure 4.5: Flow diagram for stock transfer process (AS-IS vs. TO-BE)

4.2.6 Goods Issue for Obsolete Items

Goods issue (GI) is a material withdrawal that reduces the quantity and value of the warehouse stock. Financial postings are created automatically in the system so that the stock account updated automatically to ensure data integrity. For this case, goods issue been performed for obsolete items. This is because sometimes when NZPD published books, there are some books not properly printed or damage when transferring books from one place to another and cannot be sold to customers. Therefore, goods issue is performed to scrap items from system. Movement type 551 is used to indicate this transaction. As shown in Figure 4.6, manual data entry or search has been replaced with automatic data capture where it enhances the business process efficiency.

Process flow:

1. Specify the business transaction – Goods Issue
2. Enter the movement type – 551 GI for scrap
3. Enter the material number (scan ISBN from books)
4. Maintain quantity and warehouse information
5. Post goods issue

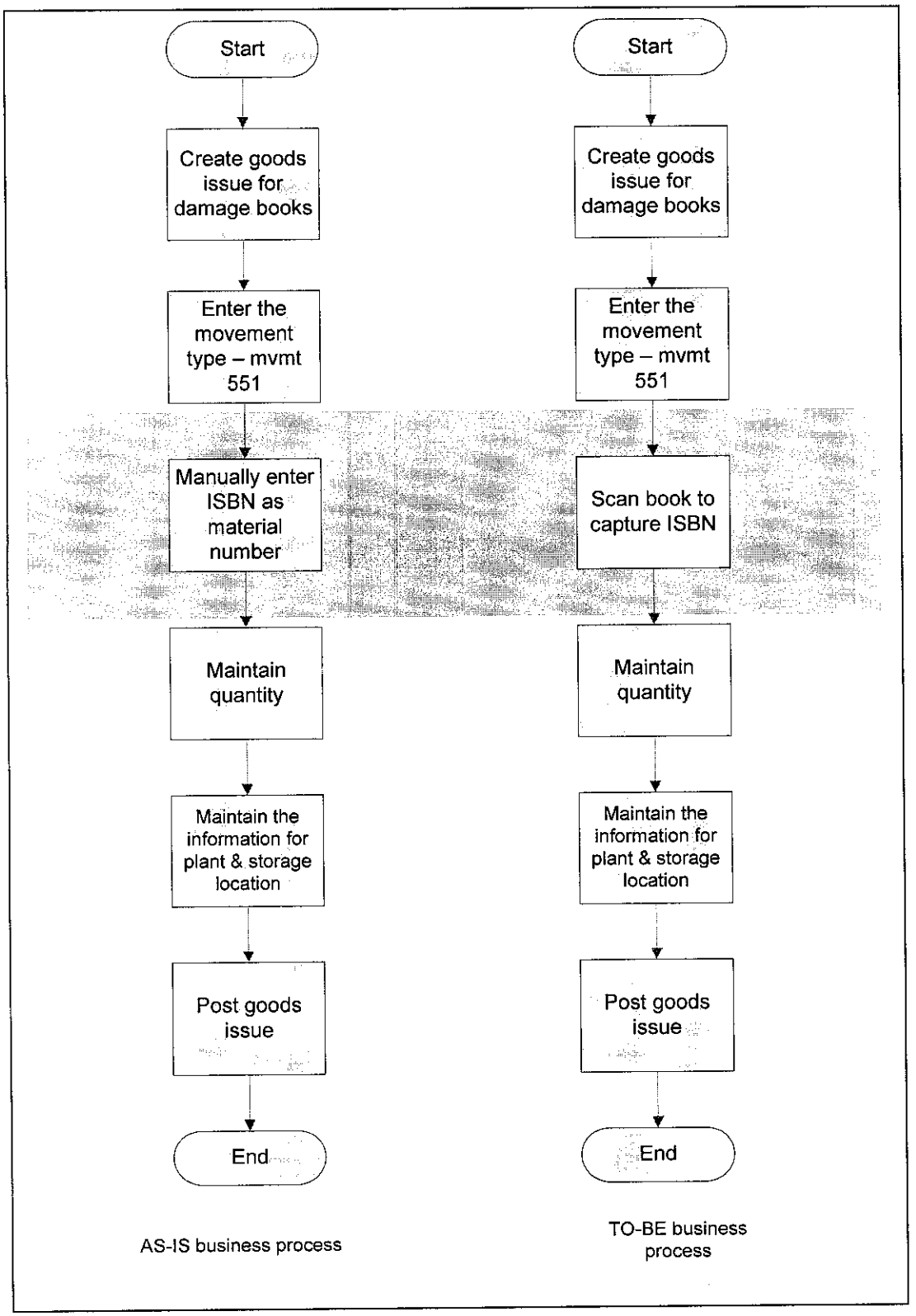

Figure 4.6 Flow diagram for goods issue process (AS-IS vs. TO-BE)

4.2.7 Entity Relationship Diagram

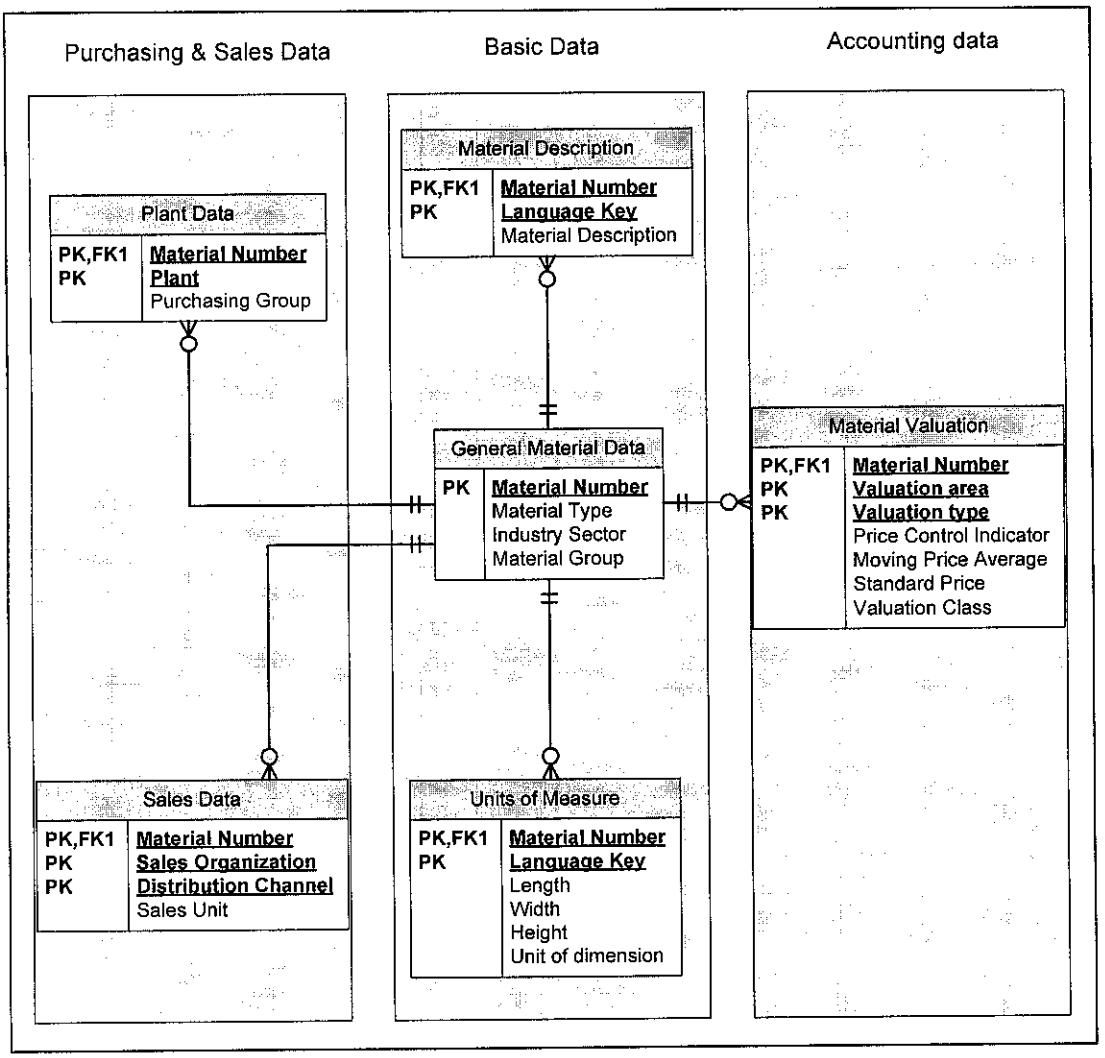

Figure 4.7: Conceptual Entity Relationship Diagram

Figure 4.6 illustrated the conceptual entity relationship diagram for some tables involved during material master data creation and meanwhile Figure 4.7 is its physical entity relationship diagram. MARA or General Material Data table contain the basic information for material been created. Material number is the primary key and also the key to link with other tables. The tables for books divided into several categories which are purchasing (MARC), sales (MARC, MVKE), basic data (MAKT, MARA, and MARM) and accounting (MBEW). The tables will represent the views been selected while creating new material master. MARA table be a center table for other tables and it holds one-to-many relationship.

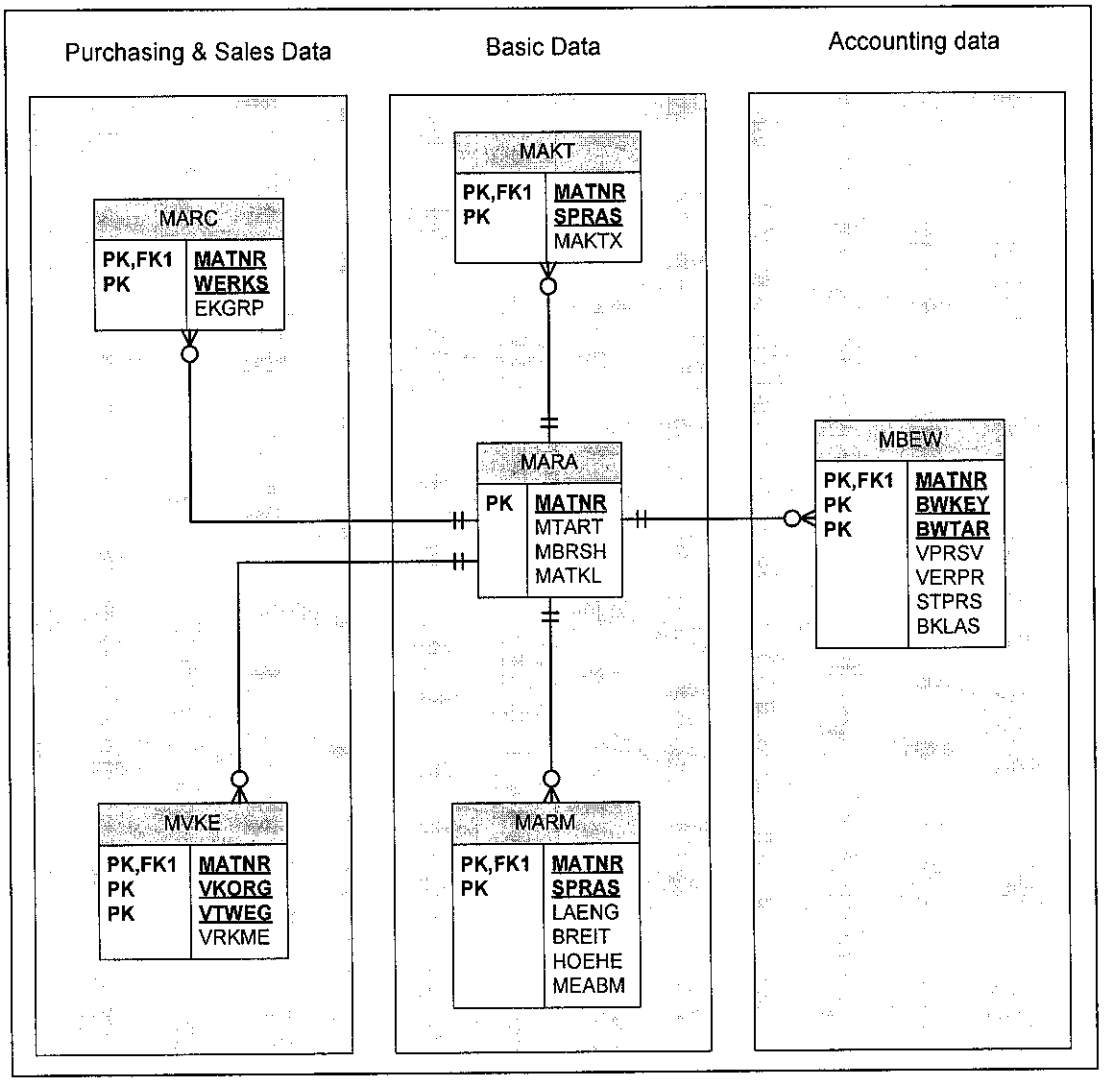

Figure 4.8 Physical Entity Relationship Diagram

4.3 System Configuration

Organizational Level in Materials Management

The initial setting that enables the usage of the system starts with the definition of the organization structure within SAP system. This is to define how the company structure is mapped and designed as organizational units in SAP system. The organizational unit that is relevant for MM module includes:

1. Client
2. Company Code
3. Plant
4. Storage Location

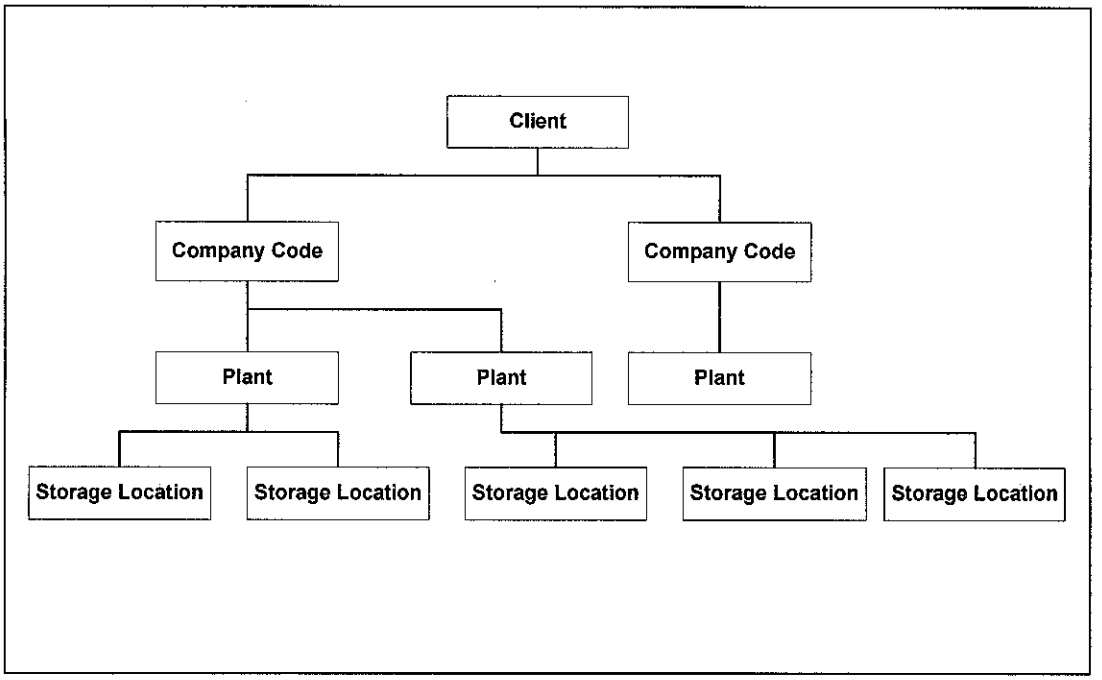

Figure 4.9: Organizational level for inventory management

4.3.1 Client

Client is the highest hierarchical level of the organizational unit within SAP R/3 system that is self contained both legal and organizational terms and in terms of data with separate master records and independent sets of tables. Specifications or data enter at this level apply to all company codes (if more than one code exists) and all other organizational units.

Table 4.3: Client identification

Org. Unit	SAP Org. Unit	SAP Code	Remarks
UTP IDES	Client	050	UTP Demo & Education System

This project will be run under server *pethsv20_P17_00* using Universiti Teknologi PETRONAS IDES system.

Organizational Unit in Accounting

In SAP R/3, it is essential to set up the organizational levels for accounting even if enterprise uses a different system for this function. For each autonomous company within the corporate group, different controlling area and separate company codes need to be configured.

4.2.2 Company Code

The company code is the smallest organizational unit in external accounting for which a complete, self-contained bookkeeping system can be replicated. This includes the recording of all accounting-relevant events and the production of all legally required final statement of accounts such as balance sheets and profit and loss (P&L) statements. In this project, NZPD (NZ Publications & Distributions Sdn. Bhd.) and SAP code 2600 will be used to represent the book publisher and distributor company. The main activity of this company is publishing and distributing books.

Table 4.4: Company code for company NZPD

Organization Unit	SAP Org. Unit	SAP Code
NZPD	Company Code	2600

Company Code

IMG: Enterprise structure→Definition→Financial Accounting→Define copy, delete, check company code→Choose→New Entries

Chart of Account

IMG: Financial Accounting →Financial Accounting Global Settings→Company Code→Enter Global Parameters

Business Area

IMG: Enterprise Structure→Definition→Financial Accounting→Define Business Area.

4.2.3 Purchasing Organization

A purchasing organization is an organizational unit within logistics that subdivides an enterprise according to the requirements of purchasing. A purchasing organization procures materials and services, negotiates conditions of purchase with vendors and assumes responsibility for such business. The purchasing organization is functionally responsible for purchase transactions and the negotiation of conditions of purchase.

IMG: Enterprise structure→Definition→Materials Management→Maintain purchasing organization

Table 4.5 Purchasing organization for company NZPD

Purchasing Organization	SAP Code	Description
NZPD		
Purchasing Org. NZPD (Purchasing Department)	2600	NZPD POrg

4.2.4 Purchasing Group

The purchasing groups carry out the activities of the purchasing organizations. However, a purchasing group is assigned neither to a purchasing organization nor a plant. A purchasing group can thus be active for all purchasing organizations and all plants if no restrictions have been imposed through authorization management.

IMG: Materials Managements→Purchasing→Create Purchasing Groups

Table 4.6 Purchasing group for company NZPD

Purchasing Group	Description
NZPD (Purchasing Team)	
260	NZPD-Production

4.2.5 Plant

The plant is an organizational unit within logistics that subdivided the enterprise for the purposes of production, procurement, maintenance and materials planning. In a plant, materials are produced and/or goods and services made available. It can also be a physical location and also virtually inside the system.

Define Plant

IMG: Enterprise structure→Definition→Logistics – General→ Define, copy, delete, check plant→Define plant→Choose→New Entries

Table 4.7 Plant for company NZPD

Organization Unit	SAP Org. Unit	SAP Code
NZPD Ampang Plant	Plant	2601

Assign Plant to Company Code

IMG: Enterprise structure→Assignment→Logistic – General→Assign plant to company code

Table 4.8 Assign plant to company code

Company Code	Plant
2600 NZPD	2601 NZPD Ampang Plant

Assign Purchasing Organization to Plant

IMG: Enterprise structure→Assignment→Material Management→Assign purchasing organization to plant

Table 4.9 Assign purchasing organization to plant

Purchasing Organization	Plant
2600 NZPD Purchasing Org.	2601 NZPD Ampang Plant

4.2.6 Storage Location

In SAP, a storage location is the place where stock is physically kept within a plant. Storage location can be used to differentiate between various types of stock in a site. It may also be defined as the total of all storage bins in a plant that are managed together. Several storage locations can be assigned to a plant. There are four possible storage locations available for this project implementation: Retail, Showroom, Book Area and Others. Once the books have been published, it will be stored in Book Area. Retail and Showroom represents the storage locations for sales activities.

IMG: Enterprise structure→Definition→Materials Management→Maintain Storage Location→Determine Work Area: Entry (plant)→New Entries

Table 4.10 Storage location for company NZPD

Organization Unit	SAP Org. Unit	SAP Code
NZPD Retail	Storage Location	w21
NZPD Showroom	Storage Location	w22
NZPD Book Area	Storage Location	w23
NZPD Others	Storage Location	w24

Master Data for Materials Management

The material master records are sources of data that is needed in many procurement processes. They should therefore always be well maintained. In SAP, material master is a centrally shared data used by all logistics module. Information captured in the material master record can be descriptive or can have functional control depending on usage. All the information a company needs to manage a material is stored in a data record in the material master, sorted by various different criteria. This information can be maintained across several organization levels or can be maintained for specific organization level (e.g. Plant, storage location, sales organization etc).

The integration of all material data in a single materials database eliminates the problem of data redundancy and permits the data to be used not only by Purchasing, but by other applications (such as Inventory Management, Materials Planning and Control, Invoice Verification and so on).

4.2.7 Material Type

Material type is used to categorize the type of material. The use of material type is to allow different number range and to control the required views in the material master. For example, a material with raw material type has purchasing view and without a sales view. A material with trading material type such as book has sales view and purchasing view. For this project, trading material type has been used to identify the materials.

IMG: Logistic – General→Material Master→Basic Setting→Material Type→Define Attributes of Material Types →New Entries

Table 4.11: Material type for NZPD's books.

Material Type	Description (max 25 char)
ZHAW	Trading material

4.2.8 Material Group

The material for this project is grouped into two which are 10000 for In-House production and 20000 for local publisher. This is essential for further analysis in the future.

IMG: Logistic – General→Material Master→Settings for Key Fields→Define Material Groups→New Entries

Table 4.12: Material group

Material Group (max 9 char)	Description (max 20 char)
100000	In-House Production
200000	Local Publisher

4.2.9 Number Range for Material Type

External numbering will be used for this project. The ISBN will be scanned during material master creation. The maximum range for material number in SAP R/3 is 18 digits.

IMG: Logistic – General→Material Master→Basic Setting→Material Type→Define Number Ranges for Each Material Type→Groups

4.3 Analysis and Discussion

4.3.1 Time Processing

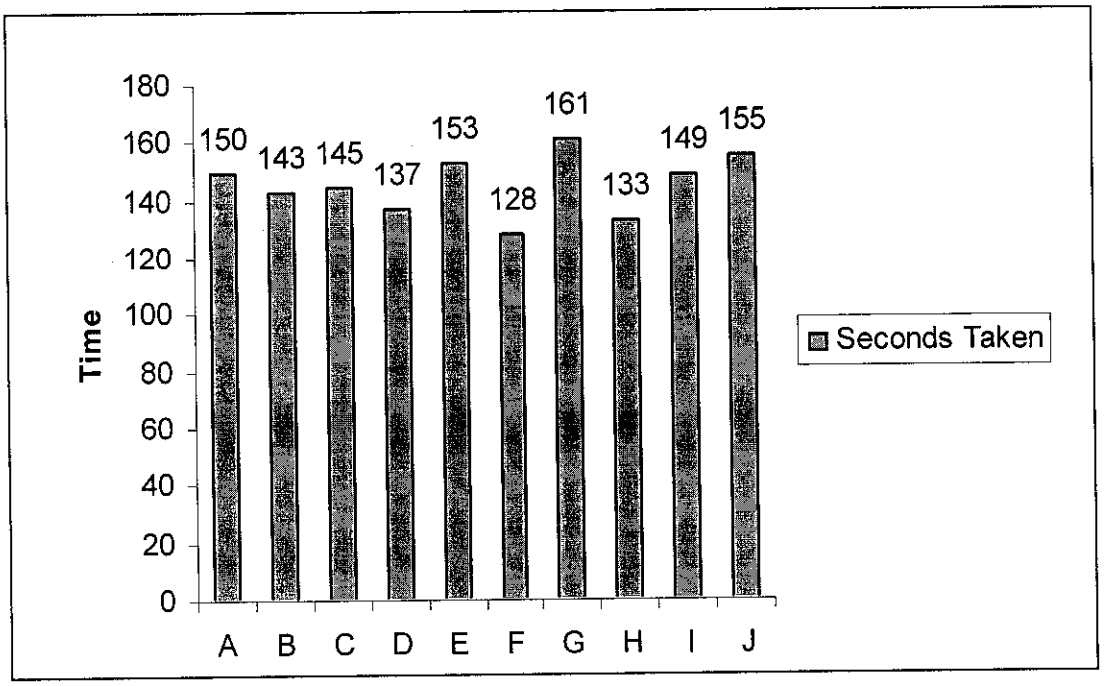

Figure 4.10: Time taken to execute Goods Issue transaction without barcode reader

As shown in Figure 4.9, ten students been selected to represent end user to perform Good Issue business process transaction. For the first part, user required to perform goods issue transaction without barcode reader and time taken to complete the transaction be recorded. The reason this study been conducted is because to stimulate the current scenario for entering the data inside SAP screens. In average, each user takes 145.4 seconds to complete the transaction.

Based on the observation, users face a difficulty in searching the ISBN inside the system. They need to maintain some information before them able to find the ISBN needed and it required quite some time to do so. Meanwhile, for users who manually enter the ISBN, a few of them entered incorrect ISBN and this delay the transaction.

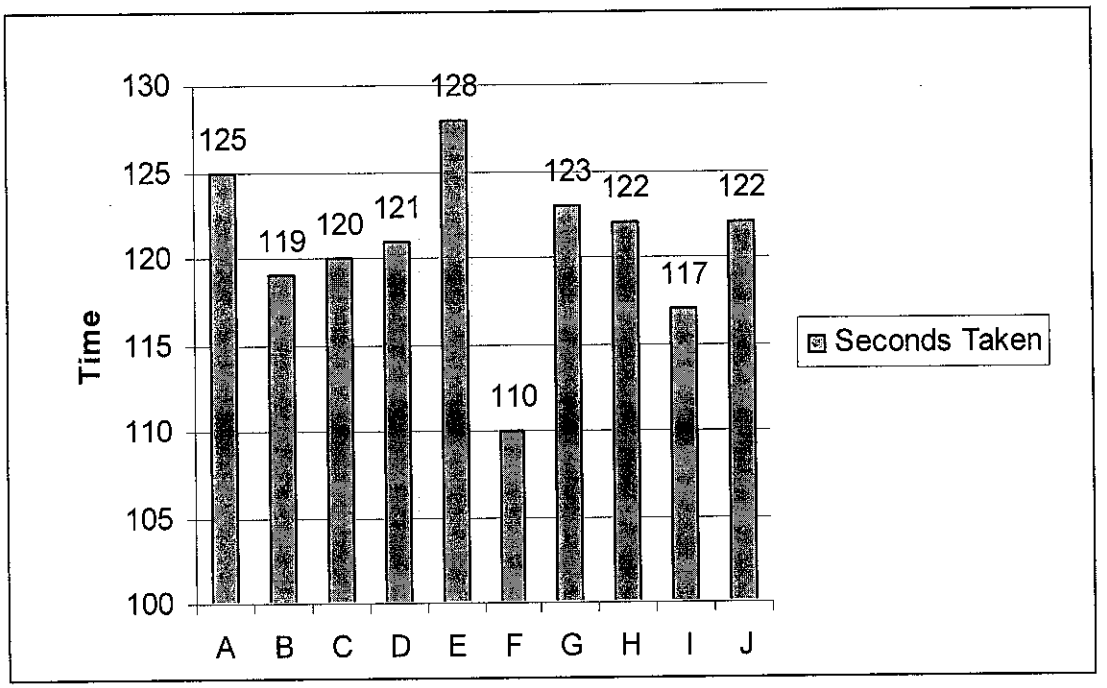

Figure 4.11: Time taken to execute Goods Issue transaction with barcode reader

Next, users need to perform Goods Issue transaction by using barcode reader to assist then for data entry. For second part, users take time 120.7 seconds in average to perform the transaction. About 24.7 second's reduction for time taken to complete the transaction. One of the factors contributes to this scenario is users only entering data using keyboard for data likes quantity, plant and storage location. The user only needs to scan the ISBN and proceed with the next process.

4.3.2 Duplication of Data

One of the problem occurs during manual data entry is duplication of data and it been caused by human errors. During normal products deliveries, the quantities and titles of books arrived might be vary. Sometimes users received a list of ISBNs or bunch of books to be updated inside SAP system. Thus, there are possibilities for users to create an incorrect material master where it will affect the inventory turnover in the future. In order to examine the effectiveness of automatic identification and data capture (AIDC) device integration, a group of five students has been identified to perform the material master creation tasks. Students required to:

1. Each user required to create an order for three books using dummy material number. They need to maintain the title for each book in purchase order.
2. Once books arrived virtually, students required to create new material master for each book.
3. Next, they need to change the previous purchase order document with new material number. (update dummy material number with ISBN)

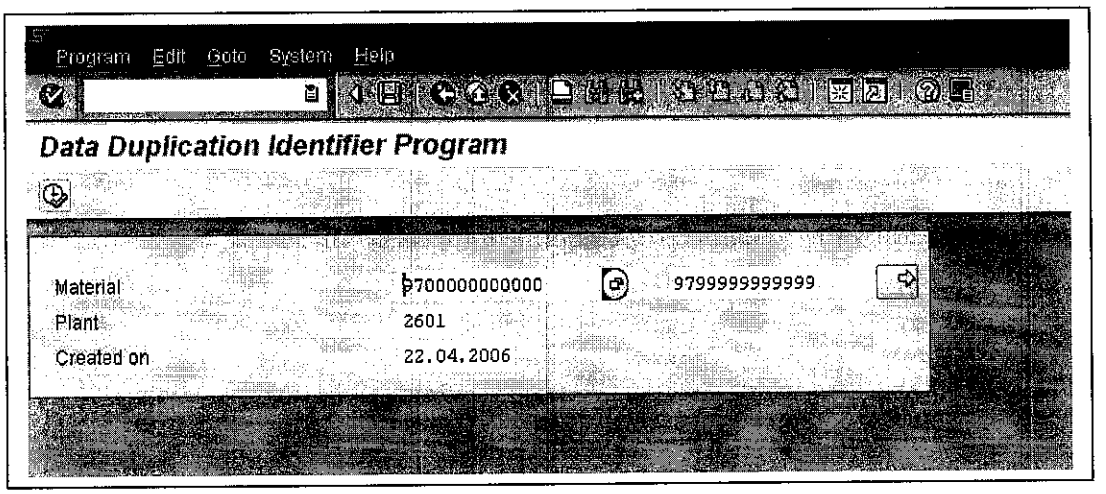

Figure 4.12: Data Duplication Identifier Program

Next, program *ZS0148_NZPD_REPORT01* been executed. The purpose of this program is to identify any duplication of material master by comparing its material description (see Figure 4.12). The data need to be maintained are material number (9700000000000 – 9799999999999), plant (2601) and data creation as shown in Figure 4.11.

```
FORM compare_record.
  LOOP AT it_mtab01 INTO wa_mtab01.
    ca_matnr1 = wa_mtab01-matnr.
    ca_maktx1 = wa_mtab01-maktx.

    IF ca_maktx2 EQ ca_maktx1.

      wa_mtab02-matnr = tm_matnr.
      wa_mtab02-maktx = tm_maktx.
      wa_mtab02-matkl = tm_matkl.
      wa_mtab02-ernam = tm_ernam.
      wa_mtab02-werks = tm_werks.

      APPEND wa_mtab02 TO it_mtab02.

      wa_mtab02-matnr = wa_mtab01-matnr.
      wa_mtab02-maktx = wa_mtab01-maktx.
      wa_mtab02-matkl = wa_mtab01-matkl.
      wa_mtab02-ernam = wa_mtab01-ernam.
      wa_mtab02-werks = wa_mtab01-werks.

      APPEND wa_mtab02 TO it_mtab02.
      CLEAR: tm_matnr, tm_maktx, tm_matkl, tm_ernam, tm_werks.

    ELSE.
      ca_matnr2 = ca_matnr1.
      ca_maktx2 = ca_maktx1.

      tm_matnr = wa_mtab01-matnr.
      tm_maktx = wa_mtab01-maktx.
      tm_matkl = wa_mtab01-matkl.
      tm_ernam = wa_mtab01-ernam.
      tm_werks = wa_mtab01-werks.

    ENDIF.
  ENDLOOP.

ENDFORM.                    "compare_record
```

Figure 4.13: ABAP codes for comparing the material master

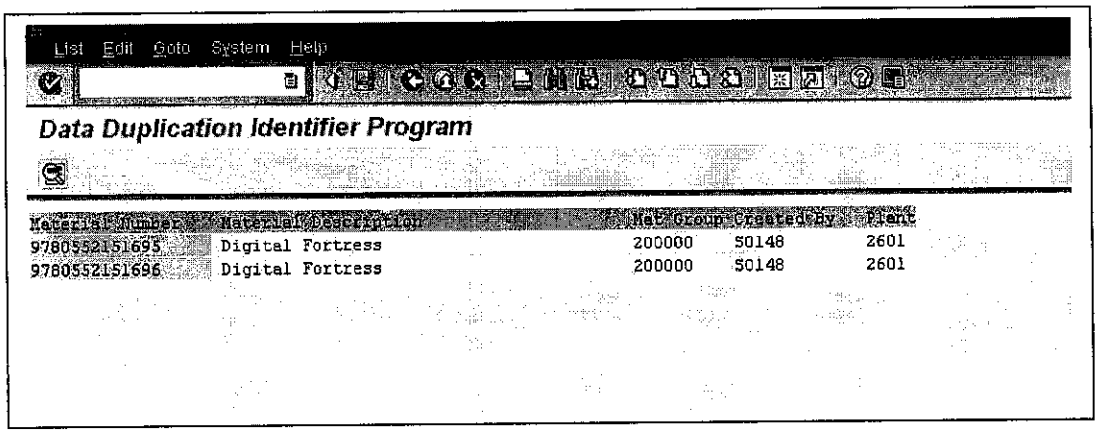

Figure 4.14: List of duplicated data

As shown in Figure 4.13, one student had created two different material numbers to represent same book. The correct ISBN for Digital Fortress is 9780552151696. This is a reason why the user takes longer time to complete the task. He needs to recreate the material master using the correct ISBN. Next, step 1 – 3 be repeated but by using barcode reader for data entry a week after. Program *ZS0148_NZPD_REPORT01* been executed again and no duplication of data found.

As a conclusion of this experiment, automatic identification and data capture (AIDC) device integration able to reduce or eliminate the data duplication and decrease the time taken to process the transactions.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

As a conclusion, Bar code data is a crucial component in today's supply chain, as more and more companies rely on Automatic Identification and Data Capture (AIDC) technology for internal manufacturing processes, proper routing and distribution. As a result, it's crucial that the data represented in those bar codes can be read, is accurate, is not duplicated, is not missing and has the quality required to guarantee its life throughout the supply chain lifecycle.

For the first half of the project duration, requirement for system requirement is really essential. The implementation of the system is executed during second half of the project duration which include integrate the barcode reader with SAP R/3 system. In the end of this project, it is expected to have good inventory administration with SAP system using automated data handling from barcode reader.

Integration of automatic identification and data capture (AIDC) devices with SAP system, would enable the organization to maintain their business performances and competitive advantages against other publishers. Productivity among employees could be increased and increased the sales performances. From the project implementation itself, automatic identification and data capture (AIDC) able to reduce time processing about 16.98% and eliminate or avoid duplication of data from occurs.

5.2 Recommendation

For future development, automatic identification and data capture (AIDC) device integration can been done by using RFID. This is because currently many organizations looking forward to implement RFID in managing their inventory business process. The scope for this project implementation can been broaden by implementing Sales and Distribution module. Therefore, reader will has a clear view how AIDC can help in managing inventory business process since it is more customer oriented.

A procurement cycle can be improved in the future by adding all possible sub modules to complete the procurement cycle. This is because for this project sub modules such as source determination, vendor selection and invoice verification has been dropped from project scope.

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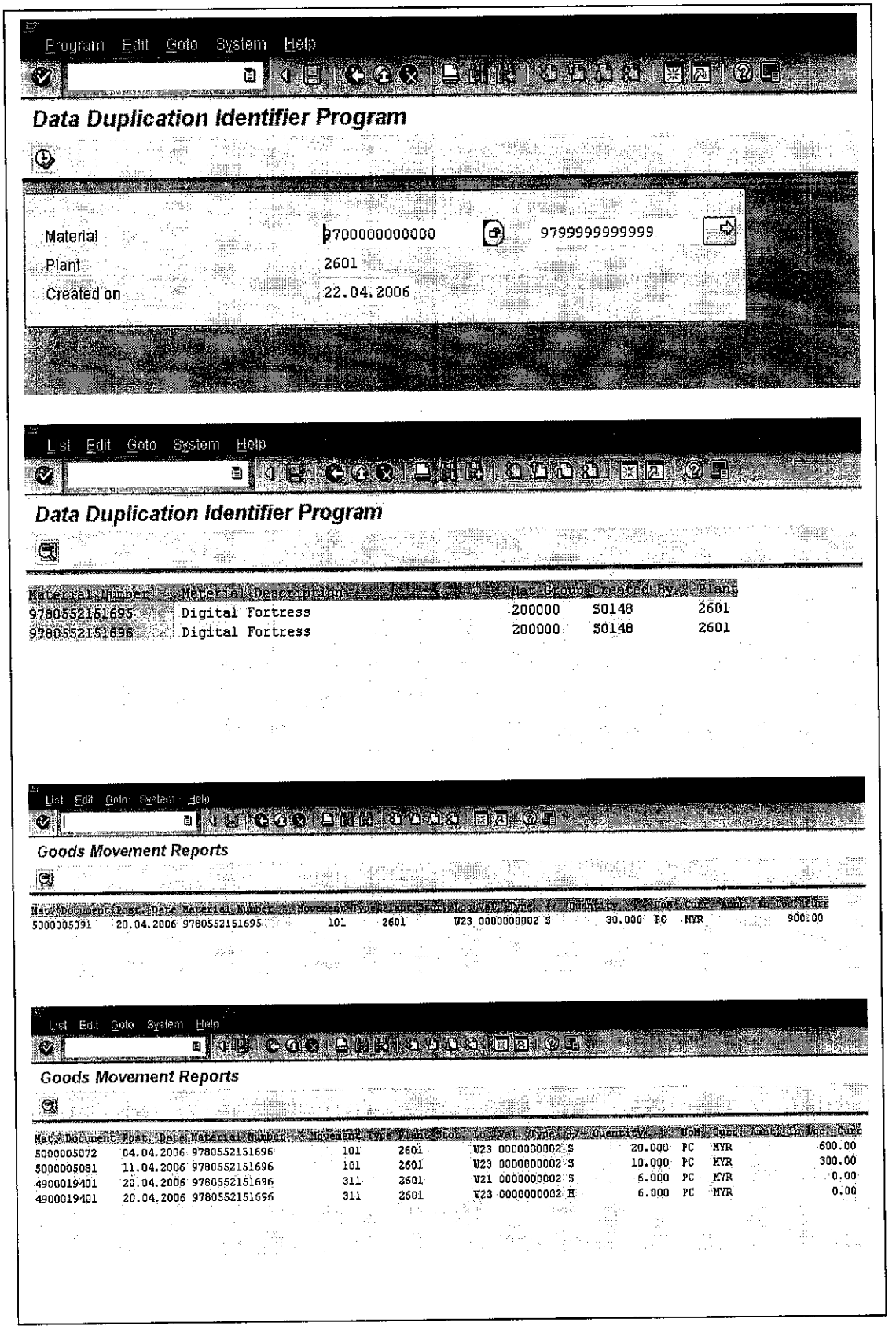
APPENDIXES

Appendix A : ABAP Codes

1. A01 – Data Duplication Identifier Program
2.

A01 – Data Duplication Identifier Program

```
Report  ZS0148_NZPD_REPORT01
```



```
*&---------------------------------------------------------------------*
*& Report  ZS0148_NZPD_REPORT01                                        *
*&                                                                     *
*&---------------------------------------------------------------------*
*&                                                                     *
*&                                                                     *
*&---------------------------------------------------------------------*

REPORT  zs0148_nzpd_report01   NO STANDARD PAGE HEADING        .
TABLES: mara, makt, mseg, mkpf, mard.

SELECTION-SCREEN: BEGIN OF BLOCK b1 WITH FRAME TITLE text-001.
SELECT-OPTIONS: so_matnr FOR mara-matnr. "material number
PARAMETERS: pa_werks TYPE mard-werks OBLIGATORY. "plant
SELECT-OPTIONS: so_ersda FOR mara-ersda NO INTERVALS NO-EXTENSION.
"material creation date
SELECTION-SCREEN: END OF BLOCK b1.

TYPES: BEGIN OF st_mtab,
          matnr TYPE mara-matnr, "material number
          maktx TYPE makt-maktx, "material descriptions
          matkl TYPE mara-matkl, "material group
          ernam TYPE mara-ernam, "created by
          ersda TYPE mara-ersda, "material creation date
          werks TYPE mard-werks, "plant
       END OF st_mtab.

TYPES: BEGIN OF st_mdoc,
          mblnr TYPE mkpf-mblnr, "material document number
          budat TYPE mkpf-budat, "posting date,
          matnr TYPE mseg-matnr, "material number
          bwart TYPE mseg-bwart, "movement type,
          werks TYPE mseg-werks, "plant
          lgort TYPE mseg-lgort, "storage location
          charg TYPE mseg-charg, "batch
          shkzg TYPE mseg-shkzg, "debit credit indicator
          menge TYPE mseg-menge, "quantity
          meins TYPE mseg-meins, "unit of measures
          waers TYPE mseg-waers, "currency
          dmbtr TYPE mseg-dmbtr, "amount in local currency
       END OF st_mdoc.


DATA: it_mtab01 TYPE STANDARD TABLE OF st_mtab,
      it_mtab02 TYPE STANDARD TABLE OF st_mtab,
      wa_mtab01 TYPE st_mtab,
      wa_mtab02 TYPE st_mtab.

DATA: it_mdoc01 TYPE STANDARD TABLE OF st_mdoc,
      wa_mdoc01 TYPE st_mdoc.


DATA: ca_matnr1 TYPE mara-matnr,
      ca_matnr2 TYPE mara-matnr,
      ca_matnr3 TYPE mara-matnr,
      ca_maktx1 TYPE makt-maktx,
      ca_maktx2 TYPE makt-maktx,
      ca_maktx3 TYPE makt-maktx.

DATA: tm_matnr TYPE mara-matnr, "material number
      tm_maktx TYPE makt-maktx, "material descriptions
      tm_matkl TYPE mara-matkl, "material group
      tm_ernam TYPE mara-ernam, "created by
      tm_werks TYPE mard-werks. "plant

START-OF-SELECTION.
```

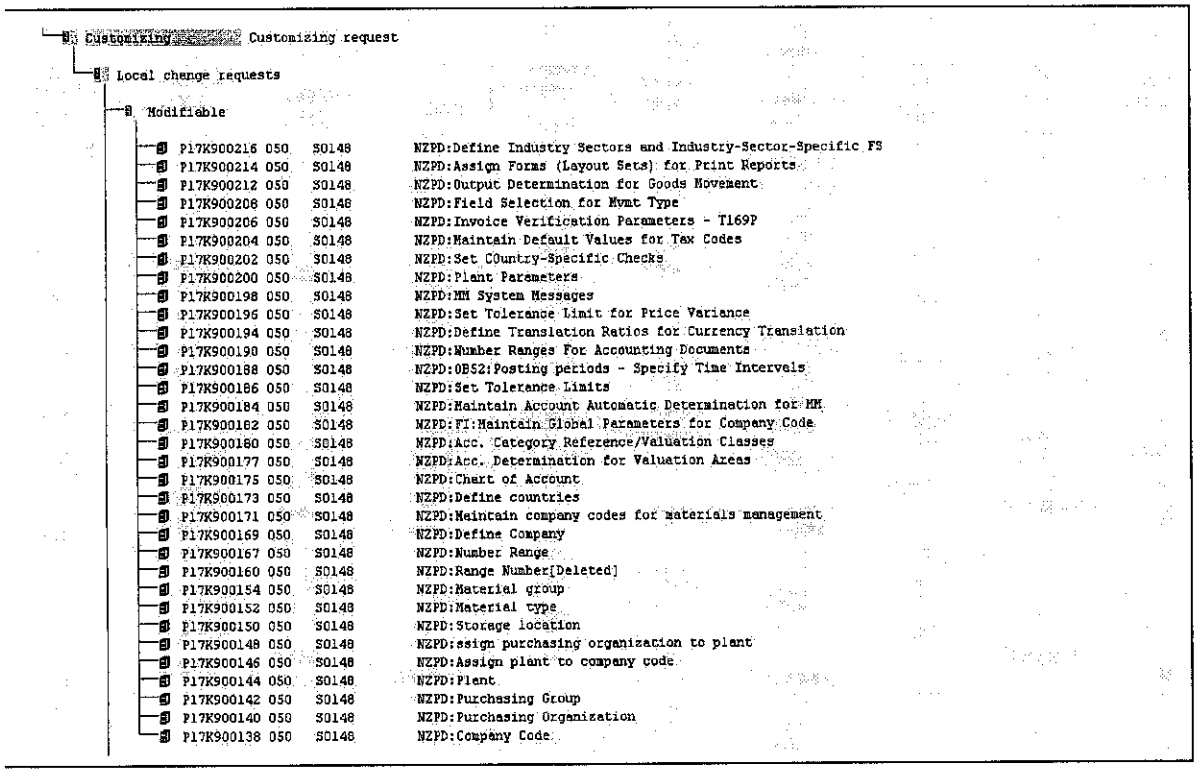
```
  SELECT r~matnr k~maktx r~matkl r~ernam r~ersda d~werks
         INTO CORRESPONDING FIELDS OF TABLE it_mtab01
         FROM mara AS r
         INNER JOIN makt AS k ON r~matnr = k~matnr
         INNER JOIN mard AS d ON k~matnr = d~matnr
         WHERE d~werks = pa_werks
         AND r~matnr IN so_matnr
         AND r~ersda IN so_ersda.

  SORT it_mtab01 BY matnr.

  DELETE ADJACENT DUPLICATES FROM it_mtab01 COMPARING matnr.

  PERFORM compare_record.
  PERFORM display_record.

TOP-OF-PAGE.
  FORMAT COLOR COL_HEADING INTENSIFIED ON.
  WRITE:/ text-011,
          text-012,
          text-013,
          text-014,
          text-015.
  FORMAT RESET.

TOP-OF-PAGE DURING LINE-SELECTION.
  SET TITLEBAR 'T_MDOC'.
  FORMAT COLOR COL_HEADING INTENSIFIED ON.
  WRITE:/(13) 'Mat. Document.',
         (10) 'Post. Date',
         (18) 'Material Number',
         (13) 'Movement Type',
         (05) 'Plant',
         (09) 'Stor. Loc',
         (10) 'Val. Type',
         (03) '+/-',
         (13) 'Quantity',
         (04) 'UoM',
         (05) 'Curr.',
         (18) 'Amnt. in Loc. Curr'.
  FORMAT RESET.

AT LINE-SELECTION.
  CASE sy-lsind.
    WHEN 1.


      SELECT k~mblnr k~budat s~matnr s~bwart s~werks s~lgort s~charg
      s~shkzg s~menge s~meins s~waers s~dmbtr
              INTO CORRESPONDING FIELDS OF TABLE it_mdoc01
              FROM mkpf AS k
              INNER JOIN mseg AS s ON k~mblnr = s~mblnr
              WHERE s~matnr = wa_mtab02-matnr.

      SORT it_mdoc01 BY budat.

      LOOP AT it_mdoc01 INTO wa_mdoc01.
        FORMAT COLOR COL_TOTAL INTENSIFIED ON.
        WRITE:/(13) wa_mdoc01-mblnr.
        FORMAT RESET.
        FORMAT COLOR COL_NORMAL INTENSIFIED ON.
        WRITE:(10) wa_mdoc01-budat,
               (18) wa_mdoc01-matnr,
               (13) wa_mdoc01-bwart CENTERED,
               (05) wa_mdoc01-werks,
               (09) wa_mdoc01-lgort RIGHT-JUSTIFIED,
               (10) wa_mdoc01-charg,
```

```
              (03) wa_mdoc01-shkzg,
              (13) wa_mdoc01-menge,
              (04) wa_mdoc01-meins,
              (05) wa_mdoc01-waers,
              (18) wa_mdoc01-dmbtr.
        FORMAT RESET.
      ENDLOOP.

      IF sy-subrc = 4.
        SKIP.
        SKIP.
        WRITE:/49 'No data available' CENTERED.
      ENDIF.
  ENDCASE.
*&---------------------------------------------------------------------*
*&      Form  compare_record
*&---------------------------------------------------------------------*
*       text
*----------------------------------------------------------------------*
*  -->  p1        text
*  <--  p2        text
*----------------------------------------------------------------------*
FORM compare_record.
  LOOP AT it_mtab01 INTO wa_mtab01.
    ca_matnr1 = wa_mtab01-matnr.
    ca_maktx1 = wa_mtab01-maktx.


    IF ca_maktx2 EQ ca_maktx1.

      wa_mtab02-matnr = tm_matnr.
      wa_mtab02-maktx = tm_maktx.
      wa_mtab02-matkl = tm_matkl.
      wa_mtab02-ernam = tm_ernam.
      wa_mtab02-werks = tm_werks.

      APPEND wa_mtab02 TO it_mtab02.

      wa_mtab02-matnr = wa_mtab01-matnr.
      wa_mtab02-maktx = wa_mtab01-maktx.
      wa_mtab02-matkl = wa_mtab01-matkl.
      wa_mtab02-ernam = wa_mtab01-ernam.
      wa_mtab02-werks = wa_mtab01-werks.

      APPEND wa_mtab02 TO it_mtab02.


      CLEAR: tm_matnr, tm_maktx, tm_matkl, tm_ernam, tm_werks.

    ELSE.
      ca_matnr2 = ca_matnr1.
      ca_maktx2 = ca_maktx1.

      tm_matnr = wa_mtab01-matnr.
      tm_maktx = wa_mtab01-maktx.
      tm_matkl = wa_mtab01-matkl.
      tm_ernam = wa_mtab01-ernam.
      tm_werks = wa_mtab01-werks.

    ENDIF.
  ENDLOOP.

ENDFORM.                    " compare_record
*&---------------------------------------------------------------------*
*&      Form  display_record
*&---------------------------------------------------------------------*
*       text
```

```
*---------------------------------------------------------------------*
*  -->  p1        text
*  <--  p2        text
*---------------------------------------------------------------------*
FORM display_record.
  LOOP AT it_mtab02 INTO wa_mtab02.
    FORMAT COLOR COL_KEY INTENSIFIED ON.
    WRITE:/ wa_mtab02-matnr.
    FORMAT RESET.
    FORMAT COLOR COL_NORMAL.
    WRITE:  wa_mtab02-maktx,
            wa_mtab02-matkl,
            wa_mtab02-ernam,
          (5) wa_mtab02-werks.
    FORMAT RESET.
    HIDE: wa_mtab02-matnr, wa_mtab02-werks.
  ENDLOOP.
ENDFORM.                    " display_record
```

ppendix B: SPRO: Implementation Guide

st of SAP configuration and transport request been done



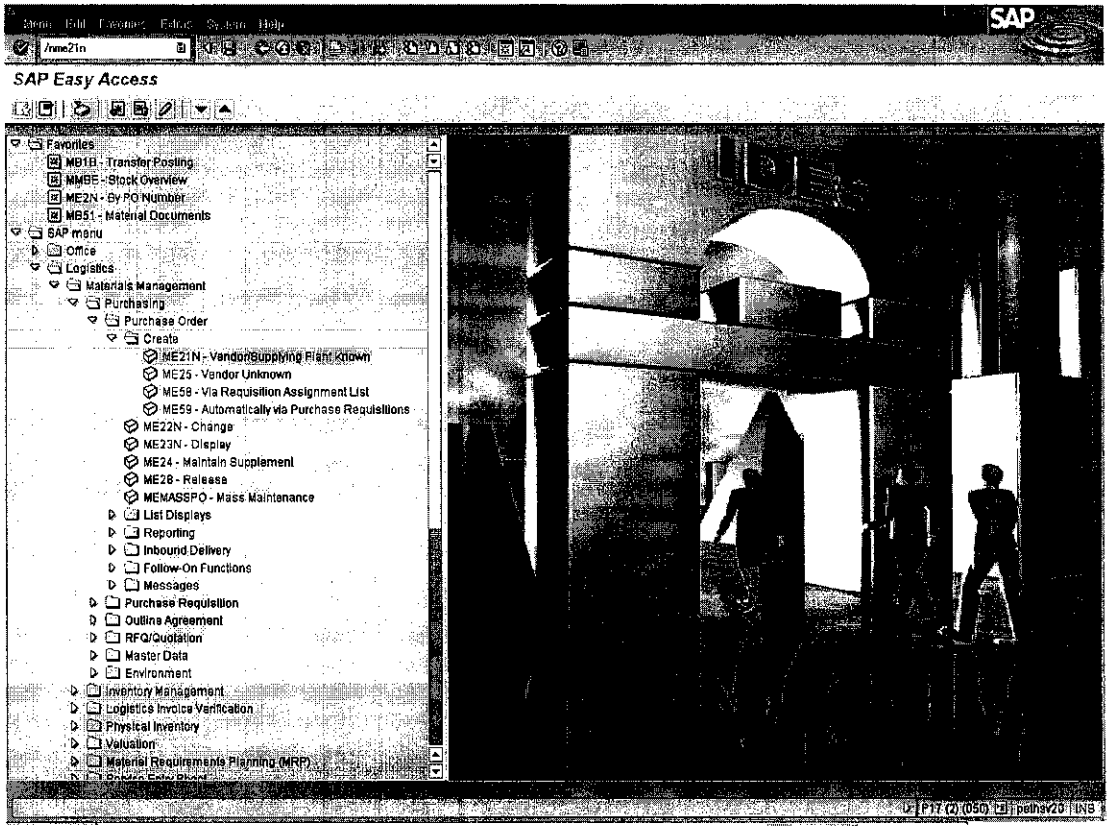
Transport ID	Client	User	Descriptions
P17K900216	050	S0148	NZPD : Define Industry Sectors and Industry-Sector-Specific FS
P17K900214	050	S0148	NZPD : Assign Forms (Layout Sets) for Print Reports
P17K900212	050	S0148	NZPD : Output Determination for Goods Movement
P17K900208	050	S0148	NZPD : Field Selection for Mvmt Type
P17K900206	050	S0148	NZPD : Invoice Verification Parameters - T169P
P17K900204	050	S0148	NZPD : Maintain Default Values for Tax Codes
P17K900202	050	S0148	NZPD : Set COuntry-Specific Checks
P17K900200	050	S0148	NZPD : Plant Parameters
P17K900198	050	S0148	NZPD : MM System Messages
P17K900196	050	S0148	NZPD : Set Tolerance Limit for Price Variance
P17K900194	050	S0148	NZPD : Define Translation Ratios for Currency Translation
P17K900190	050	S0148	NZPD : Number Ranges For Accounting Documents
P17K900188	050	S0148	NZPD : OB52:Posting periods - Specify Time Intervals
P17K900186	050	S0148	NZPD : Set Tolerance Limits
P17K900184	050	S0148	NZPD : Maintain Account Automatic Determination for MM
P17K900182	050	S0148	NZPD : FI : Maintain Global Parameters for Company Code
P17K900180	050	S0148	NZPD : Acc. Category Reference/Valuation Classes
P17K900177	050	S0148	NZPD : Acc. Determination for Valuation Areas
P17K900175	050	S0148	NZPD : Chart of Account
P17K900173	050	S0148	NZPD : Define countries
P17K900171	050	S0148	NZPD : Maintain company codes for materials management
P17K900169	050	S0148	NZPD : Define Company
P17K900167	050	S0148	NZPD : Number Range
P17K900160	050	S0148	NZPD : Range Number[Deleted]
P17K900154	050	S0148	NZPD : Material group
P17K900152	050	S0148	NZPD : Material type
P17K900150	050	S0148	NZPD : Storage location
P17K900148	050	S0148	NZPD : Assign purchasing organization to plant
P17K900146	050	S0148	NZPD : Assign plant to company code
P17K900144	050	S0148	NZPD : Plant
P17K900142	050	S0148	NZPD : Purchasing Group
P17K900140	050	S0148	NZPD : Purchasing Organization
P17K900138	050	S0148	NZPD : Company Code

Appendix C: User Manual

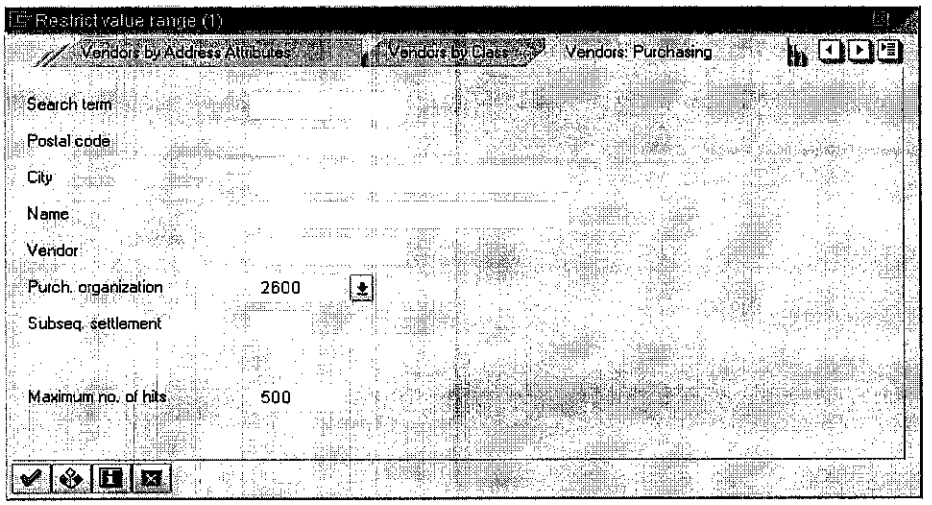
1. C01 – Create Purchase Order
2. C02 – Create Material Master

C01 – Create Purchase Order

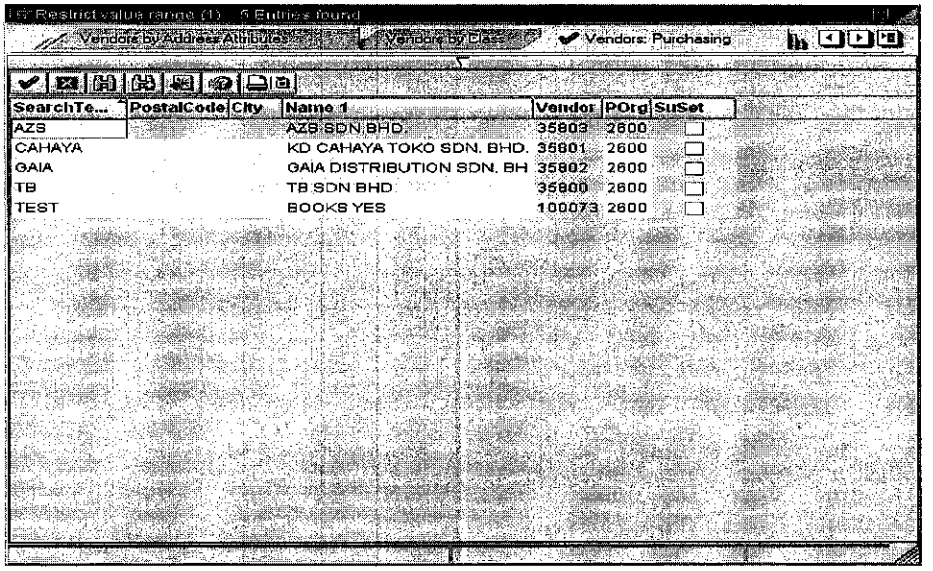
1. From SAP Main Menu choose *Logistics -> Material Management -> Purchasing -> Purchase order -> Create -> Vendor/Supplying Plant Known* (ME21N)



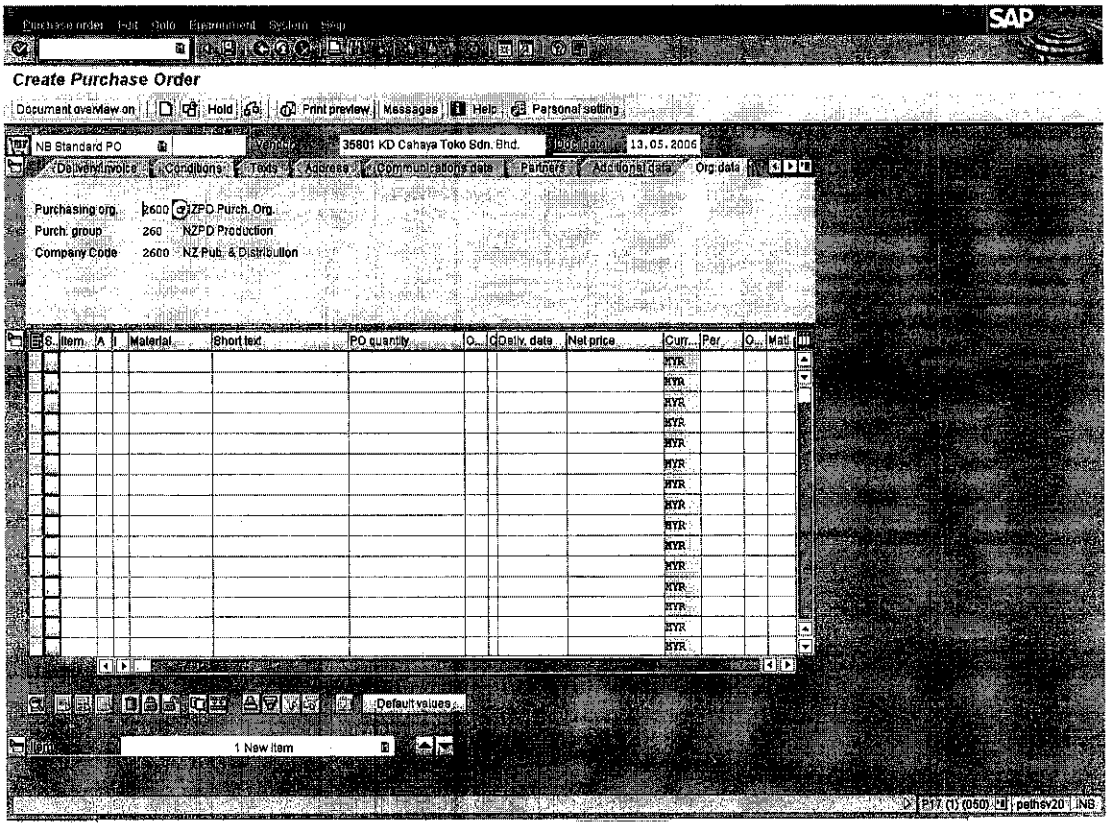
2. Enter *PO type* - dropdown menu
3. Enter *Vendor code* or choose from the listing



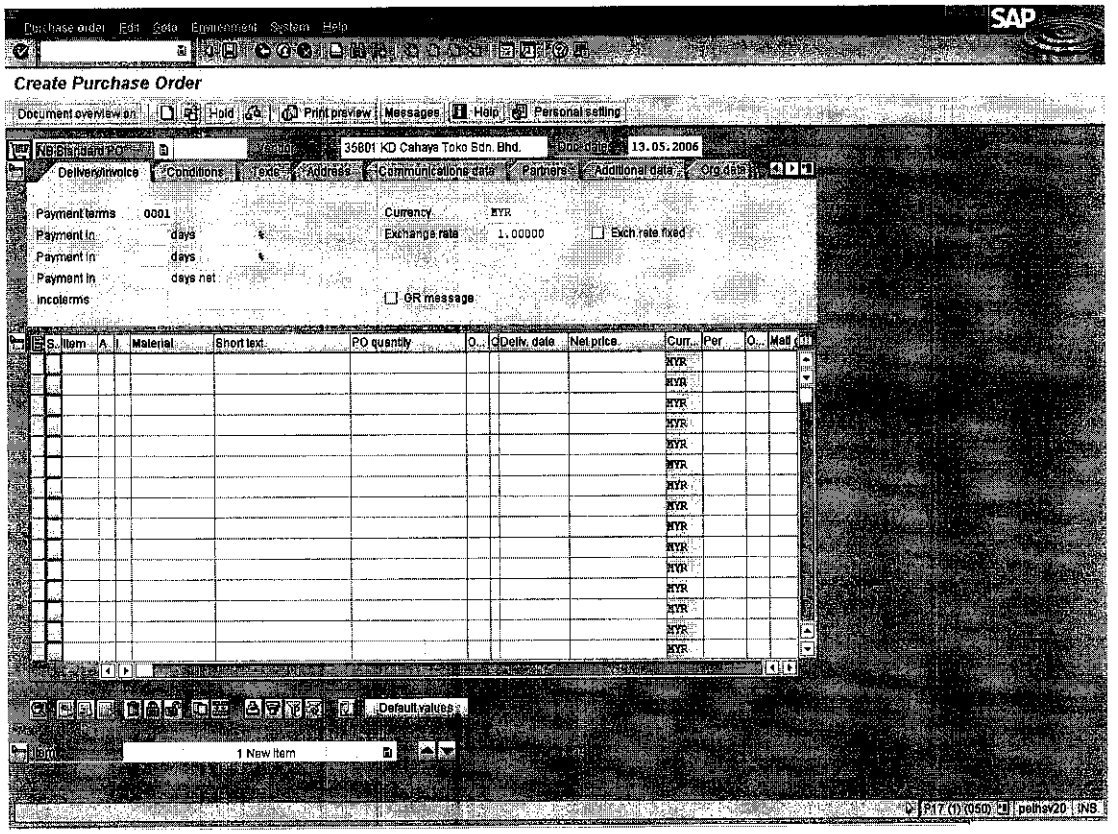
4. Double click on the record or highlight and click ✔



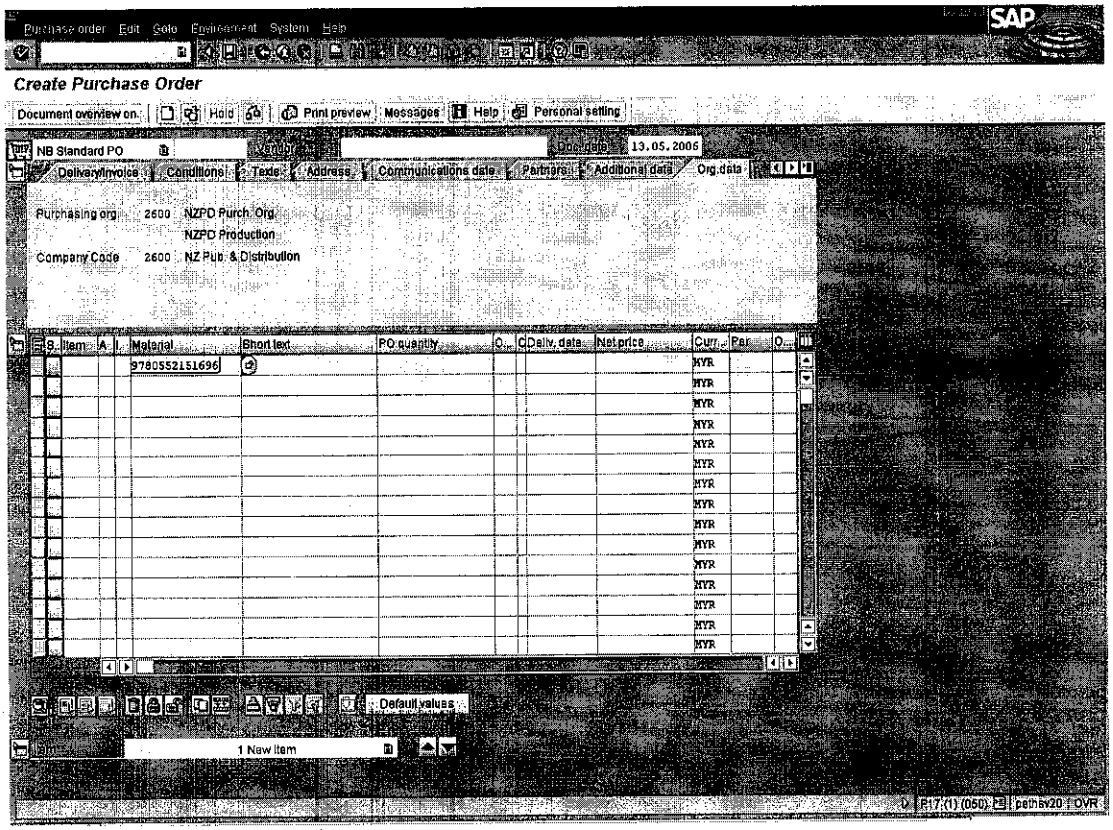
5. Enter *Purchasing Org, Purch.Group* and *Company Code*



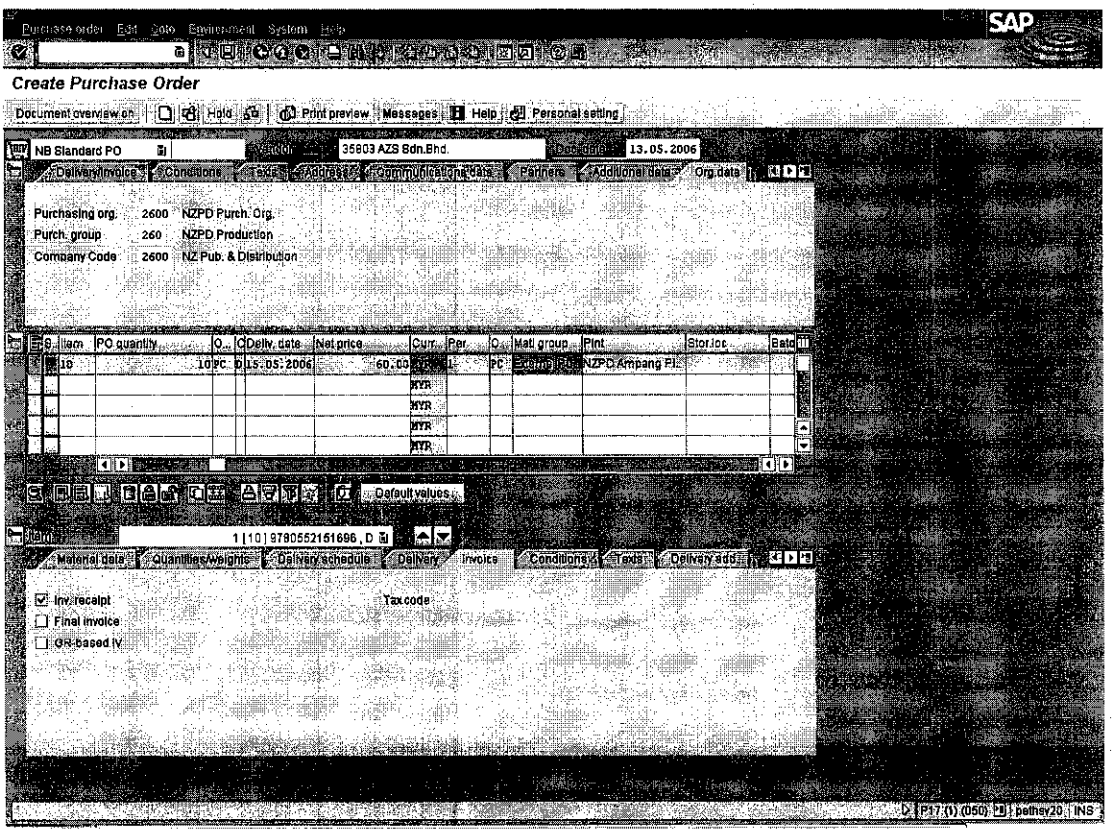
6. Enter *Payment Terms* and *Currency* (if required)



7. Scan ISBN from books to enter material number



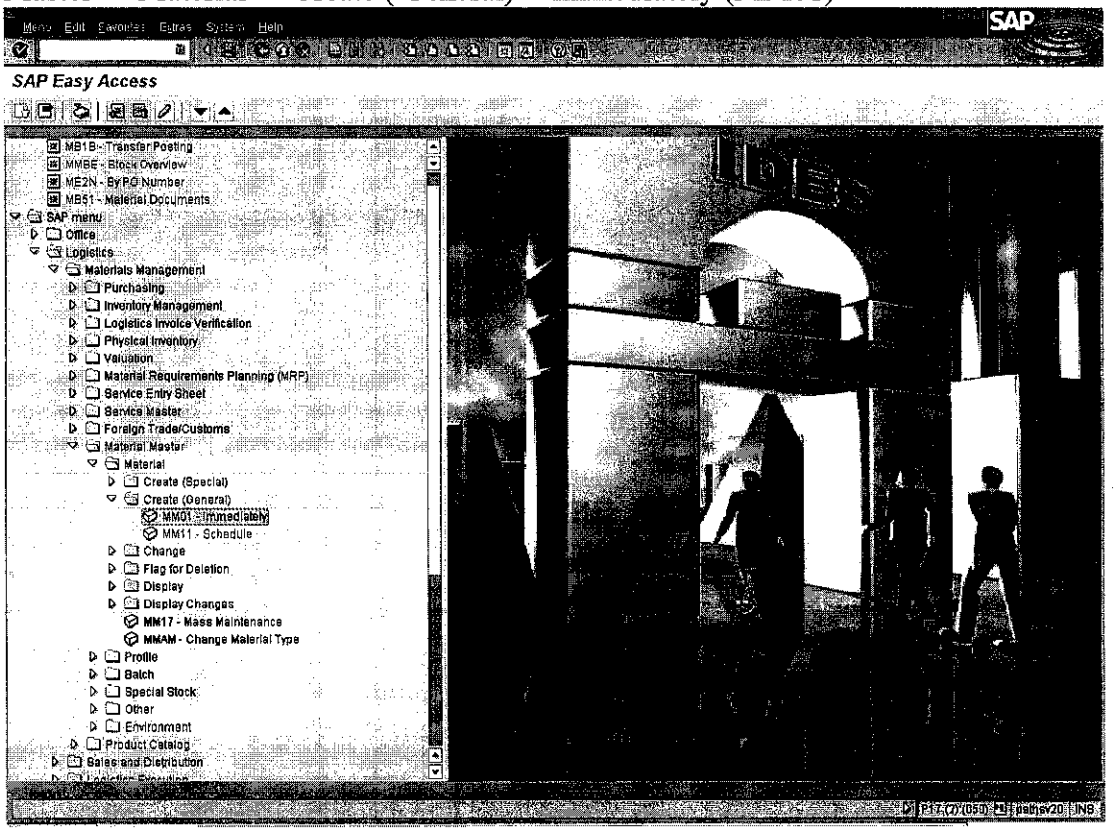
8. Enter *Quantity, Net Price, Plant* and *Storage Location*



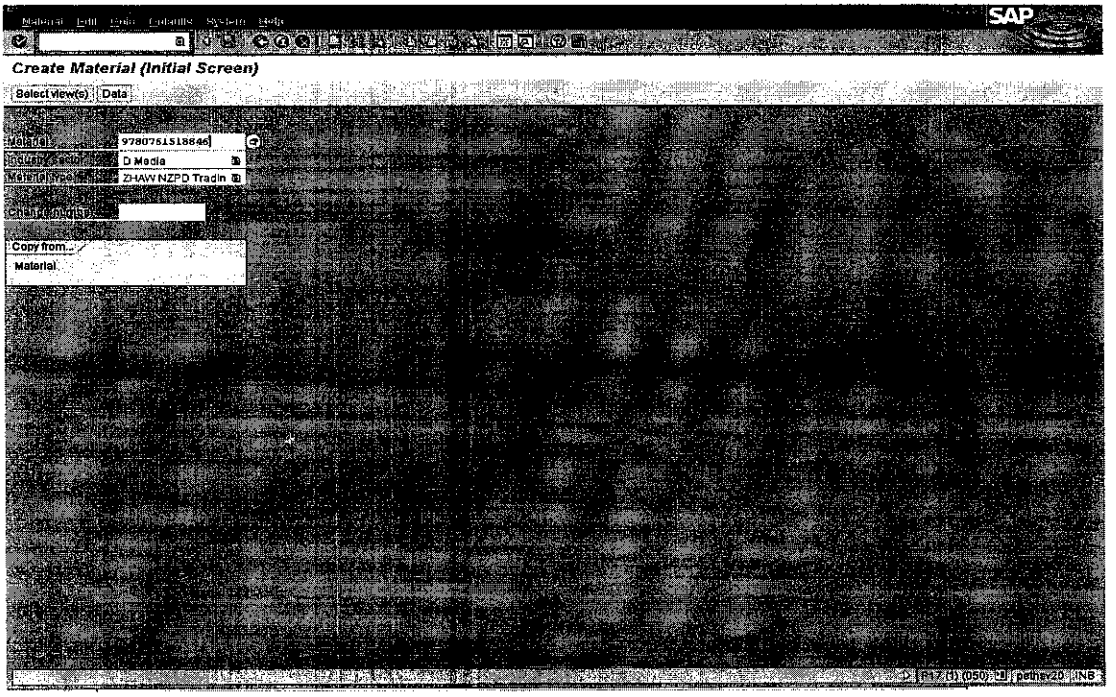
9. Click on  to verify the data
10. Click on  *Post.*

C02 – Create Material Master

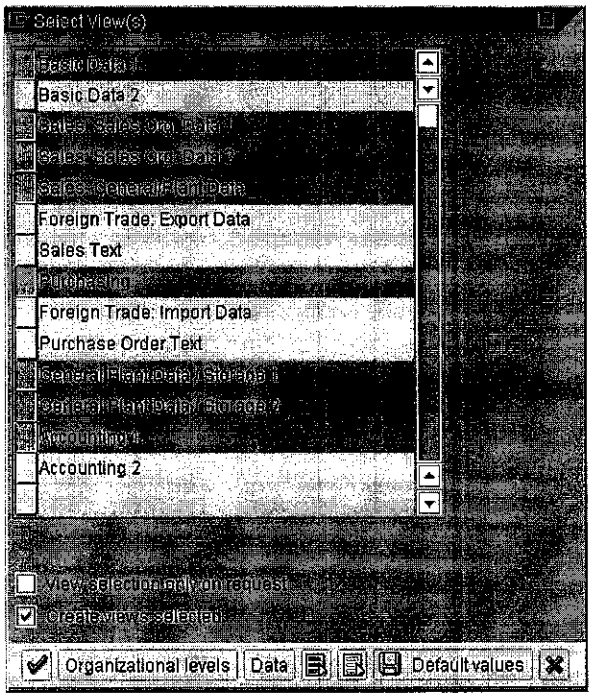
1. From SAP Menu Choose Logistics -> Material Management -> Material Master -> Material -> Create (General)-> Immediately (MM01)



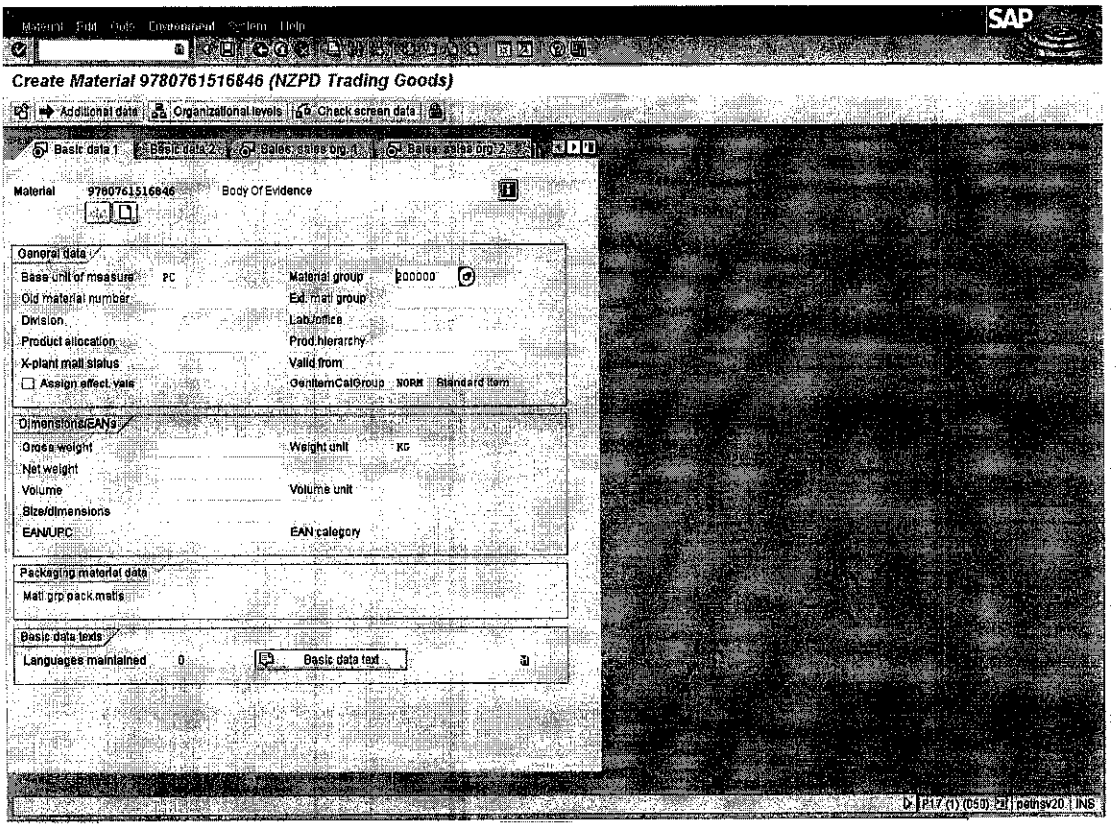
2. Scan the ISBN from book to enter material number and do selection from dropdown list for:
   - ❖ Industry Sector – D Media
   - ❖ Material Type – ZHAW Trading Goods



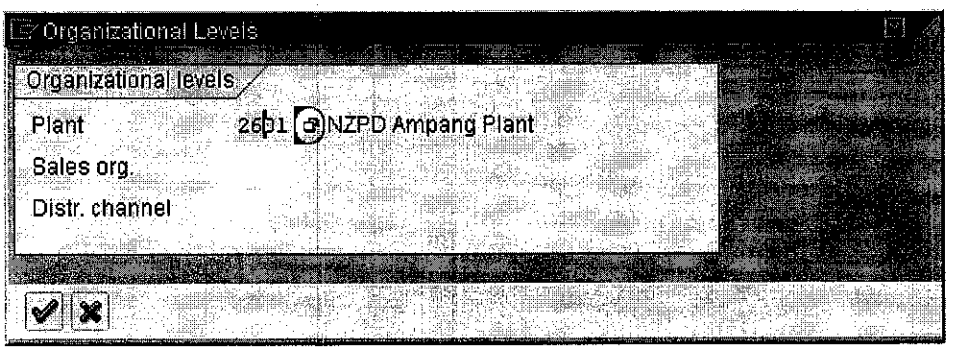
3. By using your mouse select your views and click 



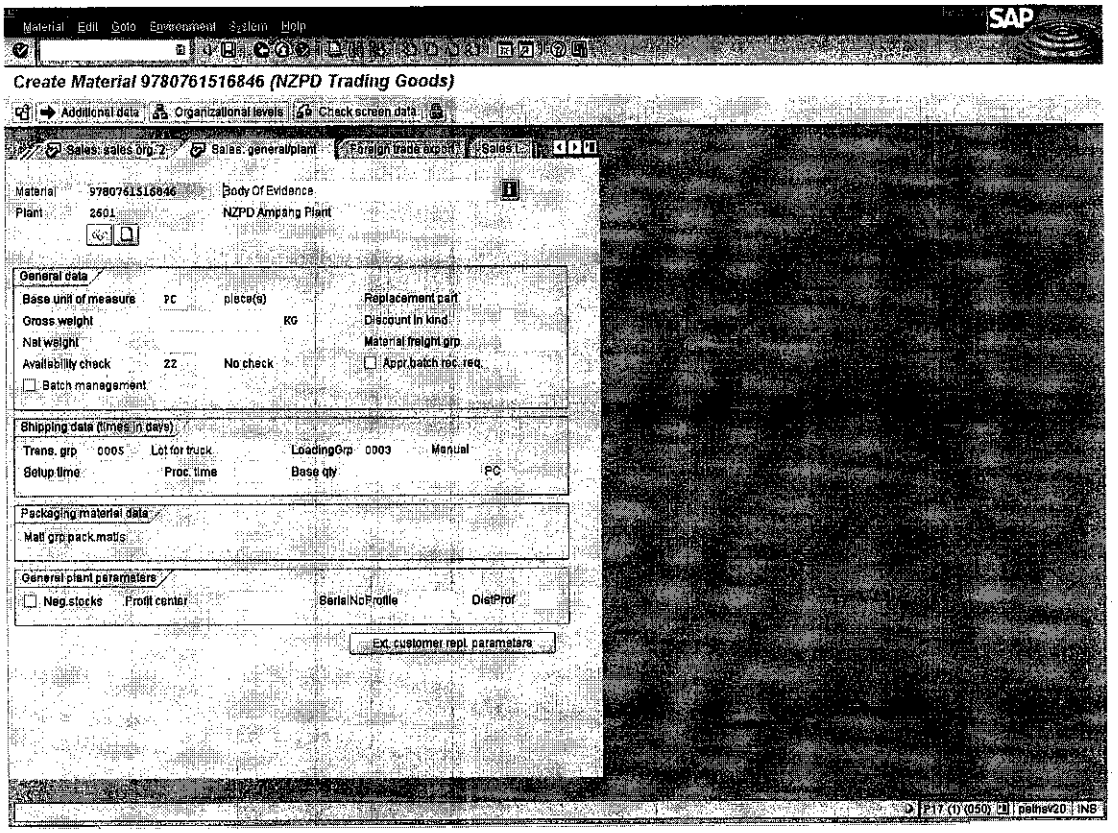
4. Maintain your material description
5. Enter *Base unit of measure* and *Material group*. Key in the data or choose from the list. Press *ENTER*.



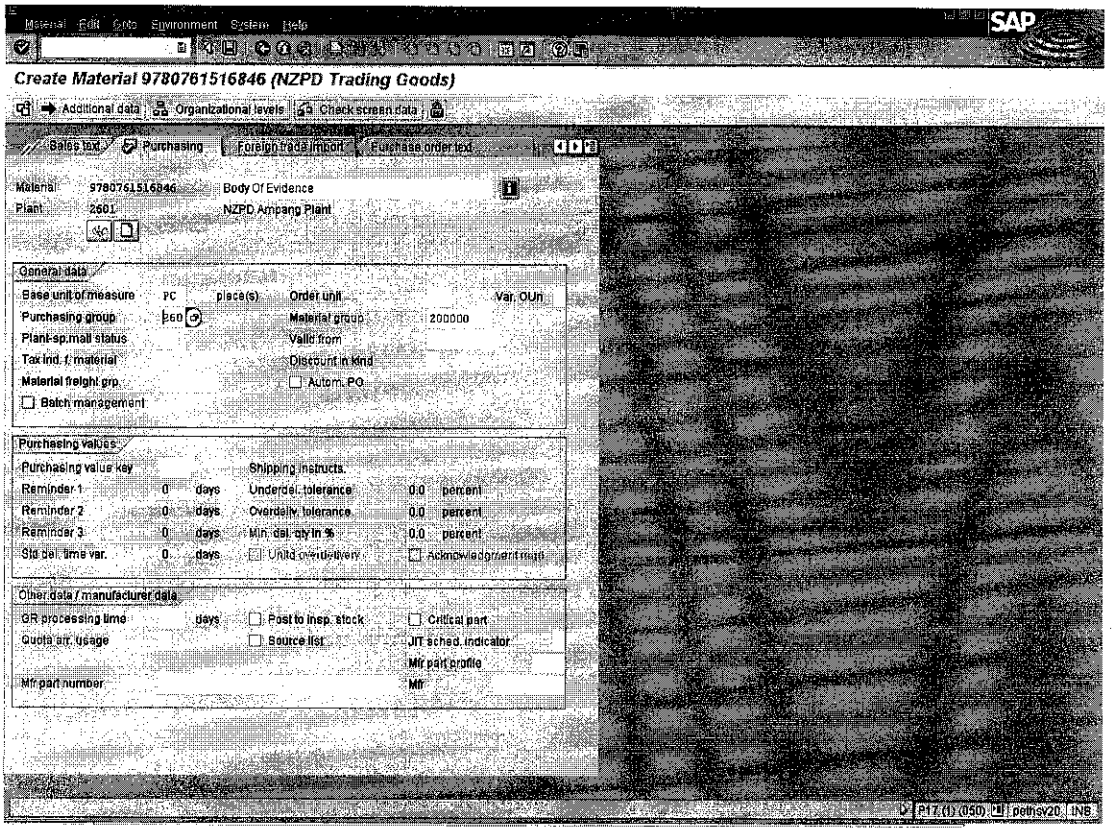
6. Maintain data for *Plant* in Sales: Org. Data 1 view. Press *ENTER.*



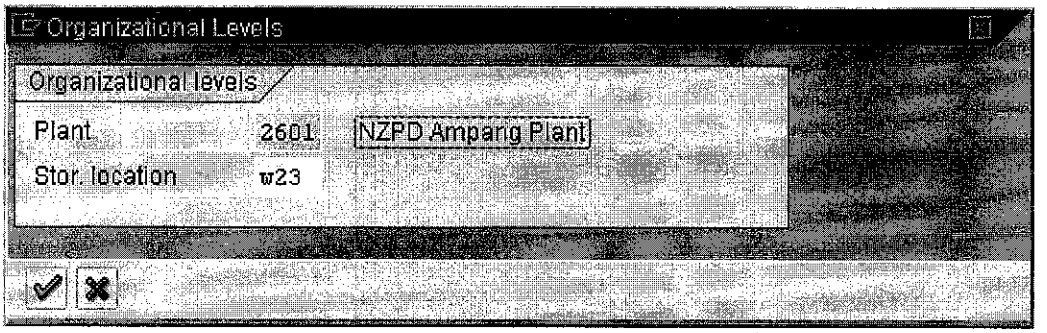
7. Enter *Availability Check, Trans. Grp* and *LoadingGr* in Sales: General/Plant Data. Press *ENTER.*



8. At Purchasing view, key in *Order unit* (if the unit is different from base unit)
9. Key in *Purchasing Group* and the rest of the necessary field and Press *ENTER.*

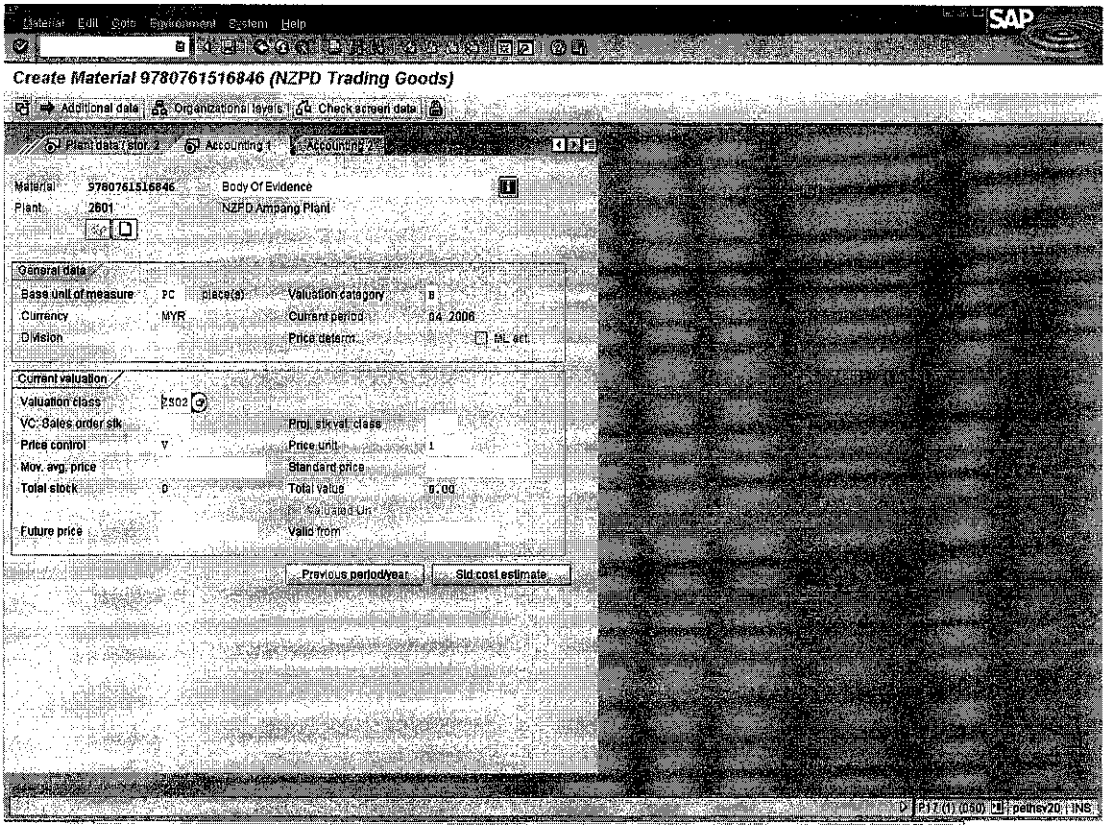


10. Maintain storage location before proceed with General Plant Data/ Storage 1 and press *Enter.*



11. Key in *Unit of issue* (if difference from base unit) and Press *ENTER.*

12. Inside Accounting view, enter data for *Valuation Category*, *Valuation Class*, *Price Control* and *Moving Average Price*.



13. Choose *Post.*
14. Click 'Yes' to save the item

Appendix D: Technical Specifications

1. D1 – Data Duplication Identifier Program
2. D2 –

D01 – Data Duplication Identifier Program

1. Document Control Section

1.1 General Information

Functional Module	MM
Program Type	ABAP Program
Creation Date	19th Apr 2006
Created By	Nazrul Aminur Hafiz Abd Rahman

1.2 Components

Main program	ZS0148_NZPD_REPORT01
Include programs	none
Transaction code	none
Function modules	none
Class methods	none

1.3 Modifications to SAP Standard

None

2. Requirement Overview

2.1 Purpose

The purpose of this program:

- To identify and examine duplicated material master in SAP system and then help user to set incorrect material master as flag to deletion status.
- To list any possible goods movement transaction which using duplicated or incorrect material master. This will help user to monitor the goods movement business flows.

2.2 Description

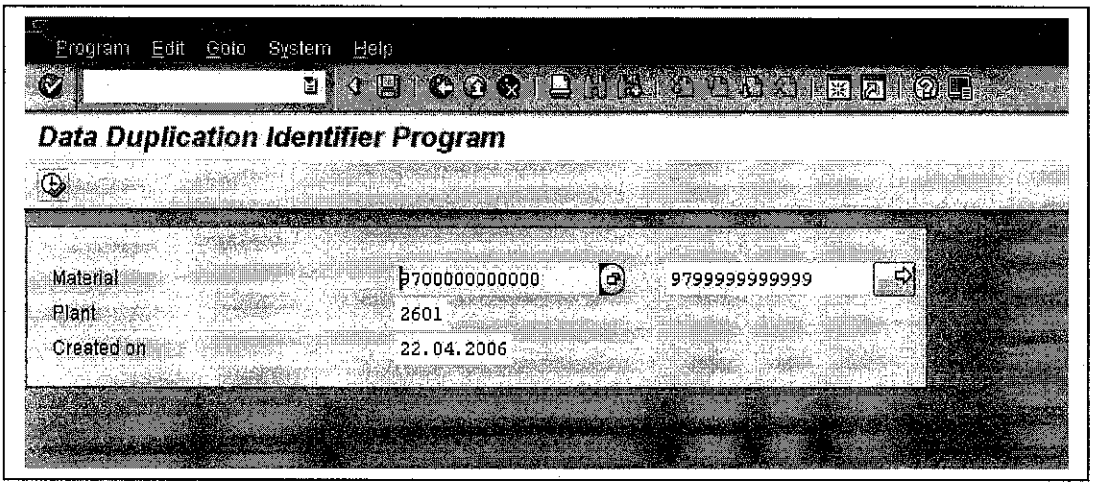
Data duplication identifier program – identify any possible duplicated material master data.

2.3 Assumptions

None

3. Program Source Code

3.1 Selection Screen



Field Name	Field Description	Type	Mandatory
so_matnr	Material	mara-matnr	N
pa_werks	Plant	mard-werks	Y
so_ersda	Date Created	mara-ersda	N

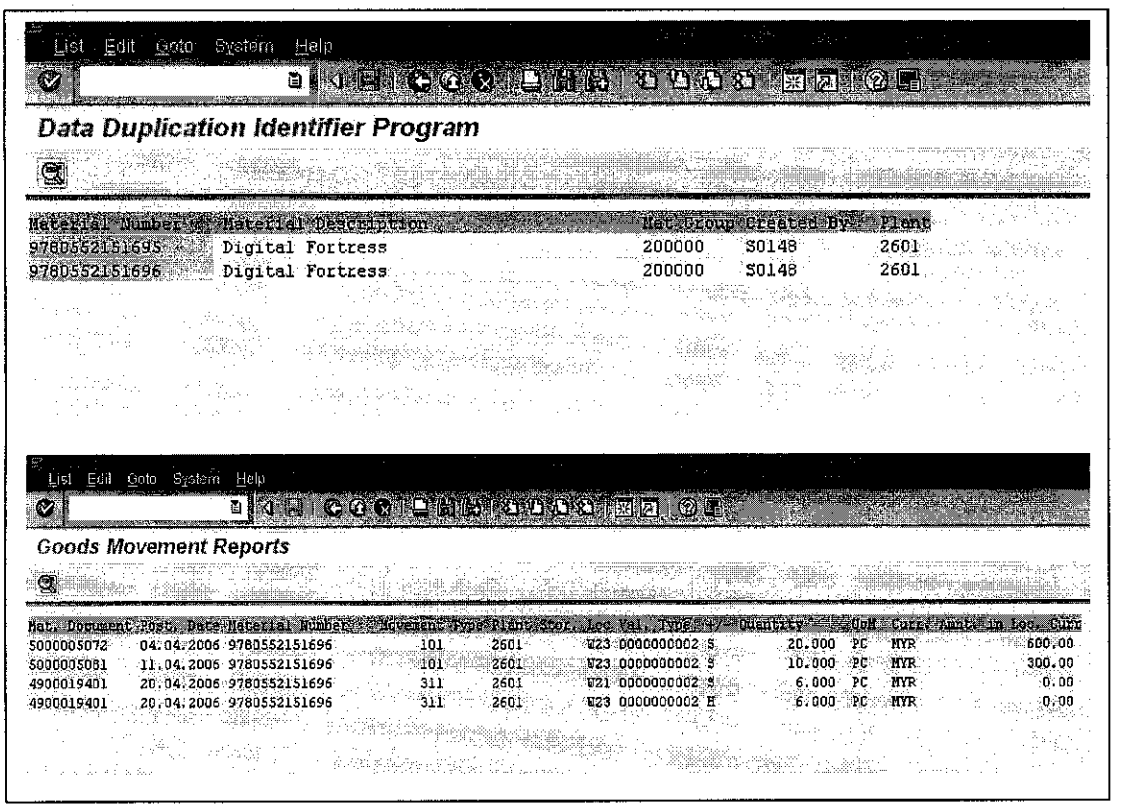
3.2 Source Code

Refer to Appendix A01

3.3 Table Used

Table Name	Descriptions
MARA	General Material
MAKT	Material Description
MARD	Storage Location Data for Material
MKPF	Header: Material Document
MSEG	Document Segment: Material

3.4 Screen Shot (Output)



4. Impact/Effect to R/3 System (if any)

4.1 Descriptions

None

4.2 Screen Shot

None